STRUCTURE OF THE GLOBAL NANOSCIENCE AND NANOTECHNOLOGY RESEARCH LITERATURE

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ABSTRACT

Text mining was used to extract technical intelligence from the open source global nanotechnology and nanoscience research literature. An extensive nanotechnology/ nanoscience-focused query was applied to the Science Citation Index/ Social Science Citation Index (SCI/ SSCI) databases. The nanotechnology/ nanoscience research literature technical structure (taxonomy) was obtained using computational linguistics, document clustering, and factor analysis. The nanotechnology/ nanoscience research literature infrastructure (prolific authors, key journals/ institutions/ countries, most cited authors/ journals/ documents) for each of the clusters generated by the document clustering algorithm was obtained using bibliometrics. Another novel addition was the use of phrase auto-correlation maps to show technical thrust areas based on phrase co-occurrence in Abstracts, and the use of phrase-phrase cross-correlation maps to show technical thrust areas based on phrase relations due to the sharing of common co-occurring phrases. The use of factor matrices quantified further the strength of the linkages among institutions and among countries, and validated the co-publishing networks shown graphically on the maps.

The ~400 most cited nanotechnology papers since 1991 were grouped, and their characteristics generated. Whereas the main analysis provided technical thrusts of all nanotechnology papers retrieved, analysis of the most cited papers allowed their unique characteristics to be displayed.

The instrumentation literature associated with nanoscience and nanotechnology research was examined. About 65000 nanotechnology records for 2005 were retrieved from the Science Citation Index/ Social Science Citation Index (SCI/SSCI), and ~27000 of those were identified as instrumentation-related. All the diverse instruments were identified, and the relationships among the instruments, and among the instruments and the quantities they measure, were obtained. Metrics associated with research literatures for specific instruments/ instrument groups were generated.

The Applications literature associated with nanoscience and nanotechnology research was examined. Through visual inspection of the Abstract phrases of the same ~65000 downloaded 2005 records, all the diverse non-medical Applications were identified, and the relationships among the non-medical Applications, both direct and indirect, were obtained. Metrics associated

with research literatures for specific Applications/ Applications groups were generated.

For medical Applications, a fuzzy clustering algorithm was applied to the ~65000 downloaded 2005 records. A sub-network that encompassed all the medical Applications was identified. Again, metrics associated with research literatures for specific medical applications were generated.

EXECUTIVE SUMMARY

Introduction

Nanotechnology is booming! In the global fundamental nanotechnology research literature as represented by the Science Citation Index/ Social Science Citation Index (SCI/ SSCI (SCI, 2006)), global nanotechnology publications grew dramatically in the last two decades.

Due to this exponential growth of the global open nanotechnology literature, there is need for gaining an integrated quantitative perspective on the state of this literature. In 2003-2005, a comprehensive text mining study was performed to overview the technical structure and infrastructure of the global nanotechnology research literature, as well as the seminal nanotechnology literature (Kostoff et al, 2005a, 2005b, 2006a, 2006b). Based on the wide-scale interest generated by these reports, it was decided to update and expand the study using more recent data, a much more comprehensive query, and more sophisticated analytical tools.

In the updated study, text mining was used to extract technical intelligence from the open source global nanotechnology and nanoscience research literature (SCI/SSCI databases). Identified were: (1) the nanotechnology/nanoscience research literature infrastructure (prolific authors, key journals/institutions/countries, most cited authors/journals/documents); (2) the technical structure (pervasive technical thrusts and their inter-relationships); (3) nanotechnology instruments and their relationships; (4) potential nanotechnology applications, and (5) potential health impacts and applications. A comprehensive literature survey of the seminal works in nanotechnology is contained in Appendix 1.

The results of this updated text mining study are divided into four main sections: Infrastructure; Technical Structure; Instrumentation; and Applications. In turn, Applications are divided into non-medical and medical. The results will be presented in the order listed above.

Infrastructure describes the performers of nanoscience/ nanotechnology research at different levels, ranging from individual to national performers, and it includes the archived literature as well. *Technical Structure* identifies the pervasive technical thrusts (and their inter-relationships) of the nanoscience/ nanotechnology literature. *Instrumentation* provides both the infrastructure and technical structure of the sub-set of the nanoscience/ nanotechnology literature that addresses specific instruments. Finally, *Applications* provides the infrastructure and taxonomy of the sub-set of the nanoscience/ nanotechnology literature that addresses specific non-medical and medical applications.

ES1. INFRASTRUCTURE

ES1.1. Country Publications

- Global nanotechnology research article production has exhibited exponential growth for more than a decade (See Figure ES1).
- The most rapid growth over that time period has come from East Asian nations, notably China and South Korea (See Figure ES2).
- Some of this apparent rapid growth (in China for example) is partially due to 1) a country's researchers publishing a non-negligible fraction of total papers in domestic low Impact Factor journals, and 2) these journals being accessed recently by the SCI/ SSCI, rather than due to growth based on increased sponsorship or productivity.
- China's representation in high Impact Factor journals is small, but increasing
- From 1998 to 2002, China's ratio of high impact nanotechnology papers to total nanotechnology papers doubled, placing China at parity for this metric with the advanced nations of Japan, Italy, and Spain.
- The US remains the leader in aggregate nanotechnology research article production
- In some selected nanotechnology sub-areas, China has achieved parity or taken the lead (see Figure ES3 for nanocomposites example).
- South Korea started even further behind than China in both total nanotechnology publications and highly cited papers, but they have advanced rapidly to become second-tier contenders in total and highly cited papers.

FIGURE ES1 – SCI/ SSCI ARTICLES VS TIME
TOTAL RECORDS RETRIEVED

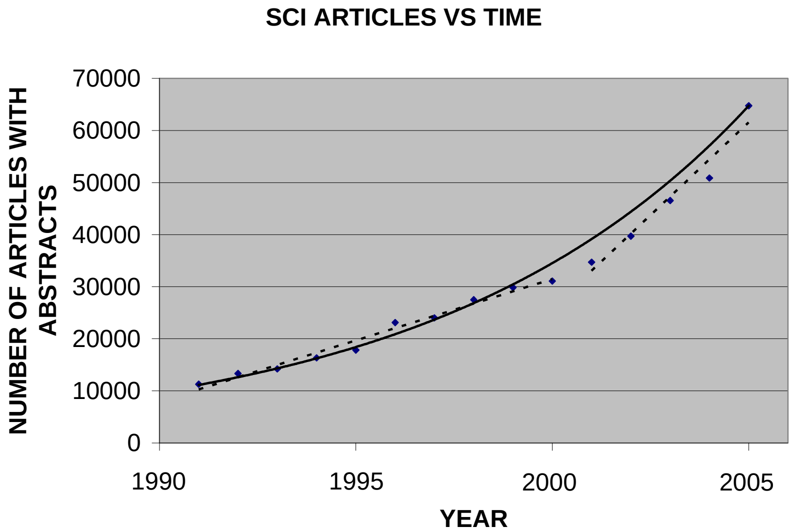


FIGURE ES2 – COUNTRY COMPARISON TIME TREND
(number of articles vs. time)

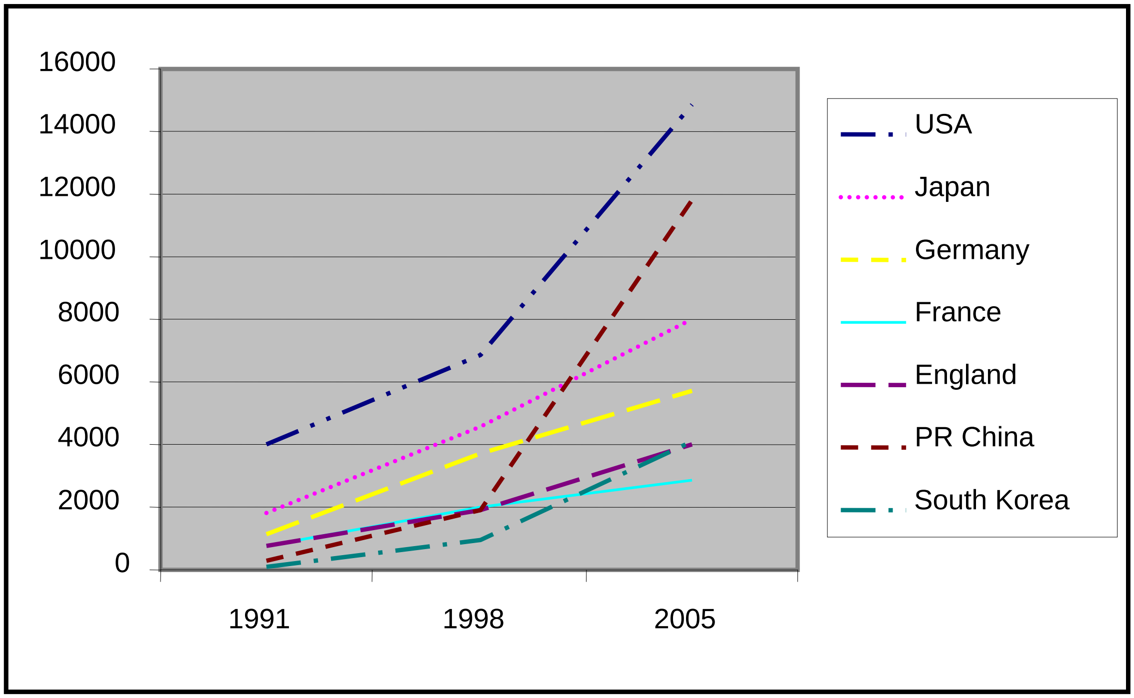
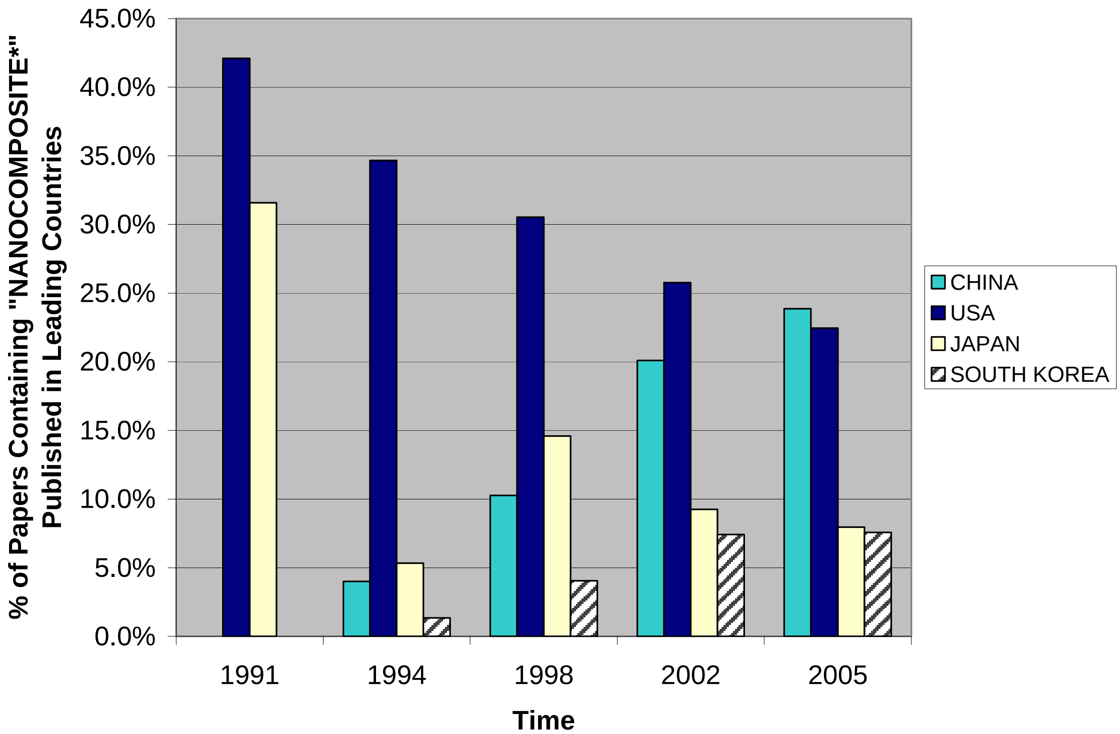


FIGURE ES3 – # PAPERS CONTAINING "NANOCOMPOSITE*"



ES1.2. Country Citations

- There is a clear distinction between the publication practices of the three most prolific Western nations and the three most prolific East Asian nations. The Western nations publish in journals with almost twice the weighted average Impact Factors of the East Asian nations. Much of the difference stems from the East Asian nations publishing a non-negligible amount in domestic low Impact Factor journals, while the Western nations publish in higher Impact Factor international journals.
- Two countries that lead in production of the most cited nanotechnology papers are the US (126) and Germany (31). The US and Germany account for forty percent of the most cited nanotechnology papers
- The high paper volume production East Asian countries of China and South Korea account for two percent of the most cited nanotechnology papers.
- Despite the increased paper productivity from East Asian countries, the US continues to generate the most cited nanotechnology papers.

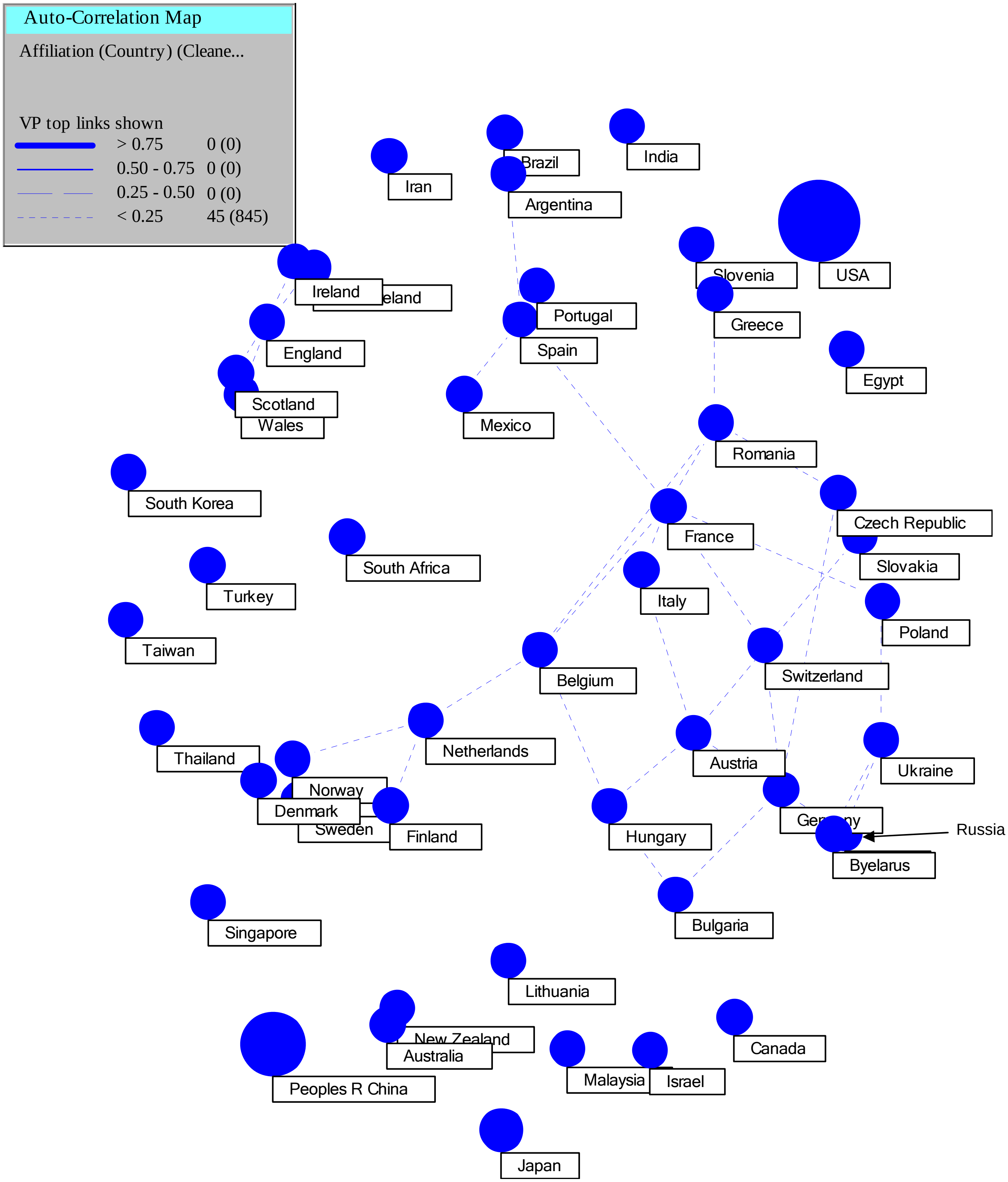
ES1.3. Institution and Journal Citations

- Of the thirty institutions publishing the most nanotechnology papers, four are from the US, whereas of the twenty-five institutions producing the most cited nanotechnology papers, twenty-one are in the US.
- The top-tier institutions producing cited papers are Harvard University (27), University of California Berkeley (23), Rice University (17), University of California Santa Barbara (16).
- The two journals that overwhelmingly contain the most cited nanotechnology papers since 1991 are Science (56) and Nature (37).

ES1.4. Country Collaborations

- The dominant country co-publishing network is a complex web of mainly European nations roughly following geographic lines: Nordic, Central Europe, Eastern Europe, and a Western Europe/ Latin American group of Romance language nations. There is also a UK component country network, but it is not linked to the interconnected continental members of the European Union (See Figure ES4).
- Correlation of countries by common thematic interest shows two major poles: US and China. The US pole is strongly connected thematically to a densely connected network of English-speaking North American representatives, Western/ Central European nations, and most of the East Asian allies. China is relatively isolated except for India, and the Eastern European and Latin American representatives are outside the main network as well.

FIGURE ES4 - COUNTRY AUTO-CORRELATION MAP (fifty most prolific countries)



ES1.5. Institutional Collaborations

- The main institution co-publishing groups are East Asian: one each from China, Japan, and South Korea.
- Publication connectivity among institutions is much weaker than common interest or citation connectivity.
- Cross-Correlation of institutions by the journals they cite reveals four nationality-based (or locality-based) clusters: Chinese, Japanese, American, and European (See Figure ES5). Institutions from the same nationality group cite the same focused journals (primarily, but not exclusively, domestic).
- Cross-Correlation of institutions by the documents they cite reveals ***only the Chinese institutions constitute a strongly-connected network*** (See Figure ES6).

FIGURE ES5 – INSTITUTION-CITED JOURNAL CROSS-CORRELATION MAP (Cited Journals 502-1003)

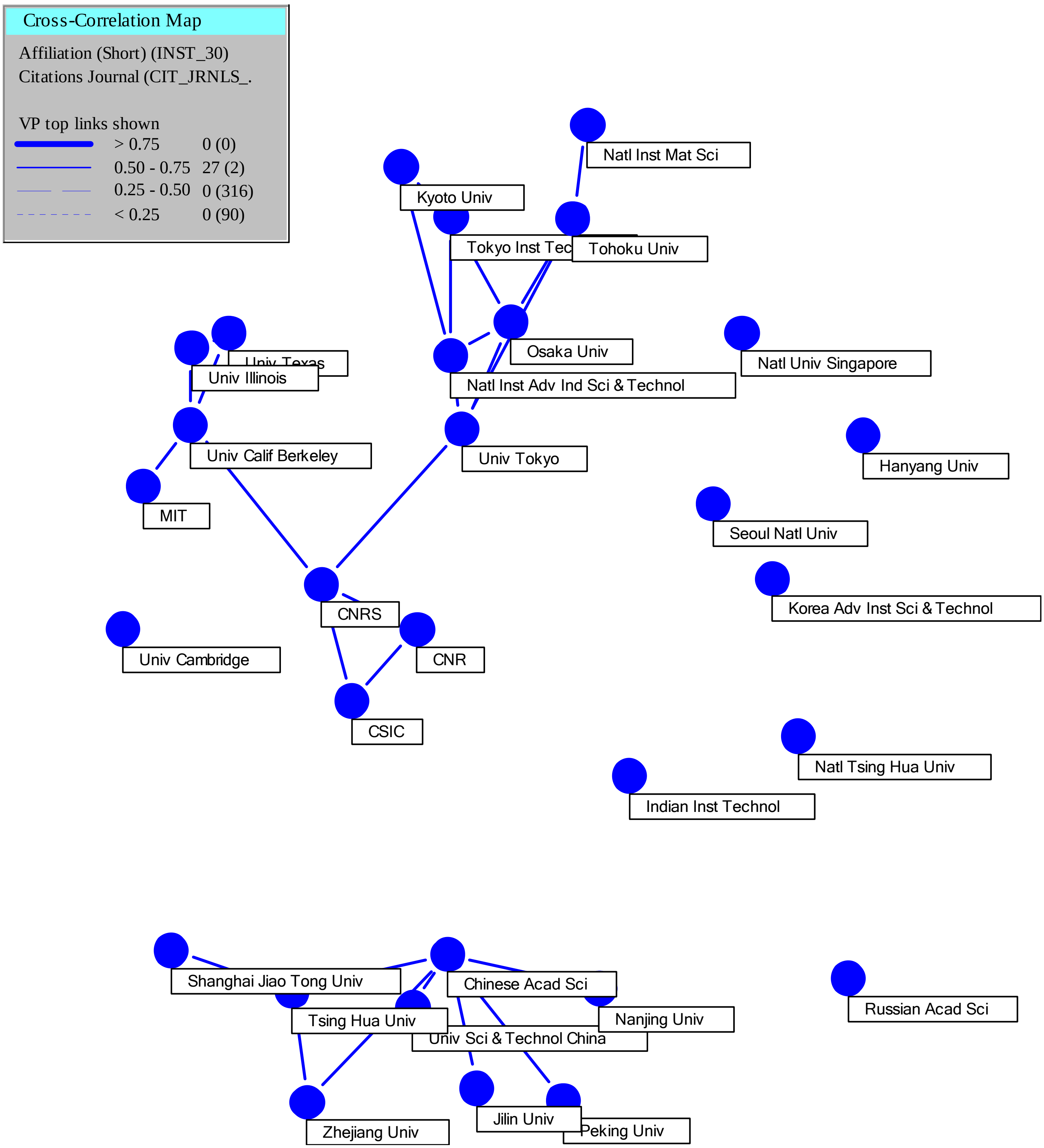
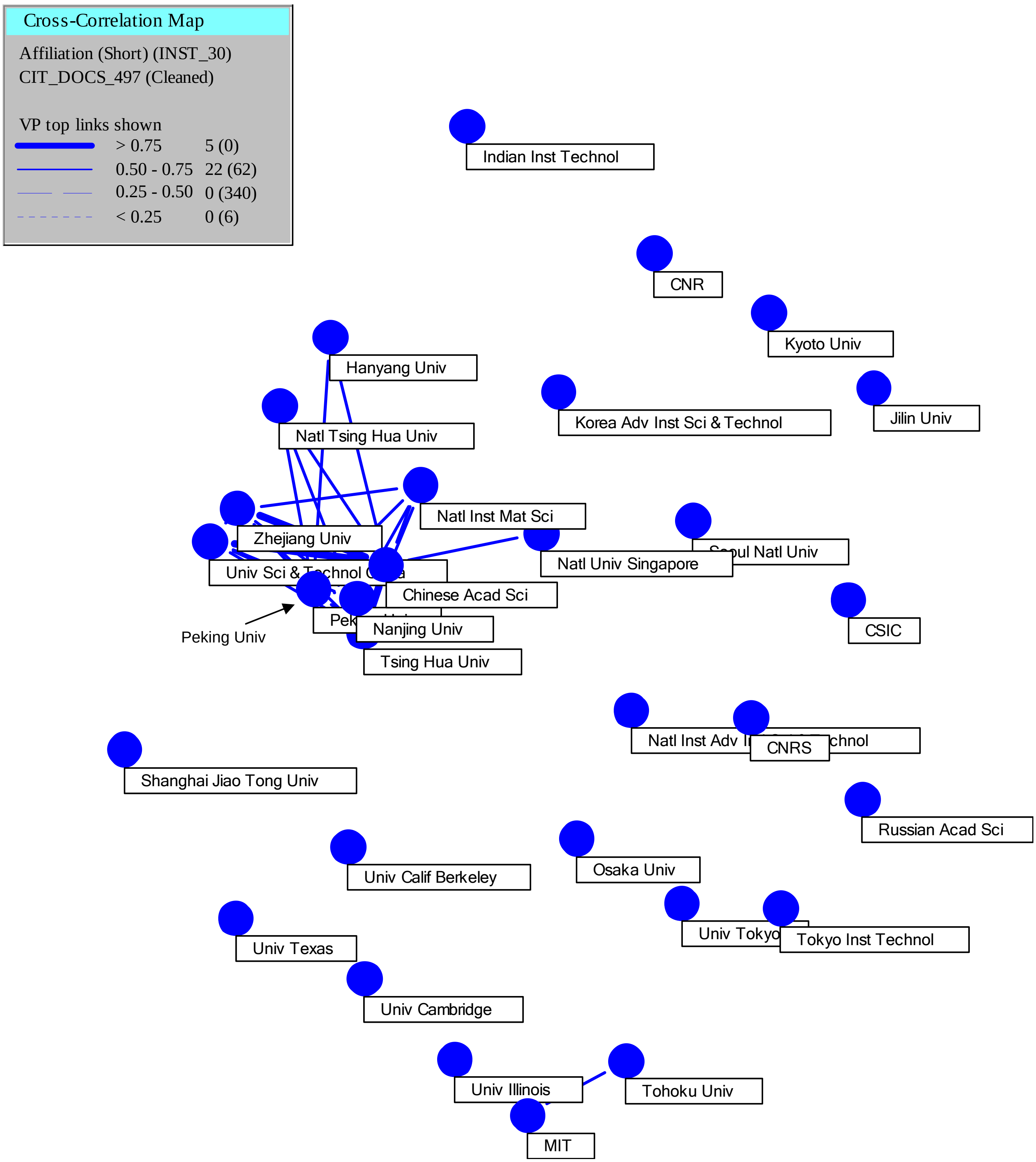


FIGURE ES6 - INSTITUTION-CITED DOCUMENT CROSS-CORRELATION MAP



ES2. TECHNICAL STRUCTURE

The total retrieved nanotechnology database for 2005 was examined from four perspectives to identify pervasive thematic thrusts: document clustering, autocorrelation mapping, factor analysis, cross correlation mapping. Each perspective provided valuable insights on the fundamental nanotechnology literature structure.

ES2.1. Document Clustering

The database was divided into 256 thematic clusters by the clustering algorithm. The USA produced most papers in 169 thrusts, China led in 70, Japan led in 15, and India, South Korea, and Spain each led in one.

A hierarchical taxonomy was constructed from these 256 elemental clusters. Of the taxonomy's sixteen fourth level categories, China was the publication leader in six. Specifically, China led in: Properties of Thin Films; Diamond Films; Applications of Carbon Nanotubes; Multi-Walled Nanotubes; Nanomaterials and Nanoparticles; and Polymers, Composites, and Metal Complexes (See Figure ES7; shaded areas denote China's publication leadership; darker shading represents stronger publication leadership). Essentially, China led in the materials and nanostructures component of the database, whereas the USA led in the Physical Science phenomena and biomedical components.

FIGURE ES7 – FOUR LEVEL HIERARCHICAL TAXONOMY

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
Quantum Phenomena, Optics, Electronics, Magnetism, Tribology, and Films (32983 Rec)	Quantum Phenomena, Optics, Electronics, Magnetism, and Tribology (26077 Rec)	Quantum Phenomena (3326 Rec)	Quantum Dots (2028 Rec)
			Quantum Wells, Wires, and States (1298 Rec)
		Optics, Electronics, Magnetism, and Tribology (22751 Rec)	Optics and Electronics (16432 Rec)
			Magnetism and Tribology (6319 Rec)
	Films (6906 Rec)	Thin Films (4760 Rec)	Properties of Thin Films (2251 Rec)
			Applications of Thin Films (2509 Rec)
		Deposition of Films (2146 Rec)	Deposition of Thin Films (1752 Rec)
			Diamond Films (394 Rec)
Nanotubes, Nanomaterials, Nanoparticles, Polymers, Composites, Metal Complexes, and Bionanotechnology (31742 Rec)	Nanotubes (3211 Rec)	Multi-walled Nanotubes (2350 Rec)	Applications of Carbon Nanotubes (474 Rec)
			Multi-walled Nanotubes (1876 Rec)
		Single-walled Nanotubes (861 Rec)	Single- and Double-walled Nanotubes (447 Rec)
			Single-walled Nanotubes (414 Rec)
	Nanomaterials, Nanoparticles, Polymers, Composites, Metal Complexes, and Bionanotechnology (28531 Rec)	Nanomaterials, Nanoparticles, Polymers, Composites, and Metal Complexes (22686 Rec)	Nanomaterials and Nanoparticles (14263 Rec)
			Polymers, Composites, and Metal Complexes (8423 Rec)
		Bionanotechnology (5845 Rec)	DNA (775 Rec)
			Proteins and Cellular Components (5070 Rec)

ES2.2. Autocorrelation Analysis

A map of the thirty highest frequency technical phrases showed the nanotechnology database divided into two major thematic groups. One was focused on instrumentation, and the other on structures that the instruments measure. The largest structures network was Films (deposition, nucleation, growth, electrooptical properties, mechanical properties), and there were Nanoparticle, Crystal, and Nanocomposite sub-networks linked to the instrumentation core as well.

ES2.3. Factor Analysis

A factor matrix of the retrieved database showed seven major thematic groups: Instrumentation; Film Formation and Properties; Nanotubes and nanowires; Nanocomposite Mechanical Properties; Growth and Nucleation; Crystal Structure; and protein Adsorption.

ES2.4. Cross-Correlation Analysis

A phrase-phrase map showed the two main thematic thrusts of 1) instrumentation and the quantities they measure (particle size, crystal structure, grain size, electrical properties), and 2) films and their related phenomena (deposition, optical properties). In this structure, Atomic Force Microscopy is the only instrument located within the Film group.

ES3. INSTRUMENTATION

A wide variety of instruments are used in nanoscience and nanotechnology research. Key among these instruments are XRD, electron microscope variants, atomic force microscopy, scanning tunneling microscopy, and spectroscopy variants.

ES3.1. Measured Quantities

Key materials, properties, phenomena, and nanostructures measured by the leading instruments are as follows:

- Materials: TiO_2, Ti, Si, SiO_2, and polymers
- Properties: Morphology/ surface morphology, thickness/diameter/particle size, surface roughness/surface area, mechanical properties/optical properties/thermal properties, crystal structure/crystallinity
- Phenomena: Deposition, oxidation, crystallization, catalytic activity, nucleation, adsorption, polymerization, adhesion, decomposition/ degradation
- Thin films, nanocomposites, nanowires, nanotubes, monolayers/self-assembled monolayers

ES3.2. Instrument Correlations

Key findings from the instrumentation correlation maps are as follows:

- Instrumentation auto-correlation map showed that the main network is in x-ray diffraction and electron microscopy. This is an indication that a well-equipped chemistry and/or material science laboratory usually contains a variety of instruments for characterizing various material properties. The instrument factor matrix showed similar grouping of a diversity of instruments in the same laboratory.
- Instrumentation-materials cross-correlation map showed that the main group consisted of electron microscopes and variants. Many of the

instruments are used to characterize materials of interest to semiconductor and microelectronics research.

- Similarly the instrumentation-properties cross-correlation map is focused mostly on the electronic properties of materials of interest to microelectronics research such as electron microscopy and atomic force microscopy.
- Same instruments are used to investigate the growth and fabrication phenonema in the instrumentation-phenomena cross-correlation map.
- Because of the dominance of nanoelectronics research, many nanostructures are focused on electronic applications and thus the Instrumentation-nanostructures cross-correlation map also showed the emphasis on instruments for characterizing the electronic structures.

ES3.3. Instrument Taxonomy

The hierarchical taxonomy offered the following insights:

- In this nanotechnology instrumentation study, ***China produced about 25% more papers than the USA*** (See Figure ES8; shading represents China's publication leadership; darker shading represents stronger publication leadership). By contrast, in the full nanotechnology study, ***the USA produced about 25% more papers than China.***
- Much of China's over-production occurred in the XRD-related categories, but there was some over-production in the transmission electron microscopy and NMR-calorimetry related categories as well.
- USA dominance appears to be in atomic force microscopy areas
- Because of the large Chinese and South Korean contributions to the nanotechnology instrumentation literature, author name analysis at aggregate levels is not effective; these Asian names are usually monosyllable, many times with no middle names. Due to the relatively high frequency of paper publications, there is good possibility that the same last name represents multiple authors. Potential name disambiguation is under study.
- Even though the USA has a large presence overall, relatively few USA institutions are listed among the most prolific in the nanotechnology instrumentation papers. The Asian and European efforts appear concentrated in relatively few but large institutions.

FIGURE ES8. NANOTECHNOLOGY INSTRUMENTATION TAXONOMY

AFM, NMR, Calorimetry (8423)	NMR, RS, Calorimetry (4684)	NMR, Complexes, Compounds (1546)	NMR Spectroscopy (306)
			NMR, Complexes, Compounds (1240)
		RS, Calorimetry (3138)	DSC (1138)
			Raman Scattering, RS, AFM (2000)
	AFM (3739)	AFM, Films, Tip, Imaging (2003)	AFM, Film, Tip, Imaging (1055)
			AFM, Film, Substrate, Deposit (948)
		AFM, Films, Deposition, Growth, Substrate (1736)	AFM, Film, Deposit, Substrate, Growth (1511)
			AFM, Magnetic (226)
EM, XRD (19090)	EM (4492)	TEM (2545)	HRTEM (296)
			TEM (2249)
		SEM, Films, Composites, Particles, Cells (1947)	SEM, Film, Particle, Cell (1652)
			SEM, IS (295)
	XRD, Films (14598)	SEM, XRD, Films, Coatings, Composites (3634)	SEM, XRD (1451)
			SEM, Film, Coating, Deposit, XRD (2183)
		XRD, TEM, Thin Films (10964)	TEM, Film, Particle, Nanoparticle, STM (5986)
			Film, XRD, XPS (4978)

Abbreviations:
AFM-Atomic Force Microscopy
NMR-Nuclear Magnetic Resonance
EM-Electron Microscopy
XRD-X-Ray Diffraction
RS-Raman Spectroscopy
TEM-Transmission Electron Microscopy
HRTEM-High Resolution Transmission Electron Microscopy
SEM-Scanning Electron Microscopy
DSC-Differential Scanning Calorimetry
IS-Infrared Spectroscopy
STM-Scanning Tunneling Microscopy

ES4. APPLICATIONS

The studies also identified the main nanotechnology Applications, both medical and non-medical, as well as the related science and infrastructure. These relationships will allow the potential user communities to become involved with the Applications-related science and performers at the earliest stages, to help guide the science conversion towards specific user needs most efficiently.

ES4.1. Non-Medical Applications

Related Science – Most Frequently Mentioned Non-Medical Applications

The pervasive materials, materials properties, phenomena, and nanostructures related to the ***most frequently mentioned*** non-medical nanotechnology Applications were identified, as follows:

- *TiO2, Pt, Si, gold, and polymers tend to stand out as the most pervasive material types*

- *Morphology, thickness /diameter/particle size, optical properties, catalytic performance, and electrochemical properties tend to stand out as the most pervasive material properties*

- *Deposition, absorption, oxidation, immobilization, catalysis, degradation, and self-assembly tend to stand out as the most pervasive nanoscale phenomena*

- *Thin films, nanowires, nanotubes (especially carbon), and self-assembled monolayers tend to stand out as the most pervasive nanostructures*

Applications Thrust Areas – Auto-Correlation

Maps were constructed to show groupings of related non-medical Applications into broader thematic areas. An autocorrelation map of the most widely referenced non-medical Applications showed five weakly-connected sub-networks:

- Electronic Devices and Components
- Optical Switching
- Tribology and Corrosion
- Optoelectronic Sensors
- Electrochemical Conversion and Catalysis

Applications Thrust Areas – Factor Analysis

Factor analyses were performed to show non-medical Applications thematic areas from a slightly different perspective. A six factor analysis showed the following themes:

- Factor 1: Optoelectronics
- Factor 2: Tribology
- Factor 3: Lithography
- Factor 4: Control Systems
- Factor 5: Devices
- Factor 6: Microsystems

Applications Thrust Areas – Factor Analysis and Visual Inspection

The main non-medical Applications thrusts identified above were augmented by important, but non-networked thrusts, and the nine resulting themes were related to science and infrastructure by co-occurrence matrices. Also, the total non-medical Applications were combined into one unit, and related to science and infrastructure by co-occurrence matrices. For non-medical Applications:

- The USA leads in total non-medical Applications publications and in six out of nine themes in the high-tech research areas such as devices, sensors, and lithography. China leads in publications in three traditional area themes such as catalysis, tribology, and electrochemistry.
- In total non-medical Applications, two of the top three institutions are Chinese. However, the USA is well represented by the large University of California and University of Illinois state university systems.
- Applied Physics Letters appears in the top layer in seven of the nine themes and is by far the leader in total non-medical Applications

publications. Journal of Physical Chemistry B appears in four of the nine themes, as does Journal of Applied Physics.

- For total non-medical Applications, the key underlying science areas include XRD, TEM, films, SEM, XPS, electron microscopy, AFM, fabrication, thickness, growth, hydrogen, substrate, carbon nanotubes, microstructures, nanoparticles, particles, diameter, TiO_2, deposits, coatings, electrodes, silicon, CO, infrared spectroscopy FTIR, electrons, biosensors, catalytic activity, oxidation, silica, thin films, nanotubes, silicon substrates, PL, photocatalytic activity, crystals, Raman spectroscopy, mechanical properties, particle sizes, proteins, catalysis, sol-gel, gold, storage, metals, optical properties, annealing, adsorption, platinum, polymer, corrosion, quantum dots. Instrumentation and the associated growth of nanostructures dominate the science efforts at present.

4.2. Medical Applications

Related Science – Most Frequently Mentioned Medical Applications

The pervasive instrumentation, materials, structures, and phenomena related to the most frequently mentioned nanotechnology medical applications were identified, as follows:

- Instrumentation: *surface plasmon resonance, atomic force microscopy, scanning electron microscopy, transmission electron microscopy, differential scanning calorimetry, x-ray photoelectron spectroscopy, fourier transform infrared spectroscopy, quartz crystal microbalance, magnetic resonance imaging, confocal laser scanning, enzyme linked immunosorbent assay, laser scanning microscopy, x-ray diffraction, mass spectrometry.*

- Materials: *protein, DNA, peptides, drugs, bovine serum albumin, poly ethylene glycol, single stranded DNA, double stranded DNA, green fluorescent protein, lipids, human serum albumin, Escherichia Coli, antibodies, tissues, enzymes, genes, oligonucleotides, gold, nucleic acid.*

- Structures: *cells, membranes, surfaces, nanoparticles, self-assembled monolayers, cell surfaces, endothelial cells, receptors*

- Phenomena: *fluorescence, interaction, polymerase chain reaction, dynamic light scattering, resonance energy transfer, particle size, drug release, cell adhesion, binding, affinity, gene expression, transfection efficiency*

Applications Thrust Areas – Visual Inspection

A medical Applications categorization constructed from visual inspection of the fuzzy clustering categories showed five thematic categories:

- Cancer Treatment
- Sensing and Detection
- Cells
- Proteins
- DNA

Applications Thrust Areas – Fuzzy Clustering

For medical Applications, analysis of nineteen thematic categories obtained from fuzzy clustering of the total 2005 nanotechnology database revealed the following:

- The USA is the publication leader in total Health types, and in all the thematic areas as well, most by a wide margin. China was the second most prolific in seven thematic areas, Japan in six, Germany in four, and England in two.
- The University of California system led in five clusters, the Chinese Academy of Science led in four, and the National University of Singapore led in three. The University of California and the Chinese Academy of Science were the most prolific in the non-medical Applications as well, but their orders were reversed. The National University of Singapore is a prolific contributor, especially in pharmaceuticals and biomaterials.
- The journal Langmuir contains the most articles in total Health, and is in the top layer of ten of nineteen themes. The only journals in common in the top layers of Applications and Health are Langmuir and Journal of Physical Chemistry B.
- For total medical applications, the key underlying science areas include cells, proteins, DNA, membranes, binding, drugs,

fluorescence, peptides, nanoparticles, detection, lipids, antibodies, immobilization, tissues, receptors, enzymes, genes, drug delivery, self assembly, cell surface, detection limit, escherichia coli, amino acid, molecular weight, particle size, real time, serum albumin, drug release, cell line, cell adhesion, DNA molecules, endothelial cells, surface plasmon resonance, atomic force microscopy, scanning electron microscopy, transmission electron microscopy, differential scanning calorimetry, x-ray photoelectron spectroscopy, bovine serum albumin, poly ethylene glycol, single stranded DNA, double stranded DNA, green fluorescent protein, fourier transform infrared spectroscopy, quartz crystal microbalance, polymerase chain reaction, self assembled monolayer, magnetic resonance imaging, confocal laser scanning, dynamic light scattering, enzyme linked immunosorbent assay, resonance energy transfer, extracellular matrix, laser scanning microscopy, human serum albumin, and poly lactic acid.

Thus, the instrumentation and nanostructure growth science areas still play a key role, but unique health-related issues/ phraseology such as proteins, drugs, antibodies, bacteria, DNA, peptides, tissues, collagen, genes, etc, are strong science interests that focus on the unique aspects of nanotechnology medical research.

BACKGROUND

There are two main technical underpinnings for this report: text mining and nanotechnology. A brief overview of each is provided in this section.

Text Mining

A typical text mining study of the published literature develops a query for comprehensive information retrieval, processes the retrieved database using computational linguistics and bibliometrics, and integrates the processed information. In this section, the computational linguistics and bibliometrics are overviewed.

Science and technology (S&T) computational linguistics [Kostoff, 2003a; Hearst, 1999; Zhu and Porter, 2002; Losiewicz et al, 2000] identifies pervasive technical themes in large databases from technical phrases that occur frequently. It also identifies relationships among these themes by grouping (clustering) these phrases (or their parent documents) on the basis of similarity. Computational linguistics can be used for:

- Enhancing information retrieval and increasing awareness of the global technical literature [Kostoff et al, 1997; Greengrass, 1997; TREC, 2004]
- Potential discovery and innovation based on merging common linkages among very disparate literatures [Kostoff, 2003b, 2005a; Swanson, 1986; Swanson and Smalheiser, 1997; Gordon and Dumais, 1998]
- Uncovering unexpected asymmetries from the technical literature [Kostoff, 2003c; Goldman et al, 1999]. For example, Kostoff [2003c] predicted asymmetries in recorded bilateral organ (lungs, kidneys, testes, ovaries) cancer incidence rates from the asymmetric occurrence of lateral word frequencies (left, right) in Medline case study articles.
- Estimating global levels of effort in S&T sub-disciplines [Kostoff et al, 2000, 2004a; Viator and Pastorius, 2001]
- Helping authors potentially increase their citation statistics by improving access to their published papers, and thereby potentially helping journals to increase their Impact Factors [Kostoff et al, 2004a, 2004b]
- Tracking myriad research impacts across time and applications areas [Kostoff et al, 2001; Davidse and VanRaan, 1997].

Evaluative bibliometrics [Narin, 1976; Garfield, 1985; Schubert et al, 1987] uses counts of publications, patents, citations and other potentially informative items to develop science and technology performance indicators. Its validity is based on the premises that 1) counts of patents and papers provide valid indicators of R&D activity in the subject areas of those patents or papers, 2) the number of times those patents or papers are cited in subsequent patents or papers provides valid indicators of the impact or importance of the cited patents and papers, and 3) the citations from papers to papers, from patents to patents and from patents to papers provide indicators of intellectual linkages between the organizations that are producing the patents and papers, and knowledge linkage between their subject areas [Narin et al, 1994]. Evaluative bibliometrics can be used to:

- Identify the infrastructure (authors, journals, institutions) of a technical domain,
- Identify experts for innovation-enhancing technical workshops and review panels,
- Develop site visitation strategies for assessment of prolific organizations globally,
- Identify impacts (literature citations) of individuals, research units, organizations, and countries

Nanotechnology

2.2.1. Literature Review Overview

A comprehensive background of the seminal works in nanotechnology is contained in Appendix 1. There are numerous books (e.g., Bhushan's Handbook of Nanotechnology [Bhushan, 2004]; Goddard's Handbook on Nanoscience, Engineering, and Technology [Goddard, 2002]; and Freitas' multi-volume set on nanomedicine [Freitas, 1999, 2003]). Appendix 1A is a more complete listing of reference books, review articles (e.g., Kricka's multi-lingual survey of nanotechnology books and patents [Kricka and Fortina, 2002]; Simon's review of the science and potential applications of nanotechnology [Simon, 2005]), and reports (e.g., The Royal Society's comprehensive review on nanoscience and nanotechnologies [Dowling et al, 2004]; Colton's in-depth review of nanoscale measurements and manipulation [Colton, 2004]). However, none of these published reviews have the spatial and temporal breadth and depth of coverage of the present report, none use a query of the extent and complexity of the present report, and none do full text mining of the results to obtain structure and infrastructure of the nanotechnology literature. Every published research review on nanotechnology typically covers a focused technology sub-set, not the total field as is done in the present report. For the Patent literature, [Huang et al, 2004] provides a comprehensive text mining analysis of international nanotechnology development that serves to complement the present study.

Technical Background Overview

Nanoscience refers to the study of materials, structures, and devices at the nanometer scale. More recently, nanoscience and nanotechnology refer to the research of materials and structures where some critical dimension is in the range of 1 to 100 nanometers. Below that size scale, the disciplines of Chemistry and Atomic/Molecular Physics have already provided detailed scientific understanding. Above that size scale, Condensed Matter Physics and Materials Science have provided detailed scientific understanding of microstructures in the last 50 years. So, the nanoscale is the last “size” frontier for materials science.

If one expected to simply extrapolate the properties of nanomaterials from the size scales above or below, then there would be little reason for the current interest in nanoscience / nanotechnology. However, there are three reasons for nanostructured materials to behave very differently at nanoscale levels: large surface/interface to volume ratios; size effects (where cooperative phenomena like ferromagnetism are compromised by the limited number of atoms/molecules); and quantum effects. Many of the models for materials properties at the micron and larger sizes have characteristic length scales of nanometers. When the size of the structure is in the nanometer region, the parameters used in the microscopic models will no longer be adequate to model/predict the property. One can expect “surprises” – new materials properties that may be technologically exploitable.

While the scientific understanding of nanostructures is deficient, their use in technology is at least two thousand years old. The Lycurgis cup, a Roman artifact pictured in the lower left of Figure 1, utilizes nanosized gold (Au) clusters to provide different colors depending on front or back lighting. The Roman artisans knew how to achieve the effect even though they may not have understood the scientific basis for the nanoclusters. In the last century, nanostructures have contributed to <u>many</u> significant technologies - examples include the addition of nanosized carbon particles to rubber for improved mechanical properties (tires), the use of nanosized particles for catalysis in the petrochemical industries, and the nucleation of nanosized silver (Ag) clusters during photographic film exposure. These technologies were all developed empirically. As depicted in Figure 0, one might assign these examples to an empiric epoch in the continuing evolution of nanotechnology.

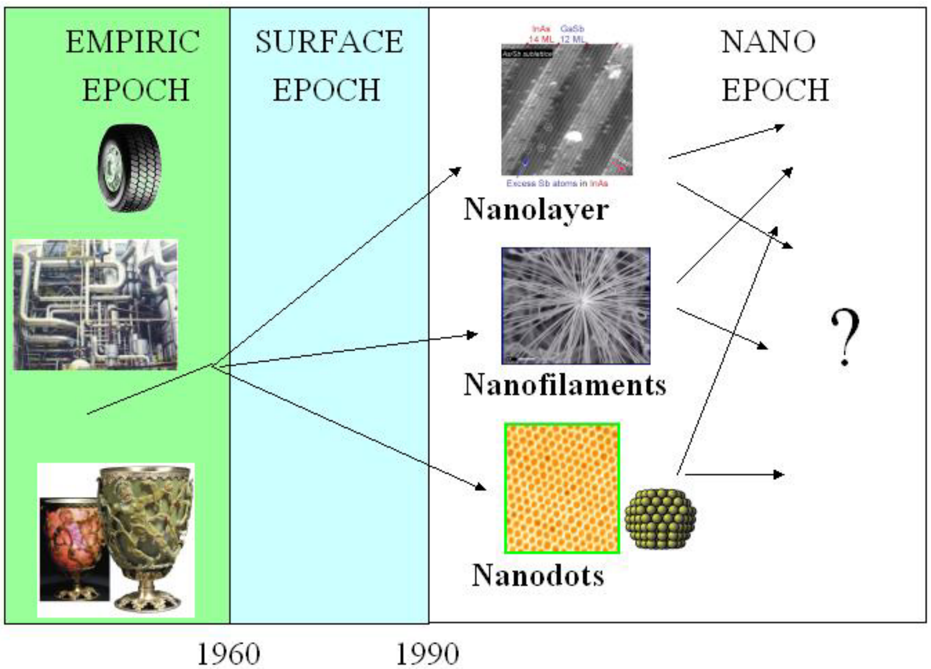


Figure 0: Paleontology of Nanostructures

Empirically based technology, without greater scientific understanding, is usually difficult to extend or control. The scientific foundation of nanostructures received a boost in the 1960s when surface science enjoyed a renaissance. Surface science deals with the study of material surfaces, and generally was constrained to the nanometer size scale in one dimension. Events catalyzing that renaissance were the development of new surface-sensitive analytical tools, the ready availability of ultra-high vacuum (a by-product of the space age), and the maturity of solid-state physics (surfaces representing a controlled lattice defect – termination of repeating unit cells). The principal economic driving force was the electronics industry, but surfaces were also recognized to play an essential role in many "reliabilities"

– adhesives, corrosion protection, friction, wear, fracture, etc. From 1960 to the present, surface science has progressed from "clean, flat and cold" into the technologies of thin films (two or more nanoscale interfaces) and film processing.

What might be labeled as modern nanotechnology development began in the late 1980s, when the science literature involving nanostructures showed the beginnings of a classic S-curve. The emergence of nanoscience/ nanotechnology in the 1990s has close parallels to the 1960 surface science renaissance. First, beginning in 1980, the discovery and development of proximal probes – scanning tunneling microscopy/spectroscopy, atomic force microscopy/spectroscopy, near-field microscopy/spectroscopy – have provided tools for visualization, measurement, and manipulation of individual nanosized structures. Those tools took 10-15 years for invention to the development of reliable commercial instruments in the market. The properties of the individual nanostructures can now be observed, instead of at the macroscopic ensemble averaged level. In turn, those properties can be understood in terms of composition / structure. With that understanding came the possibility for control, and with control came the possibility for accelerated progress toward new materials and new technology.

Second, in addition to the new experimental measurement capabilities, computer hardware is now sufficiently advanced (speed and memory capacity) such that accurate predictions, based on ab initio first principles, are enabled for reasonable number of atoms in a nanostructure. Modeling and simulation will play a leading role in the race toward nanotechnology. Third, the disciplines of biology, chemistry, materials, and physics have all reached a point where nanostructures are of interest – chemistry building up from simpler molecules, physics/materials working down from microstructures, and biology sorting out from very complex cellular systems into simpler subsystems. Finally, there are several economic engines driving the interest in information technology (electronics and photonics), biotechnology (pharmaceuticals and healthcare), and high performance materials. Estimates of potential economic impact cite a worldwide commercial market on the order of $1 trillion per year well before 2020 for systems whose function is enabled by the properties of nanostructures – "Nano-Inside."

With the substantial scientific and economic opportunities, it is not surprising to find strong global interest in fostering nanoscience / nanotechnology, with the intent of accelerating scientific discovery into innovative commercial product. The increasing nanotechnology patent literature gives evidence for that acceleration. From estimates of global FY05 budgets, over $3.5 billion was invested worldwide in nanotechnology S&T in 2005, with the U.S. federal government nanotechnology investment of about $1.1 billion. Every industrialized nation, as well as almost every developing nation, has launched nanotechnology initiatives. This strong commitment of science and technology (S&T) funds ensure the rapid growth in nanoscience and nanotechnology will continue.

INTRODUCTION

Broadly speaking, nanotechnology is the development and use of techniques to study physical phenomena and construct structures in the physical size range of 1-100 nanometers (nm), as well as the incorporation of these structures into applications. Although size is a convenient way of defining the area, it alone is not enough to distinguish the nanoscale material from microscopic material. For example, there is no line of demarcation that separates structures at 120 nm from that of 100 nm. In practice, nanotechnology has more to do with the investigation of novel properties that manifest themselves at that size scale, and of the ability to manipulate and artifically construct structures at that scale. Experiments and computer simulation have been targeted at very small scales for decades. The advances in high speed and high storage capacity computers, as well as accurate instruments for measuring and manipulating at the nanoscale, have accelerated the development of nanoscale structures and devices into reality.

Public and private support for further nanotechnology development has increased dramatically. In the National Nanotechnology Initiative, launched in 2001, the U. S. Federal government will contribute billions of dollars to further development by the end of the decade. World-wide, other governments have infused substantial funding to nanotechnology programs. The private sector is heavily investing in this technology as well, anticipating the large size of the potential market for nanotechnology products.

Along with the growth in the tools and products of nano-science and technology (and its financial support) has come the growth in the related technical literature. In the fundamental nanotechnology research literature as represented by the SCI/ SSCI, publications grew from 11,265 articles in 1991 to 64,737 articles in 2005 (almost a sixfold increase in fourteen years), using the query listed in Appendix 2.

Given this voluminous literature, as well as the other voluminous literatures of Patents, Technical Reports, other large databases, and the Web, how can one gain an integrated perspective of the overall state of nanotechnology? Text mining offers one potential approach. This report describes the results of applying text mining to the SCI/ SSCI nanotechnology literature. The full list of keywords used in queries to retrieve the data in the literature is contained in Appendix 2.

Then, the retrieved dataset is analyzed to produce the following characteristics and key features of the nanotechnology field: recent prolific nanotechnology authors; journals that contain numerous nanotechnology papers; institutions that produce numerous nanotechnology papers; keywords most frequently specified by the nanotechnology authors; authors, papers and journals cited most frequently; pervasive technical themes of the nanotechnology literature; and relationships among the pervasive themes and sub-themes.

APPROACH

1. Databases

The primary objective of this study was to identify and characterize the global research literature that was related directly to nanotechnology/ nanoscience. A secondary objective was to estimate the relative level of global effort in the sub-categories of nanoscience/ nanotechnology research, as reflected by the emphasis in the published literature.

To accomplish these objectives, the first step was to define the most appropriate databases to be accessed consistent with available resources. There are multiple global databases that contain research articles in the diverse disciplines that comprise nanotechnology/ nanoscience, multiple global patent databases, sponsoring agency award narrative databases, classified databases, proprietary technology databases, technical report databases (e.g., DTIC, NTIS), books, physical science and biomedical magazines not accessed by the major databases, Web articles/ pages, and many other types.

Each of these databases/ sources has its own perspective to offer on the nanoscience/ nanotechnology problem, and each has value to contribute. Unfortunately, because of terminology that tends to be specific to each database (e.g., the basic research literature databases tend to use different terminology from the very applied research literature databases.), a separate text mining analysis of each database, including database-specific query development, is required to maximally exploit the information available from each database. These multiple database analyses translate into massive resource expenditures. Therefore, the database selection task translates into a decision to select the most appropriate database(s) that will allow the study objectives to be attained.

The SCI/ SSCI covers most of the research disciplines related to nanoscience/ nanotechnology, and allows citation information to be obtained. Because citation bibliometrics are an important tool used by the first author's text mining group, and this citation capability is an SCI/ SSCI specialty, the SCI/ SSCI was selected as the database for the analyses. Additionally, it was desired to focus on the original research component of the SCI/ SSCI, as well as reviews, and not mix objects of different categories (e.g., editorials, letters, etc). Therefore, only records classified as Articles or Reviews in the SCI/ SSCI were downloaded.

2. Query Development

Once the source database was selected, the iterative search approach of Simulated Nucleation (Kostoff et al, 1997a) was used to generate the bulk of the search query. The SCI/ SSCI-retrieved database consisted of selected journal records (including authors, titles, journals, author addresses, author keywords, abstract narratives, and references cited for each paper) obtained by searching the Web version of the SCI/ SSCI for nanoscience/ nanotechnology research articles. While some time trends were studied, most of the analysis covered 2005 only. The database used represented the bulk of the documented, peer-reviewed high quality nanoscience/ nanotechnology research open literature.

To extract relevant articles from the SCI/ SSCI, a test query was used, and the Title, Keyword, and Abstract fields were searched using phrases relevant to nanoscience/ nanotechnology. The resultant Abstracts were then culled to leave those relevant to nanoscience/ nanotechnology. Gradations of relevancy or non-relevancy were not considered. Phrase frequency analyses were performed on the textual database of retrieved papers. The high frequency single, double, and triple word phrases judged to be characteristic of relevant papers, and their Boolean combinations, were then added to produce the topic field component of the final query shown in the Introduction.

Two additional fields were accessed for the remainder of the query. All journals with nano* in their title were retrieved using the Source field. All their contents were relevant. Essentially all institutions with nano* in their address field were retrieved using the Address field. All these retrievals were relevant. The detailed query is contained in Appendix 2.

3. Bibliometrics

The results from the publications bibliometric analyses are presented first, followed by the results from the citations bibliometrics analysis. The SCI/ SSCI bibliometric fields incorporated into the database included, for each paper, the author, journal, institution, keywords, and references for each paper.

The publications bibliometrics are counts of papers published by different entities. These metrics can be viewed as output and productivity measures. They are not direct measures of research quality, although there is some threshold quality level inferred, since these papers are published in the (typically) high caliber journals accessed by the SCI/ SSCI.

The citation bibliometrics are counts of citations to documents published by different entities. While citations are ordinarily used as impact or quality metrics (Garfield, 1985), much caution needs to be exercised in their frequency count interpretation, since there are numerous reasons why authors cite or do not cite particular documents (MacRoberts and MacRoberts, 1989, 1996; Kostoff, 1998b).

The citations in all the retrieved SCI/ SSCI papers were aggregated, the authors, specific documents, years, journals, and countries cited most frequently were identified, and are presented in order of decreasing frequency. A small percentage of any of these categories received large numbers of citations.

4. Taxonomies

Past text mining studies by the first author (e.g., Kostoff et al, 1998a, 1999, 2000a, 2000b, 2001a, 2001b, 2002, 2004a, 2004b, 2004c, 2005b, 2005c, 2005d, 2005e, 2006a, 2006c, 2006d) have used a variety of approaches to identify the main technical themes in the database(s) being analyzed, as well as the inter-relationships among themes. These approaches include extracting key phrases and manually assigning them to categories; extracting key phrases and assigning them with a statistical computer algorithm, using factor analyses and multi-link clustering; and grouping documents based on text similarity.

Based on recent text mining results, three theme identification/ relationship identification methods were used: document clustering, factor analysis, correlation mapping. All these methods used the Abstracts text only. All will now be overviewed briefly.

4A. In document clustering, documents are combined into groups based on their text similarity. Document clustering yields numbers of documents in each cluster directly, a proxy metric for level of emphasis in each taxonomy category.

Different document clustering approaches exist (Cutting et al, 1992; Guha et al, 1998; Hearst, 2000; Karypis et al, 1999; Prechelt et al, 2002; Rasmussen, 1992; Steinbach et al, 2000; Willet, 1988; Wise, 1992; Zamir and Etzioni, 1998). The approach presented in this section is based on a partitional clustering algorithm (Karypis, 2004; Zhao and Karypis, 2004) contained within a software package named CLUTO. Most of CLUTO's clustering algorithms treat the clustering problem as an optimization process that seeks to maximize or minimize a particular clustering criterion function defined either globally or locally over the entire clustering solution space. CLUTO uses a randomized incremental optimization algorithm that is greedy in nature, and has low computational requirements. CLUTO is described in more detail in Appendix 3.

Two hundred and fifty-six individual clusters were chosen for the database (2005 Articles retrieved from the SCI/ SSCI). Because of the data volume, these clusters are presented in detail in Appendix 7. Compared to past document clustering algorithm inputs, a much larger trivial words list was selected to eliminate obvious non-technical words. With more trivial words eliminated, text similarity becomes based on the desired high technical content words, and sharper, less ambiguous clusters result. CLUTO also agglommorates the 256 clusters in a hierarchical tree (taxonomy) structure, and this taxonomy is presented later in the present report.

4B. Factor Analysis

Factor analysis of a database aims to reduce the number of variables in a system, and to detect structure in the relationships among variables. Correlations among variables are computed, and highly correlated groups (factors) are identified. The relationships of these variables to the resultant factors are displayed clearly in the factor matrix, whose rows are variables and columns are factors. In the factor matrix, the matrix elements Mij are the factor loadings, or the contribution of variable i (in row i) to the theme of factor j (in column j). The theme of each factor is determined by those variables that have the largest values of factor loading. Each factor has a positive value tail and negative value tail. For each factor, one of the tails typically dominates in terms of absolute value magnitude. This dominant tail is used to determine the central theme of each factor. Factor analysis was used to quantify word/ phrase, institution, and country collaborations.

4C. Correlation Mapping

An auto-correlation function describes the correlation between a random function and a copy of itself shifted by some 'lag' distance. One can produce a map showing terms that commonly occur together. For example, an auto-correlation map of institutions shows teams of institutions that publish together.

A cross-correlation map shows relationships among items in a list based on the values in another list. A cross-correlation map of institutions and phrases can show groups of organizations that write about the same things. A cross-correlation map of countries and phrases can show groups of nations that write about the same things.

5. Instrument Identification

The following approach describes how the main nanotechnology instruments were identified, along with the main categories of items that they measure. A phrase frequency analysis was performed on the total retrieved 2005 database, and hundreds of thousands of phrases were generated. All single word, adjacent double word, and adjacent triple word phrases were extracted and corrected to eliminate phrases containing trivial words at the beginning or end, and their occurrence frequencies were recorded. The phrases were then inspected visually, starting from the highest frequency. Approximately 60000 phrases were examined visually. Every instrument-related phrase was extracted. Then, the root phrase for each instrument (e.g., microscop*, spectroscop*) was inserted into the phrase search engine, and all variants of the instrument terminology were retrieved, including the lowest frequency variants Approximately 240 phrases resulted. Additionally, phrases related to materials, properties, phenomena, and nanostructures were extracted during the visual inspection process.

6. Applications Identification

The same visual inspection procedure was used to identify non-medical applications as was used for instrumentation, with the exception that every non-medical applications-related phrase was extracted. For medical applications, a fuzzy clustering approach was used. The sub-section of the hierarchical taxonomy that covered medical applications was identified.

RESULTS

Query/ Records Retrieved

As stated previously, the query described in the Introduction and contained in Appendix 2 was input to the SCI/ SSCI search engine, and 64737 research Article and Review records were retrieved for 2005. The query was also used to generate time trends of publications.

Publication Time Trends

1. Numbers of Aggregate Publications

FIGURE 1 – SCI/ SSCI ARTICLES VS TIME TOTAL RECORDS RETRIEVED

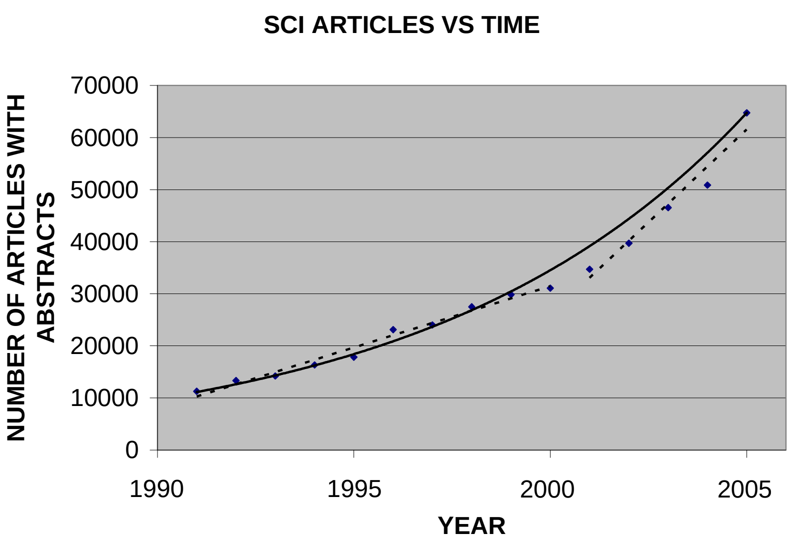


Figure 1 shows the annual totals of nanotechnology/ nanoscience articles retrieved from the SCI/ SSCI for the period 1991-2005. The points are the actual number of articles retrieved, the solid line is an exponential fit to the data that includes the two end points, and the two dotted lines are linear fits to the data for adjacent time periods (1991-2000; 2001-2005). The slope of the second line is greater, indicating that the rate of increase of nanoscience/ nanotechnology articles produced was higher in the last five years than during the 1990s.

2. Temporal Country Publication Distributions

FIGURE 2A – COUNTRY COMPARISON TIME TREND

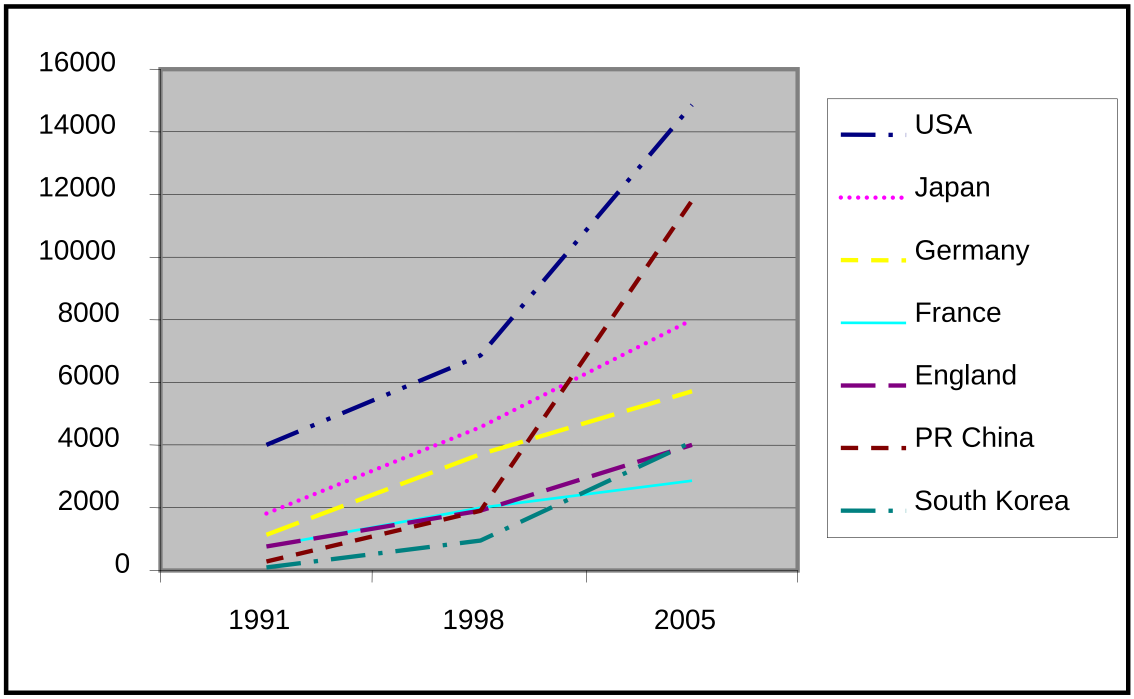


Figure 2A shows the breakdown of nanoscience/ nanotechnology article production by country for three selected years (1991, 1998, and 2005). All of the leading countries in nanotechnology have increased production from 1991 to 2005, but the growth in research has not been uniform globally. The USA leads the world in nanotechnology paper publications, whereas the most dramatic increase is from the Peoples Republic of China, from 1,860 papers in 1998 to 11,768 papers in 2005. South Korea has increased published research output by a factor of forty since 1991.

FIGURE 2B – COUNTRY TIME TREND PERCENTAGES

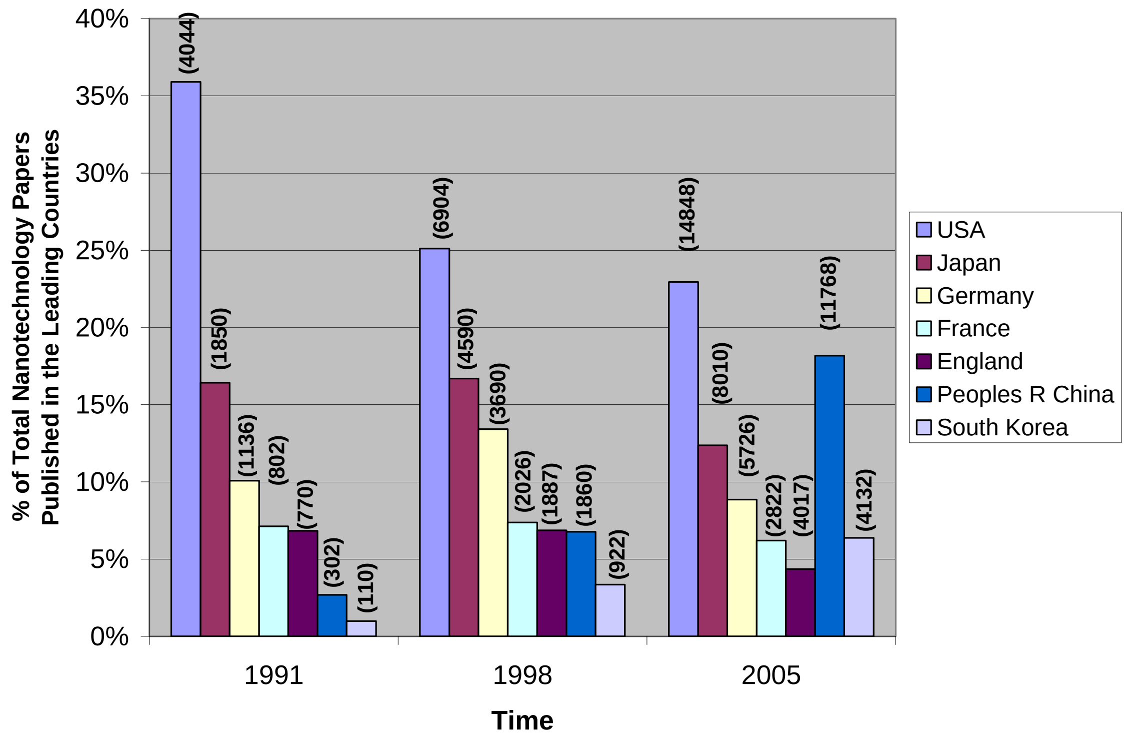
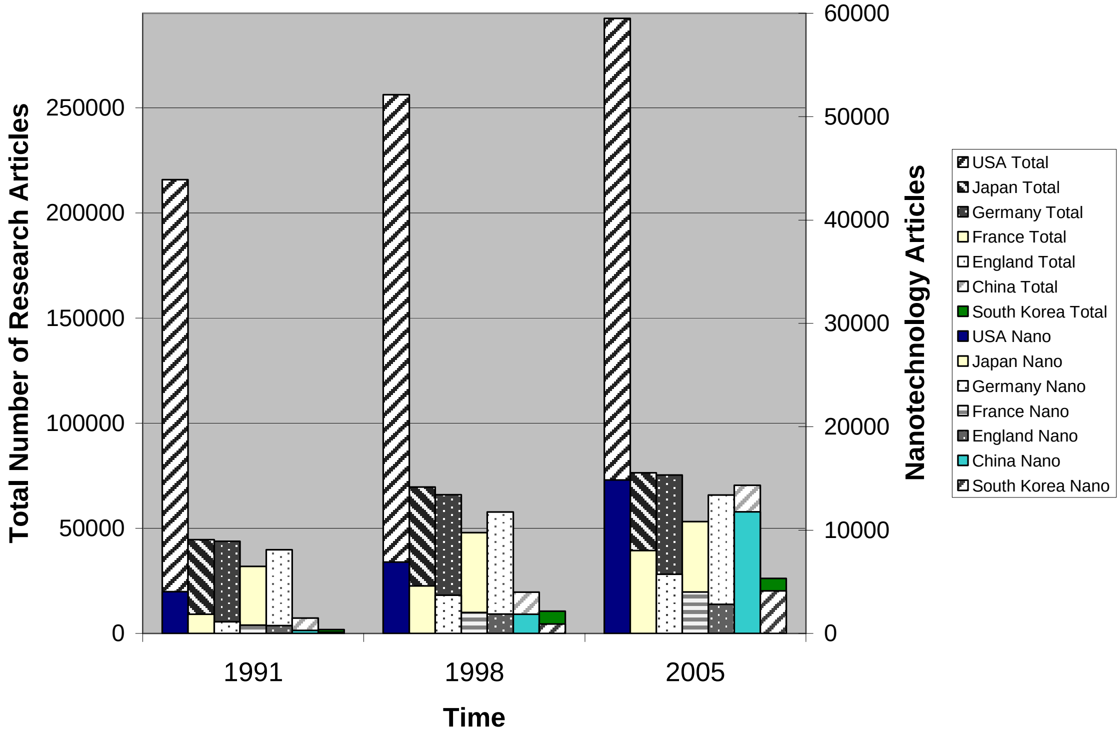


Figure 2B shows the breakdown of nanoscience/ nanotechnology article production by countries in percentage shares for the same three selected years. The numbers in parentheses above the bars are actual numbers of papers produced for the year in question. Over this time period, the United States' and Japan's shares of global nanotechnology/ nanoscience publications have dropped (the USA dropped from 36% to 23%, and Japan from 16.5% to 12.5%), as countries that were not as prolific at the beginning of the 1990s grew rapidly over the course of the decade. Most notably, China and South Korea both published about forty times more research articles in 2005 than in 1991. The other leading countries increased their output by at most five times.

Figure 2C places these nanotechnology/ nanoscience numbers in perspective by plotting their temporal trends as a function of total country SCI/ SSCI articles. As the total number of research articles for most countries has gone up, the percentage of nanotechnology papers has also gone up disproportionately relative to other technical disciplines.

FIGURE 2C – NANOTECHNOLOGY FRACTION OF TOTAL ARTICLES



From the aggregate country temporal perspective of Figure 2B, the US appears well ahead of China in numbers of articles produced, although China is growing rapidly. From the aggregate nanotechnology perspective of Figure 2A, the US is moderately ahead of China in articles produced, although China appears poised to overtake the US in a few years if the trends shown continue.

3. Temporal Nanotechnology Sub-Area Publication Distributions across Countries

While the publication results aggregated across all nanotechnology/ nanoscience sub-areas are interesting, even more illuminating are the results dis-aggregated by nanotechnology sub-area. Based on a recent comparison of China's research area emphases with those of the US (Kostoff et al, 2006c), some nanotechnology sub-areas were identified where China's research article outputs were comparable in absolute numbers to those of the US. The time histories of the major country contributors to three selected nanotechnology sub-areas are shown in Figures 3A-3C.

Two caveats are in order. The numbers shown do not add up to 100% in any year, since only four selected countries are shown. Other contributors will supply the remainder. Second, when all contributions are included, the numbers could total beyond 100%, since co-authored papers are counted for each of the co-authors. With those caveats, the discussion proceeds.

FIGURE 3A – # PAPERS CONTAINING "XRD AND NANO*"

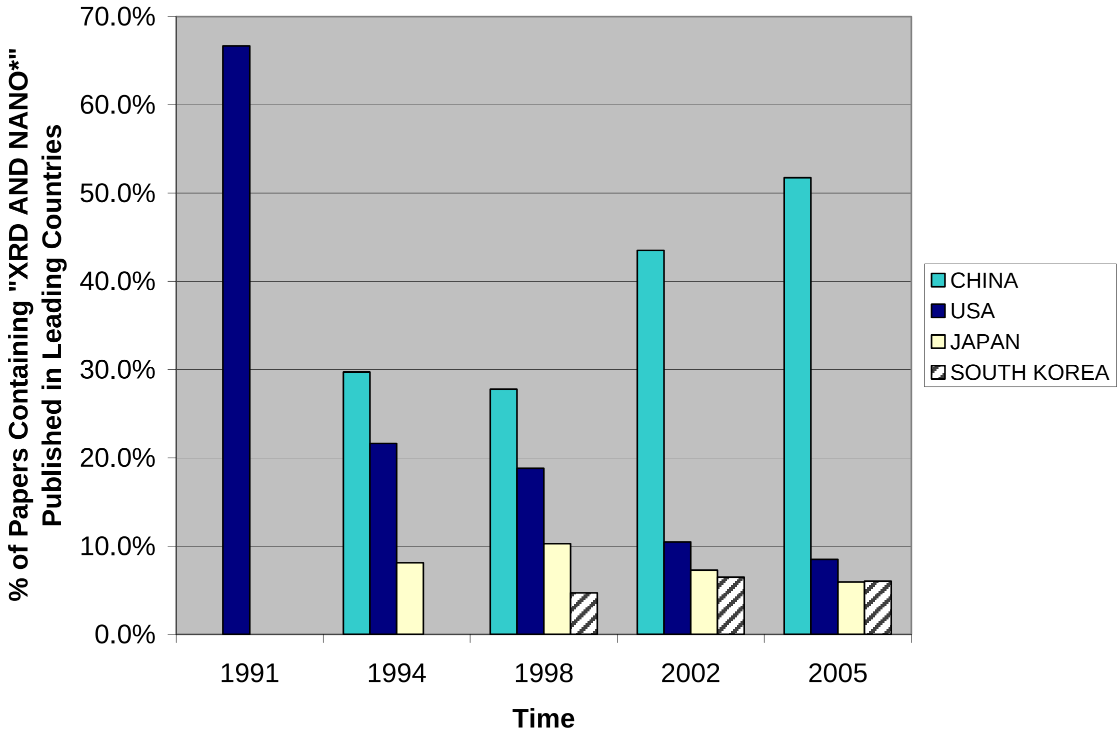


FIGURE 3B – # PAPERS CONTAINING "NANOCOMPOSITE*"

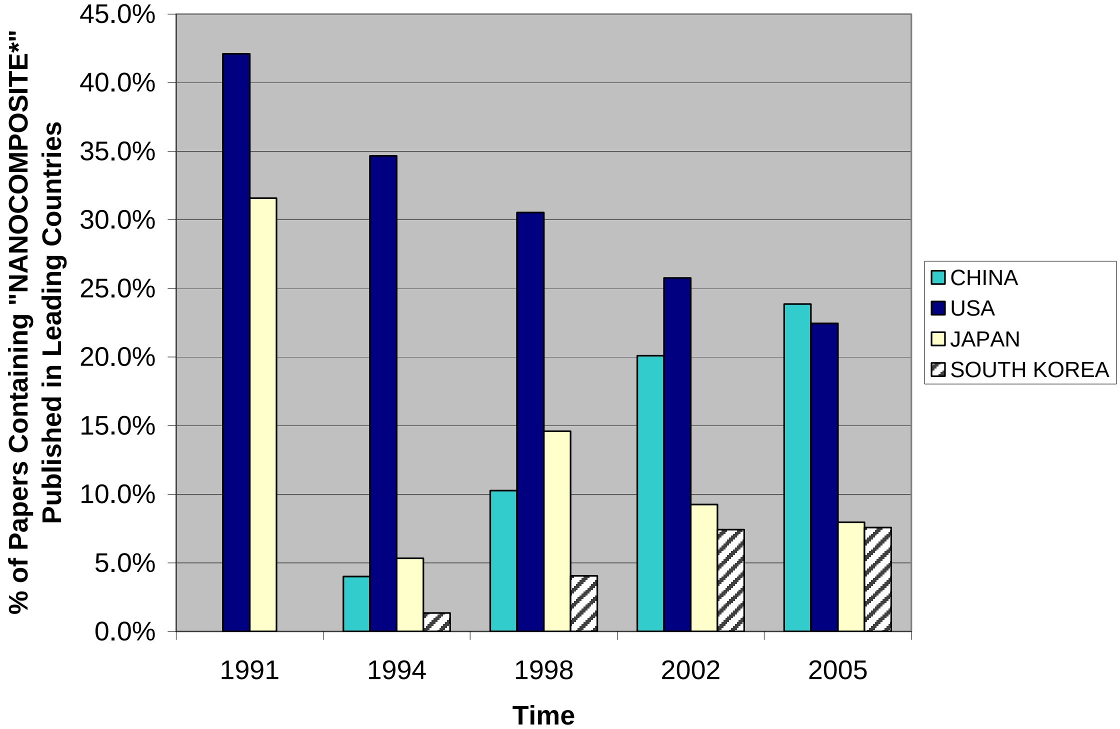
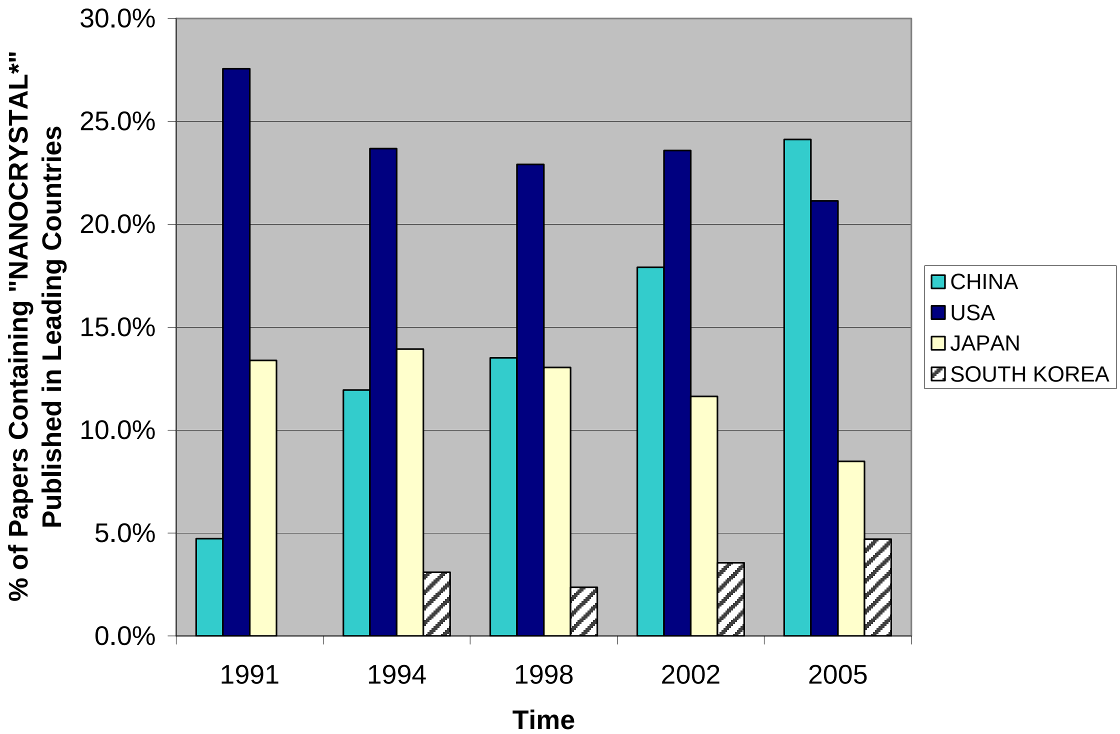


FIGURE 3C – # PAPERS CONTAINING “NANOCRYSTAL*”



From the aggregate country temporal perspective of Figure 2B, the US appears well ahead of China in numbers of articles produced, although China is growing rapidly. From the aggregate nanotechnology perspective of Figure 2A, the US is moderately ahead of China in articles produced, although China appears poised to overtake the US in a few years if the trends shown continue.

However, from the dis-aggregated nanotechnology perspective of Figures 3A-3C, China has already achieved parity with the US in some important nanotechnology sub-areas, at least from an article production perspective. This analysis shows the importance of going beyond the national aggregate (overall technology) level, as exemplified by King, 2004, and even beyond a broad technology aggregate level (such as nanotechnology), to understand critical sub-technology trends occurring globally.

Bibliometrics

Prolific Authors

1. List of Prolific Author Names

TABLE 1 – MOST PROLIFIC NANOTECHNOLOGY RESEARCH AUTHOR NAMES (2005)*

AUTHOR	#PAPERS
Zhang, Y	237
Wang, J	219
Li, Y	215
Wang, Y	209
Liu, Y	204
Zhang, J	174
Lee, JH	165
Wang, L	151
Kim, JH	142
Chen, Y	141
Wang, X	139
Li, J	137
Zhang, L	137
Wang, H	135
Kim, J	133
Kim, SH	115
Lee, J	114
Lee, JY	113
Lee, S	111
Liu, J	111
Chen, J	107
Xu, J	106
Yang, Y	104
Li, L	103
Zhang, X	102
Wang, Q	98
Kim, H	92
Lee, SJ	90
Yang, J	87
Zhang, H	87

*Note: Each name does not necessarily refer to one person.

Table 1 presents the 30 most prolific nanotechnology research author names from 2005 and their publication frequency. All of the names listed are monosyllabic, either of Chinese or Korean origin, and many surnames are identical. This implies that the names are quite common, and for a field of study as large as nanoscience/ nanotechnology one might find easily find multiple authors with the same name. The unrealistically high author publication frequencies listed for one year validate that assumption.

2. List of Prolific Authors and their Institutions
(names partially disambiguated)

TABLE 2 – MOST PROLIFIC NANOTECHNOLOGY RESEARCH AUTHORS LISTED WITH THEIR INSTITUTION (2005)

AUTHOR	#PAPERS	INSTITUTION	COUNTRY
Qian, YT	86	UNIV SCI & TECHNOL CHINA	PEOPLES R CHINA
Li, Y	54	CHINESE ACAD SCI	PEOPLES R CHINA
Jiang, L	53	CHINESE ACAD SCI	PEOPLES R CHINA
Chu, PK	52	CITY UNIV HONG KONG	PEOPLES R CHINA
Cingolani, R	52	UNIV LECCE	ITALY
Zhang, LD	52	CHINESE ACAD SCI	PEOPLES R CHINA
Wang, ZG	51	CHINESE ACAD SCI	PEOPLES R CHINA
Zhang, Y	45	CHINESE ACAD SCI	PEOPLES R CHINA
Du, YW	44	NANJING UNIV	PEOPLES R CHINA
Hopkinson, M	44	UNIV SHEFFIELD	ENGLAND
Shi, JL	44	CHINESE ACAD SCI	PEOPLES R CHINA
Gao, L	43	CHINESE ACAD SCI	PEOPLES R CHINA
Liu, Y	43	CHINESE ACAD SCI	PEOPLES R CHINA
Knoll, W	42	MAX PLANCK INST POLYMER RES	GERMANY
Zhu, DB	42	CHINESE ACAD SCI	PEOPLES R CHINA
Chang, SJ	41	NATL CHENG KUNG UNIV	TAIWAN
Mullen, K	41	MAX PLANCK INST POLYMER RES	GERMANY
Bando, Y	40	NATL INST MAT SCI	JAPAN
Bhushan, B	40	OHIO STATE UNIV	USA
Lee, ST	40	CITY UNIV HONG KONG	PEOPLES R CHINA
Reinhoudt, DN	40	UNIV TWENTE	NETHERLANDS
Schubert, US	40	EINDHOVEN UNIV TECHNOL	NETHERLANDS
Yu, DP	40	PEKING UNIV	PEOPLES R CHINA
Arakawa, Y	39	UNIV TOKYO	JAPAN
Kim, TW	39	HANYANG UNIV	SOUTH KOREA
Li, YD	39	TSING HUA UNIV	PEOPLES R CHINA
Zhang, J	39	CHINESE ACAD SCI	PEOPLES R CHINA
Liu, WM	38	CHINESE ACAD SCI	PEOPLES R CHINA
Pearton, SJ	38	UNIV FLORIDA	USA

Appendix 4 explores the “multiple authors with same name” issue further, and presents a partial name disambiguation approach. An author-institution co-occurrence matrix is generated for the most prolific authors and institutions. The top authors are extracted manually, by looking for author-institution pairings with high publication totals. This method identifies each author uniquely provided that each institution contains only one author with a given full name in a specific technology. However, the software is not configured to allow mapping by authors deconvolved using this approach.

Only four names from the list of top 30 prolific author names (Table 1) remained in the list of the 29 most prolific authors (Table 2). The author with the most papers, YT Qian, was not included in the original list of 30. The four authors included in both tables are Y. Zhang (45/237), Y. Li (54/215), Y. Liu (43/204), and J. Zhang (39/174), given here with the amount of papers they published and the total amount of papers for authors with the same name. The top 29 authors are dominated by Chinese authors, as were the names, but other nations are represented, and there is a smaller Korean presence. Work is continuing on improving the name disambiguation procedure, and will be reported in Scientometrics at a later date.

Prolific Journals

TABLE 3 – JOURNALS CONTAINING MOST ARTICLES ON NANOTECHNOLOGY (2005)

JOURNAL	#PAPERS	IMPACT FACTOR	THEME
APPLIED PHYSICS LETTERS	2332	4.13	PHYS
PHYSICAL REVIEW B	2273	3.19	PHYS
JOURNAL OF APPLIED PHYSICS	1488	2.50	PHYS
JOURNAL OF PHYSICAL CHEMISTRY B	1450	4.03	CHEM
LANGMUIR	1103	3.71	CHEM
THIN SOLID FILMS	932	1.57	MATLS
JOURNAL OF THE AMERICAN CHEMICAL SOCIETY	817	7.42	CHEM
JOURNAL OF CRYSTAL GROWTH	776	1.68	MATLS
JAPANESE JOURNAL OF APPLIED PHYSICS PART 1-REGULAR PAPERS BRIEF COMMUNICATIONS & REVIEW PAPERS	771	1.10	PHYS
PHYSICAL REVIEW LETTERS	721	7.50	PHYS
CHEMISTRY OF MATERIALS	655	4.82	CHEM
NANOTECHNOLOGY	655	2.99	NANO
APPLIED SURFACE SCIENCE	640	1.26	MATLS
POLYMER	552	2.85	MATLS
MATERIALS LETTERS	531	1.30	MATLS
MACROMOLECULES	516	4.02	CHEM
NANO LETTERS	473	9.85	NANO
JOURNAL OF MAGNETISM AND MAGNETIC MATERIALS	456	0.99	MATLS
SURFACE & COATINGS TECHNOLOGY	449	1.65	MATLS
PHYSICA E-LOW-DIMENSIONAL SYSTEMS & NANOSTRUCTURES	432	0.95	PHYS
CHEMICAL COMMUNICATIONS	422	4.43	CHEM
ADVANCED MATERIALS	409	9.11	MATLS
CHEMICAL PHYSICS LETTERS	384	2.44	PHYS
JOURNAL OF VACUUM SCIENCE & TECHNOLOGY B	380	1.63	PHYS
APPLIED PHYSICS A-MATERIALS SCIENCE & PROCESSING	378	1.99	MATLS
JOURNAL OF THE ELECTROCHEMICAL SOCIETY	376	2.19	CHEM
SURFACE SCIENCE	370	1.78	MATLS
JOURNAL OF ALLOYS AND COMPOUNDS	363	1.37	MATLS
JOURNAL OF MATERIALS CHEMISTRY	360	3.69	MATLS
JOURNAL OF APPLIED POLYMER SCIENCE	355	1.07	MATLS
JOURNAL OF CHEMICAL PHYSICS	355	3.14	PHYS

The journals containing the most research articles on nanotechnology/ nanoscience are shown in Table 3. The highest ranking journals emphasize physics, chemistry, and materials, in that order. The physics journals listed have a median Impact Factor of 3.14, the chemistry journals 4.03, the materials journals 1.65, and the nanotechnology journals 6.42.

There are many causes that can contribute to low journal Impact Factor. These include low quality publications and/ or limited journal circulation and/ or overly applied papers and/ or technical field covered (i.e., number of researchers working in technical field and available to cite papers). The Impact Factor issue will be explored with greater resolution when the specific taxonomy categories are analyzed.

To identify hierarchical groups of journals, Bradford's Law is invoked. Bradford's law states that documents on a given 'subject' [are] distributed (scattered) according to a certain mathematical function so that a growth in papers on a subject requires a growth in the number of journals/information sources. The numbers of the groups of journals to produce nearly equal numbers of articles is roughly in proportion to 1: n: n^2 …, where n is called the Bradford multiplier (Hjorland and Nicolaisen, 2005).

The top 31 journals can be subdivided according to Bradford's law into four groups, each one of which contains roughly 5000 articles. *Applied Physics Letters* and *Physical Review B* make up the first set (4605 articles), the next four journals comprise the next echelon (4973), and the following eight are in the third group (5587). It should take another doubling of the number of journals to get approximately 5000 more articles total, and the next sixteen journals account for 6654 articles. Even though this figure is still in the vicinity of the 5000 benchmark, the fact that the number of articles increases for each group means that the Bradford multiplier is probably less than 2.

Prolific Institutions

1. List of Prolific Institutions

TABLE 4 – INSTITUTIONS PRODUCING MOST NANOTECHNOLOGY PAPERS (2005)

INSTITUTION	COUNTRY	#REC
Chinese Acad Sci	PEOPLES R CHINA	2916
Russian Acad Sci	RUSSIA	1217
CNRS	FRANCE	824
Tsing Hua Univ	PEOPLES R CHINA	749
Tohoku Univ	JAPAN	680
Univ Tokyo	JAPAN	664
Osaka Univ	JAPAN	652
Natl Inst Adv Ind Sci & Technol	JAPAN	568
Natl Univ Singapore	SINGAPORE	565
Nanjing Univ	PEOPLES R CHINA	534
Zhejiang Univ	PEOPLES R CHINA	528
Tokyo Inst Technol	JAPAN	515
CNR	ITALY	502
Kyoto Univ	JAPAN	498
Seoul Natl Univ	S. KOREA	484
Univ Sci & Technol China	PEOPLES R CHINA	482
Univ Illinois	USA	461
Natl Inst Mat Sci	JAPAN	459
CSIC	SPAIN	455
Univ Calif Berkeley	USA	427
Univ Texas	USA	419
Peking Univ	PEOPLES R CHINA	400
Korea Adv Inst Sci & Technol	S. KOREA	392
Univ Cambridge	UK	392
Jilin Univ	PEOPLES R CHINA	378
Shanghai Jiao Tong Univ	PEOPLES R CHINA	367
MIT	USA	364
Indian Inst Technol	INDIA	361
Natl Tsing Hua Univ	TAIWAN	357
Hanyang Univ	S. KOREA	355

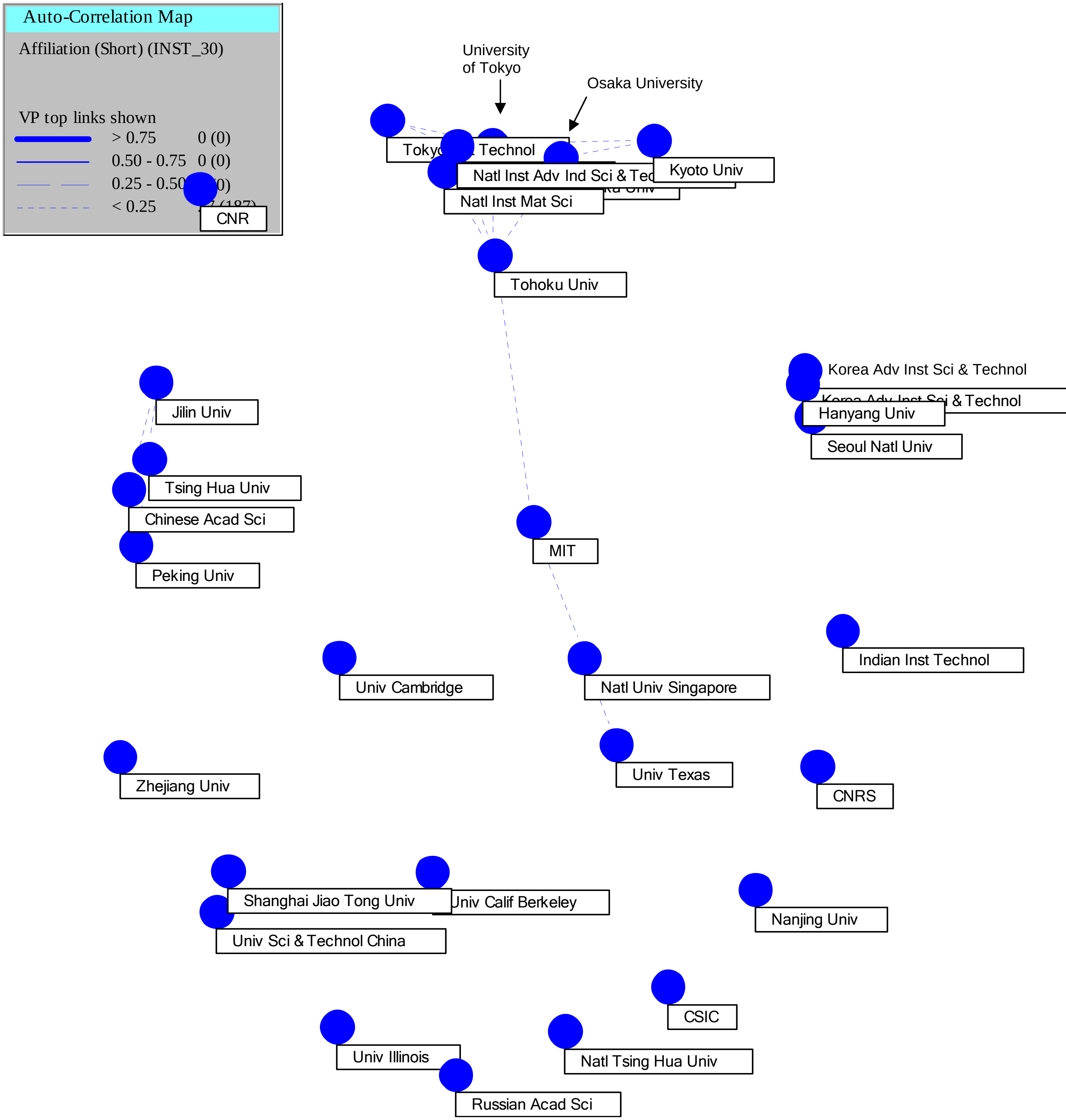
Table 4 presents the 30 institutions producing the most nanotechnology research papers. Universities comprise two-thirds of the top institutions, and they account for six of the top ten. Twenty-one of the prolific institutions are located in Asia. The most prolific is the Chinese Academy of Sciences (CAS), which consists of 84 institutes throughout China, one University of Science and Technology of China at Hefei, Anhui, two colleges, four documentation centers, three technical support centers, and two news and publishing units. Both China and Japan have the largest number of prolific organizations, with eight and seven institutions, respectively. The top three institutions are not universities, but rather multi-center national research institutions. The more applied nature of such institutions correlates with the substantial representation of applied journals as shown later.

On the other hand, the USA institutions shown are all universities. Universities of Illinois and Texas are multi-campus state university systems, while University of California Berkeley and MIT are single campus institutions. ***However, if the University of California campuses are combined into one, as is the case for Texas and Illinois, then the University of California system total becomes 1604, making the University of California system second in the institutional rankings.*** Neither the research budgets nor numbers of researchers of the institutions are analyzed, so the relative productivity cannot be estimated and assessed at this time.

The Russian Academy of Sciences' contribution is significant because their nanoscience/ nanotechnology paper output is more than half of the total nanotechnology output for the country. This indicates that the Russian Academy is the principal nanotechnology research institution in Russia, with significantly diminished participation from other universities and institutions.

2. Institution Auto-Correlation Map

FIGURE 4A – INSTITUTION AUTO-CORRELATION MAP (top thirty institutions)



What are the linkages among these institutions? To display linkages among institutions visually, two mapping approaches were performed: auto-correlation mapping and cross-correlation mapping. Figure 4A is an institution auto-correlation map that shows institutional relationships based on actual co-authorships. Figure 4B is a cross-correlation map that shows institutional relationships based on use of common terminology, and Figures 4C and 4D show institutional linkages based on cited journals. The only difference between the two institution-cited journal maps is that Figure 4C displays the network of institutions based on the 500 cited journals publishing the most nanoscience/ nanotechnology articles, and Figure 4D maps institutions according to common citation of the next 500 journals. Figure 4E is a cross-correlation map of institutions and cited documents.

There are three main co-publishing groups seen in the institution auto-correlation map (Figure 4A), one Chinese, one Japanese, and one South Korean. Out of the intra-national groups, the Japanese one has the strongest links. All the Japanese institutions that were plotted are included in the group, namely, Tohoku University, the University of Tokyo, Osaka University, the National Institute for Advanced Industrial Science and Technology, Tokyo Institute of Technology, Kyoto University, and the National Insitute for Materials Science. Similarly, the three leading Korean institutions (Seoul National University, Korea Advanced Institute of Science & Technology, Hanyang University) are all grouped together, but the Chinese group (Chinese Academy of Sciences, Tsing Hua University, Peking University, Jilin University) is not all-inclusive, as a few Chinese institutions remain separate from it. There is also weak international connectivity among MIT, the National University of Singapore, the University of Texas, and Tohoku University.

TABLE 5 – CO-OCCURRENCE MATRIX FOR TOP CHINESE INSTITUTIONS

	CHINESE ACAD SCI	TSING HUA UNIV	NANJING UNIV	ZHEJIANG UNIV	UNIV SCI & TECHNOL CHINA	PEKING UNIV	JILIN UNIV	SHANGHAI JIAO TONG UNIV
CHINESE ACAD SCI	2916	84	33	23	29	62	38	27
TSING HUA UNIV	84	749	4	1	2	20	21	11
NANJING UNIV	33	4	534	3			2	2
ZHEJIANG UNIV	23	1	3	528	2	1	2	2
UNIV SCI & TECHNOL CHINA	29	2		2	482	3		12
PEKING UNIV	62	20		1	3	400	3	
JILIN UNIV	38	21	2	2		3	378	
SHANGHAI JIAO TONG UNIV	27	11	2	2	12			367

A co-occurrence matrix was generated for the eight Chinese institutions shown in Figure 4A to understand quantitatively why some institutions are linked, whereas others are not. Looking at the absolute number of co-authored papers gives one a general idea as to which institutions are linked. For instance, the largest entry in Table 5 is for the Chinese Academy of Sciences and Tsing Hua University. None of the institution pairs with single digit (or less) collaboration totals are connected on Figure 4A. However, Table 5 does not explain why Tsing Hua University and Jilin University (21 co-occurrences) are connected, but Nanjing University and the Chinese Academy of Sciences (33 co-occurrences) are not. For this reason, Table 5 was recast in percentage terms.

TABLE 6 – CO-OCCURRENCE MATRIX FOR TOP CHINESE INSTITUTIONS (BY PERCENTAGE OF TOTAL ARTICLES)

	CHINESE ACAD SCI	TSING HUA UNIV	NANJING UNIV	ZHEJIANG UNIV	UNIV SCI & TECHNOL CHINA	PEKING UNIV	JILIN UNIV	SHANGHAI JIAO TONG UNIV
CHINESE ACAD SCI		2.9%	1.1%	0.8%	1.0%	2.1%	1.3%	0.9%
TSING HUA UNIV	11.2%		0.5%	0.1%	0.3%	2.7%	2.8%	1.5%
NANJING UNIV	6.2%	0.7%		0.6%	0.0%	0.0%	0.4%	0.4%
ZHEJIANG UNIV	4.4%	0.2%	0.6%		0.4%	0.2%	0.4%	0.4%
UNIV SCI & TECHNOL CHINA	6.0%	0.4%	0.0%	0.4%		0.6%	0.0%	2.5%
PEKING UNIV	15.5%	5.0%	0.0%	0.3%	0.8%		0.8%	0.0%
JILIN UNIV	10.1%	5.6%	0.5%	0.5%	0.0%	0.8%		0.0%
SHANGHAI JIAO TONG UNIV	7.4%	3.0%	0.5%	0.5%	3.3%	0.0%	0.0%	

In Table 6, the rows and columns are the institutions, and the matrix entries are the percentage of the papers written by the institutions. For example, 2.9% of the Chinese Academy of Sciences research articles were co-authored with Tsing Hua University, and these same 84 articles represent 11.2% of all of Tsing Hua's nanotechnology articles. There is no set cut-off for which institutions are linked on the map; rather, each institution is connected with the partners who made the most significant contribution. Jilin University is linked to the Chinese Academy of Sciences and to Tsing Hua University because these two institutions co-authored 10.1% and 5.6%, respectively, of Jilin's articles, almost an order of magnitude higher than Jilin's other partners. On the other hand, the only substantial contribution to Nanjing's nanotechnology output came from the Chinese Academy of Sciences (6.2% compared to 0.7% at best), but these 33 papers accounted for only 1.1% of the Chinese Academy of Sciences' total papers. The latter institution has more significant collaborators, so these two insitutions do not appear linked on Figure 4A.

3. Institution Cross-Correlation Maps

FIGURE 4B – INSTITUTION-PHRASE CROSS-CORRELATION MAP

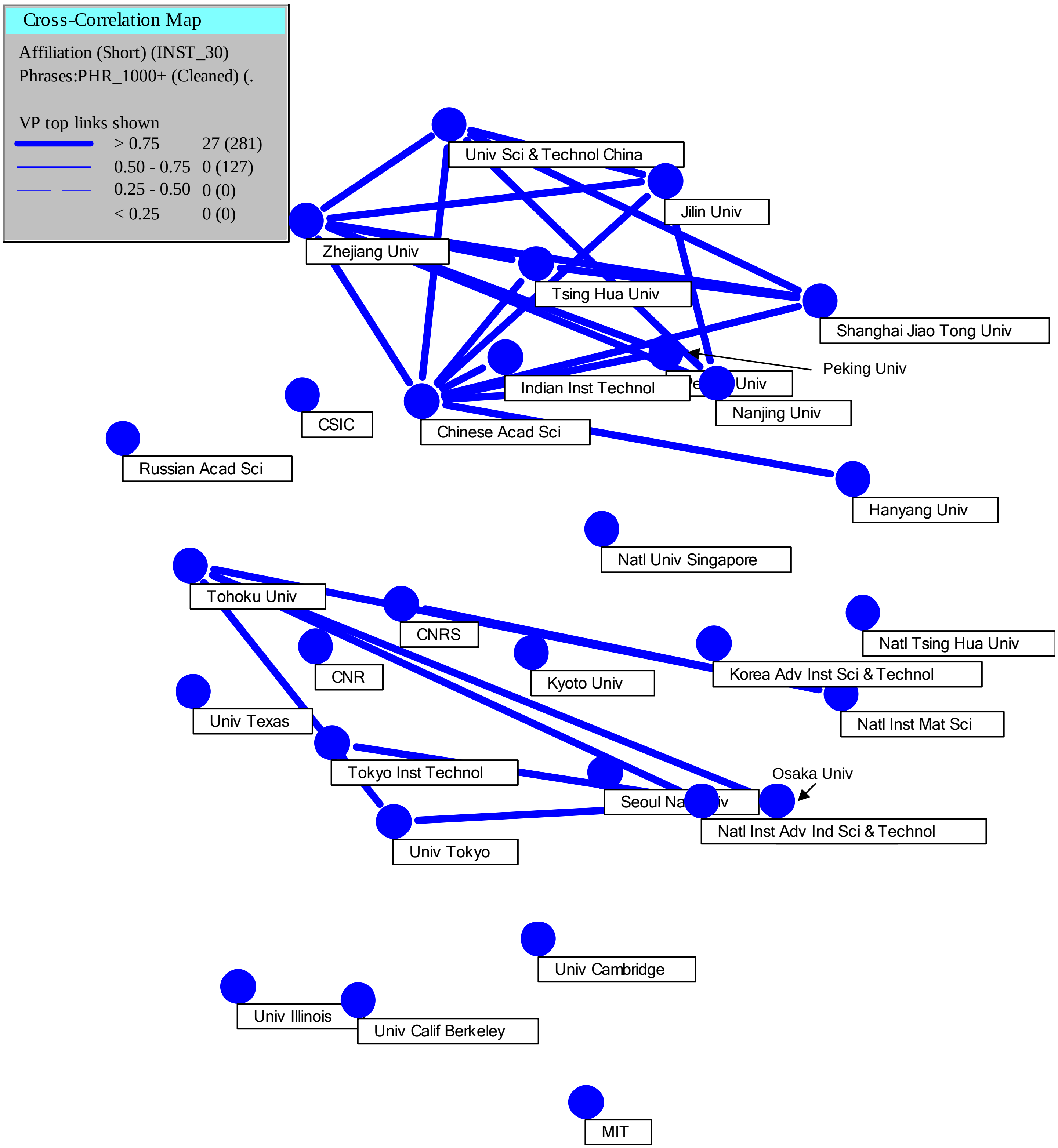


FIGURE 4C – INSTITUTION-CITED JOURNAL CROSS-CORRELATION MAP (Cited Journals 1-501)

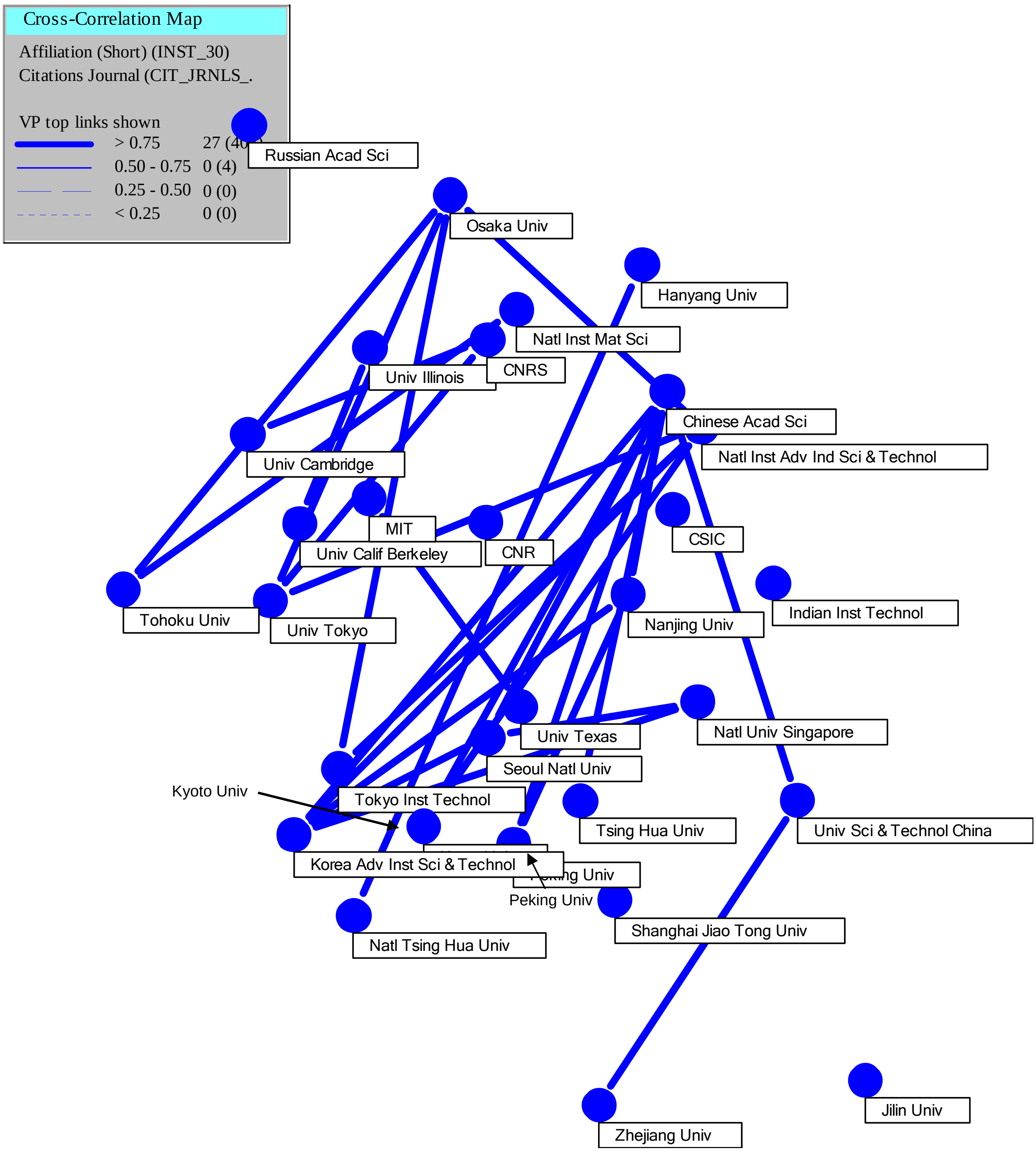


FIGURE 4D – INSTITUTION-CITED JOURNAL CROSS-CORRELATION MAP (Cited Journals 502-1003)

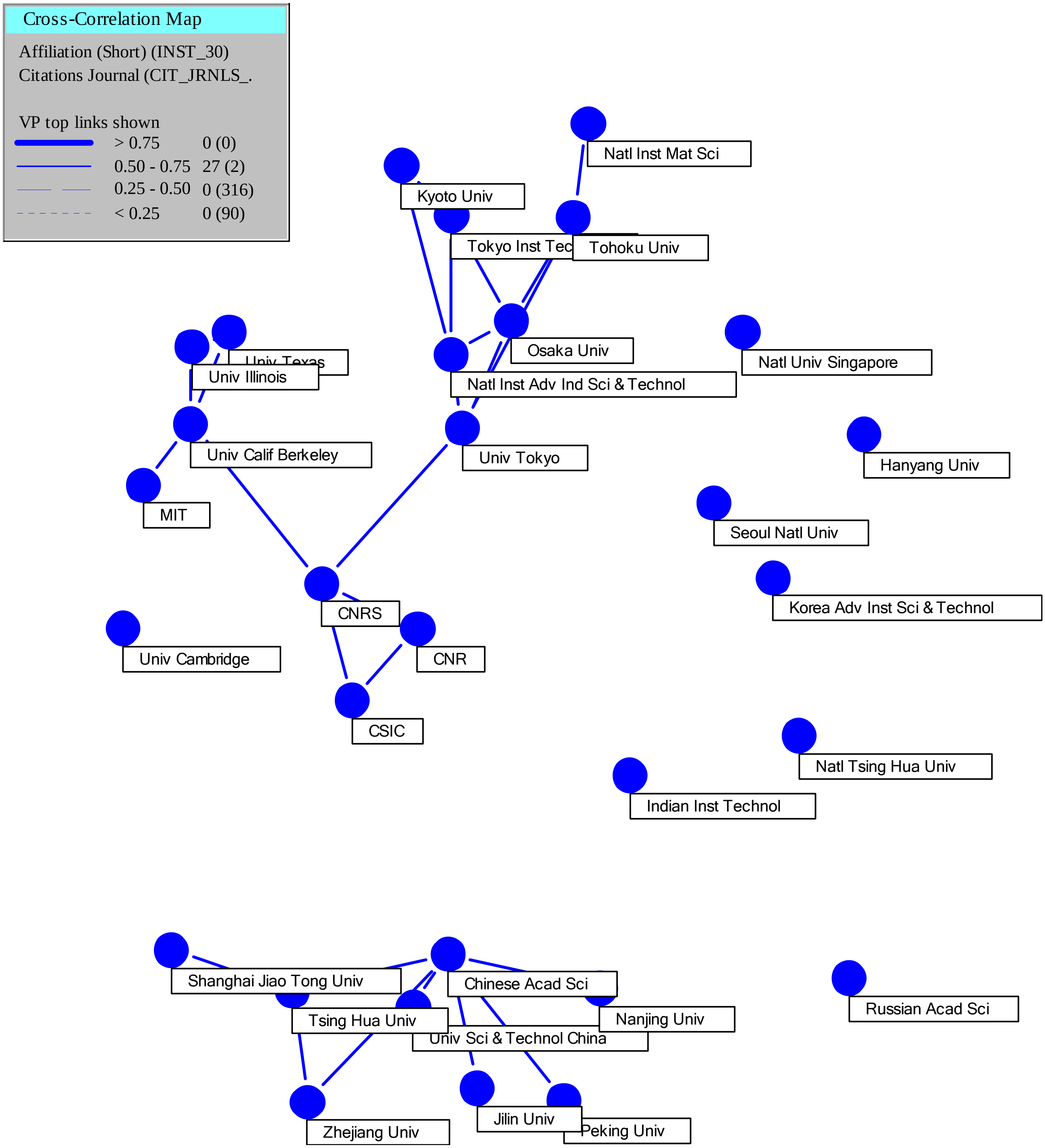
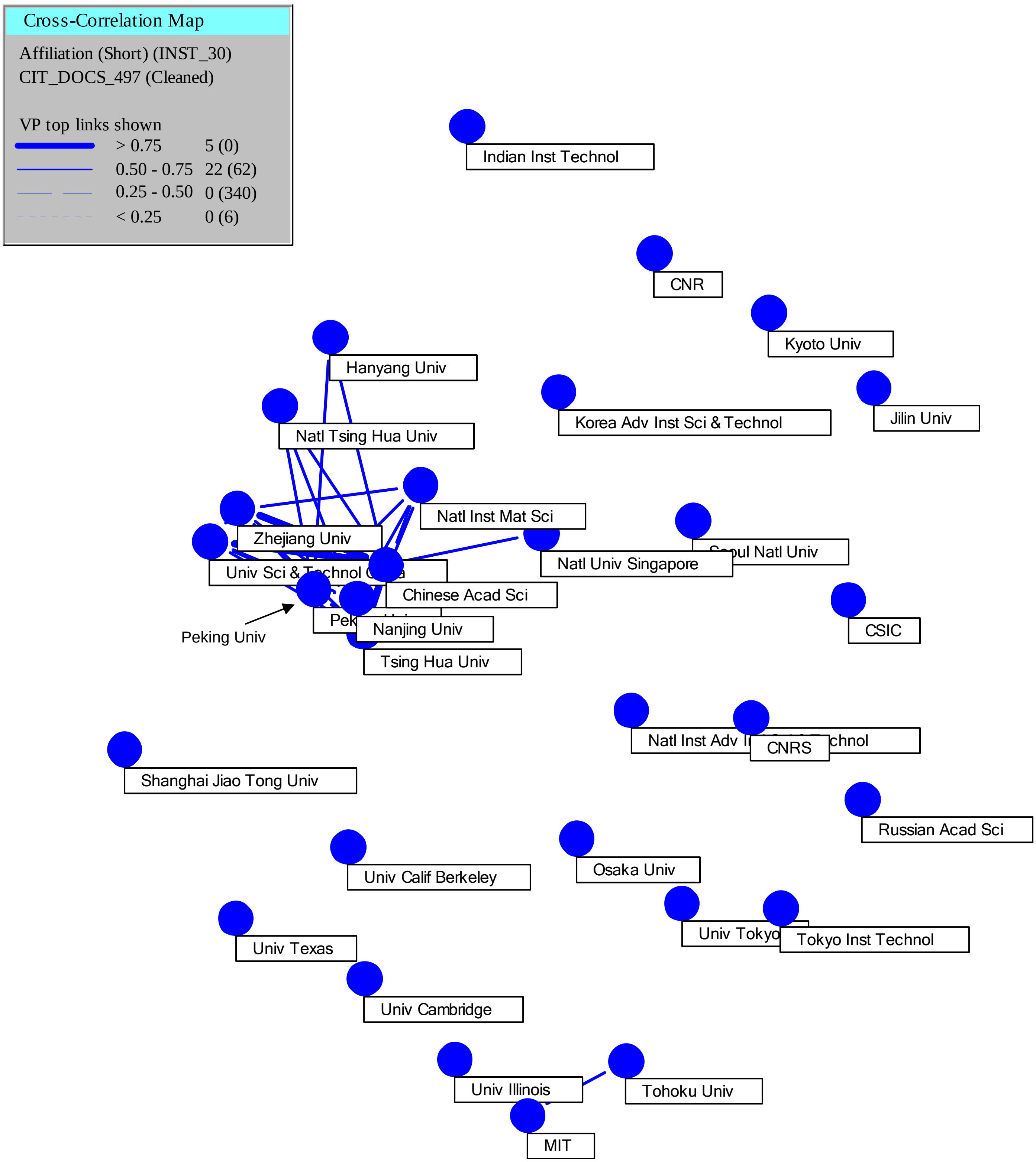


FIGURE 4E - INSTITUTION-CITED DOCUMENT CROSS-CORRELATION MAP



Publication connectivity is much weaker than common interest connectivity or citation connectivity. On Figure 4A, all connections shown are weak (barely visible), based on the link strength criteria listed in the legend on the figure. On Figures 4B and 4C many links are very strong, and Figure 4E has strong links.

The institution-phrase cross-correlation map (Figure 4B) contains two very strongly intra-connected groups, one Chinese and one containing primarily Japanese and South Korean institutions. The Indian Institute of Technology (a national multi-institution group) forms a strong link with the Chinese Academy of Sciences as well, and CNR (Consiglio Nazionale delle Ricerche) and CNRS (Centre National de la Recherche Scientifique) are included in the Japanese/ Korean group. Four American universities and the University of Cambridge stand apart as a fourth group, but the connections among these institutions are very weak at best.

Figure 4C, the first institution-cited journal cross-correlation map, shows that the connections based on the leading cited journals are very strong. It is not possible to classify the top thirty institutions based on references to the 500 most cited journals. All of the important nanotechnology centers are aware of the key journals in which high quality articles appear.

Performing a cross-correlation map of the top thirty institutions with the next 500 cited journals provides a better picture of linkages that exist. Figure 4D shows four clusters based on nationality, one Chinese, one Japanese, one American, and one European. The map demonstrates that institutions from the same country cite the same focused journals, and these journals tend to be domestic, although not exclusively. One can verify this result by tabulating the top five cited journals (out of Cited Journals 502-1003) for each institution and identifying their origins in the SCI. For the Chinese group, half of the 34 top journals are Chinese publications. Fourteen of the 25 identified journals for Japanese institutions were published in Japan, and nine out of ten journals are domestic for the American group. The European group is slightly different in nature, as CNR and CSIC do not have any highly cited domestic journals. However, CNRS has two of three top journals printed in France, and altogether the three institutions have twelve of fifteen cited journals published within the European Union. Another point to note from Figure 4D is that the Chinese group is isolated from the other institutions, whereas the Japanese and the American institutions link to the European research centers, both through CNRS.

The institution-cited document cross-correlation map (Figure 4E) shows a strongly-linked group of Chinese institutions, which also contains the National University of Singapore, Hanyang University (South Korea), and the National Tsing Hua University (Taiwan). The isolation of the Chinese institutions in Figure 4D and the strong intra-connectivity of the Chinese institutions in Figure 4E are in line with the findings of Zhou and Leydesdorff (2006). They concluded that Chinese researchers cite articles in leading international journals, but non-Chinese researchers do not cite Chinese-authored articles to the same extent, especially those published in Chinese-language journals. The strong intra-Chinese institution connectivity of Figure 4E reflects strong China-China citations. The citation of articles in international journals by Chinese institutions is backed up by the fact that Iijima's 1991 article in *Nature* is the most highly cited document for all ten of the insitutions in the main group of Figure 4E. Furthermore, these insitutions cite articles from *Science* by ZW Pan and MH Huang next most frequently, followed by an *Advanced Materials* article by YN Xia. While these three highly cited first authors are all of Chinese descent, all of them work at US institutions. MIT and Tohoku University have a formidable link based on documents cited in common, but no other organizations are connected based on cited documents.

4. Institution Factor Matrices

Based on the thirty institutions shown in Table 4 and on the roughly four-five groupings discerned from the auto-correlation map of Figure 4A, the six factor institution factor matrix of Table 7 was generated (using the TechOasis software (Search, 2006)). The institution names listed in Table 4 constitute the first column of Table 7, and the factors are the remaining columns. Each factor represents a group of institutions that co-author significantly. The high factor loadings that determine the main collaborators are shaded.

TABLE 7 – SIX FACTOR MATRIX
(thirty most prolific institutions)

FACTOR	1	2	3	4	5	6
NATL INST MAT SCI	0.486	0.048	0.027	-0.038	0.054	0.02
UNIV TOKYO	0.472	-0.029	-0.077	0.041	-0.047	-0.057
NATL INST ADV IND SCI & TECHNOL	0.451	-0.013	0.008	0.034	0.026	-0.06
TOHOKU UNIV	0.438	0.028	0.094	-0.199	0.094	0.082
TOKYO INST TECHNOL	0.361	0.023	0.027	0.053	-0.055	0.038
OSAKA UNIV	0.292	-0.136	-0.073	0.104	0.019	-0.221
KYOTO UNIV	0.199	-0.132	-0.136	0.148	-0.065	-0.257
TSING HUA UNIV	-0.027	0.536	-0.032	0.08	-0.025	-0.013
CHINESE ACAD SCI	-0.108	0.522	-0.005	0.083	0.212	-0.153
PEKING UNIV	-0.025	0.437	-0.034	-0.134	-0.047	-0.101
JILIN UNIV	-0.019	0.394	-0.102	0.147	-0.174	-0.007
HANYANG UNIV	-0.011	-0.033	0.588	0.049	-0.212	-0.07
KOREA ADV INST SCI & TECHNOL	-0.038	-0.027	0.572	0.064	-0.26	-0.061
SEOUL NATL UNIV	-0.044	-0.058	0.398	0.069	-0.26	-0.064
MIT	0.046	0.026	0.051	-0.561	-0.024	0.152
NATL UNIV SINGAPORE	-0.089	-0.06	-0.069	-0.55	-0.021	-0.168
UNIV TEXAS	-0.094	-0.068	-0.084	-0.434	-0.11	-0.199
UNIV SCI & TECHNOL CHINA	-0.081	-0.093	0.217	-0.023	0.556	-0.035
SHANGHAI JIAO TONG UNIV	-0.062	-0.015	0.22	0.033	0.54	-0.007
ZHEJIANG UNIV	-0.075	-0.079	-0.015	0.002	0.18	-0.113
CNRS	-0.005	-0.054	-0.045	0.07	-0.012	0.458
UNIV CAMBRIDGE	0.01	0.033	0.005	-0.093	-0.014	0.429
CSIC	-0.039	-0.066	-0.057	0.077	-0.015	0.407
CNR	-0.046	-0.072	-0.07	0.097	-0.019	0.363
UNIV CALIF BERKELEY	-0.038	-0.021	-0.05	-0.06	-0.212	0.013
UNIV ILLINOIS	-0.067	0.017	-0.088	-0.018	-0.218	-0.02
INDIAN INST TECHNOL	-0.056	-0.125	-0.078	0.048	-0.018	-0.07
RUSSIAN ACAD SCI	-0.145	-0.271	-0.227	0.166	-0.16	-0.088
NATL TSING HUA UNIV	-0.093	-0.141	-0.094	0	-0.006	-0.13
NANJING UNIV	-0.076	-0.044	-0.089	0.188	0.094	-0.208

Six distinct groupings, based mainly on nationality, are shown, one for each factor.

- Factor 1 is the Japanese-based group. National Institute for Materials Science is strongly linked to University of Tokyo, National Institute of Advanced Industrial Science & Technology, Tohoku University, and Tokyo Institute of Technology and weakly linked to Osaka Univeristy and Kyoto University. Japanese authors from the top institutions frequently co-author research articles with their counterparts at other institutions.

- Factor 2 is one of the two China-based groups. Tsing Hua University is strongly linked to Chinese Academy of Sciences, Peking University, and Jilin University. As in Japan, there is ample co-publication among the researchers from China's top institutions.
- Factor 3 is the Korean-based group. Hanyang University is strongly linked to Korea Advanced Institute of Science and Technology and Seoul National University. This group represents co-authorship within South Korea only; no links to North Korea are shown.
- Factor 4 is the only multi-national group. MIT is strongly linked to National University of Singapore (NUS) and Univeristy of Texas. As indicated by Figure 4A this group is probably based on the individual connections between the American universities and NUS, rather than an association among all three. The Singapore-MIT Alliance (SMA) was formed in 1998, joining the engineering and life sciences programs of MIT, NUS, and Nanyang Technological University (NTU). Thus, the SMA is being used to pursue joint research in nanoscience/ nanotechnology, and likely a factor matrix containing fifty institutions would include NTU in a group with MIT and NUS.
- Factor 5 is the second China-based group. University of Science & Technology of China (USTC) is strongly linked to Shanghai Jiao Tong University (SJTU). These two Chinese universities are likely separate from the other top institutions of their country due to some difference in the technical thrusts emphasized. Also, note that USTC and SJTU are weakly linked to the Korean group.
- Factor 6 is a Western European group. CNRS is strongly linked to University of Cambridge, CSIC, and CNR. This group represents cooperation among European institutions, as a French, a Spanish, and an Italian research center are joined with a British university.

Thus, the main groupings from the auto-correlation institution map are reproduced in the first four factors in the six factor matrix. The last two factors are additional groupings that were not readily evident in the auto-correlation map.

7. Institution Technical Themes

What are the technical areas of emphasis of the major nanotechnology/ nanoscience research institutions? To identify these technical themes, an institution-phrase co-occurrence matrix was generated for the five leading institutions. The major Abstract phrases for the top five institutions are as follows:

- **Chinese Academy of Sciences** (x-ray diffraction [XRD], transmission electron miscroscopy [TEM], scanning electron miscroscopy [SEM], films, atomic force microscopy [AFM], room temperature, x-ray photoelectron spectroscopy [XPS], electron microscopy, microstructures, crystals, photoluminescence [PL], thickness, Fourier-transform infrared [FTIR] spectroscopy, growth, diameter, materials, Raman spectroscopy, water, carbon nanotubes [CNTs], substrate, nanowires, nanoparticles, annealing, particles, infrared [IR], magnetic properties, mechanical properties, infrared [IR] spectroscopy, optical properties)
- **Russian Academy of Sciences** (XRD, crystals, structures, films, TEM, nanoparticles, materials, electrons, quantum dots [QD], thickness, quantum wells [QW], growth, electron microscopy, particles, AFM, PL, room temperature [RT], water, annealing, conductivity, irradiation, hydrogen [H], nanotubes, magnetic fields, XPS, IR spectroscopy, kinetics, molecular beam epitaxy [MBE])
- **Centre National de la Recherche Scientifique** (TEM, XRD, films, materials, RT, growth, AFM, XPS, annealing, particles, crystals, SEM, nanoparticles, substrate, silicon, optical properties, deposits, MBE, electron microscopy, PL, devices, QD, thickness, water, microstructures, thin films, structures, H, electrons, Raman spectroscopy, adsorption)
- **Tsing Hua University** (XRD, SEM, TEM, microstructures, films, XPS, thickness, AFM, CNTs, materials, electron microscopy, diameter, sol-gel, crystals, RT, particles, Raman spectroscopy, nanoparticles, substrate, nanotubes, Auger electron spectroscopy [AES], nanowires, particle sizes, powders, water, FTIR spectroscopy, coatings, electrodes, crystallization, growth, corrosion resistance)
- **Tohoku University** (XRD, films, TEM, RT, diameter, annealing, thickness, growth, particles, crystals, single-walled carbon nanotubes [SWNTs], magnetic fields, electrons, microstructures, CNTs, substrate, H, silicon, silica, scanning tunneling microscopy [STM], SEM, AFM, materials, nitrogen, magnetic properties, fabrication, precipitation, grain boundary, deposits, conductivity, microscopy)

It is hard to determine a unique technical focus for each institution because the same instruments, structures, mechanisms, and substances are repeated for the five institutions. One explanation for this finding is that each research center wants to work at the cutting edge of nanotechnology, and these forefront areas of research are heavily funded at each institution. Figure ?4C supports an argument of competitiveness in similar areas, since commonality of seminal references among major institutions implies a similarity in the referencing research.

The top three American institutions and the major Abstract phrases for each are shown below for comparison.

- **University of Illinois** (films, AFM, devices, TEM, XRD, growth, substrate, annealing, water, SWNTs, electrons, XPS, nanotubes, thin films, diameter, silicon, RT, materials, fabrication, electron microscopy, QD, membranes, structures, gold, thickness, adsorption, chemical vapor deposition [CVD], pores, simulations, particles, microscopy)
- **University of California-Berkeley** (TEM, AFM, films, materials, particles, substrate, RT, XRD, electron microscopy, water, carbon monoxide [CO], nanowires, devices, growth, nanoparticles, oxidation, diameter, structures, iron, thickness, adsorption, metals, dislocations, kinetics, tip, annealing, thin films, silicon, SEM, platinum, electronic structures, nucleation)
- **University of Texas** (TEM, XRD, materials, nanoparticles, XPS, particles, SEM, growth, AFM, films, annealing, electron microscopy, proteins, substrate, silicon, devices, RT, structures, fabrication, mechanical properties, silica, water, SWNTs, PL, nanowires, nanocomposites, diameter, deposits, binding, hafnium dioxide [HfO2])

Although the three American institutions do have some unique phrases (such as CVD, CO, and HfO2) that are top phrases for the five leading institutions, there is a significant amount of overlap among the technical thrusts of the three leading American institutions and those of the world's top institutions.

8. Institution-Journal Co-Occurrence Matrix

The leading five institutions (the term institution is used loosely even though the academies have many institutes) based on the number of publications are listed below along with the five journals in which they published nanotechnology articles most frequently in 2005. The journals and institutions are followed by their Impact Factors (in square brackets) and the number of articles published. An average Impact Factor is calculated for each institution as a weighted average of the five Impact Factors listed. Non-journal sources are given an Impact Factor of zero. Note that there are no U.S. institutions in this select group.

- **Chinese Academy of Sciences [2.63] 2916** (Applied Physics Letters [4.13] 116, Journal of Physical Chemistry B [4.03] 99, Journal of Crystal Growth [1.68] 87, Acta Physica Sinica [1.05] 80, Chinese Physics Letters [1.28] 78)
- **Russian Academy of Sciences [1.21] 1217** (Semiconductors [0.62] 85, Physics of the Solid State [0.70] 66, Physical Review B [3.19] 53, Russian Chemical Bulletin [0.59] 50, JETP Letters [1.45] 41)
- **Centre National de la Recherche Scientifique [3.71] 824** (Physical Review B [3.19] 59, Applied Physics Letters [4.13] 42, Journal of Applied Physics [2.50] 29, Physical Review Letters [7.50] 23, Journal of Crystal Growth [1.68] 19)
- **Tsing Hua University [1.03] 749** (High-Performance Ceramics III, Pts. 1 and 2 [0.00] 49, Rare Metal Materials and Engineering [0.40] 32, Physical Review B [3.19] 21, PRICM 5: The Fifth Pacific Rim International Conference on Advanced Materials and Processing, Pts 1-5 [0.00] 16, Journal of Physical Chemistry B [4.03] 14)
- **Tohoku University [2.72] 680** (Physical Review B [3.19] 44, Applied Physics Letters [4.13] 39, Materials Transactions [1.10] 24, Journal of Applied Physics [2.50] 22, IEEE Transactions on Magnetics [1.01] 19)

The major thrust of four of the top five research institutions is towards physics, and a large number of articles are also published in materials science. Physics journals have higher Impact Factors than those focused on materials (as shown previously), and, in both subjects, the Impact Factor drops as journals are dedicated to a narrower field. At the institution level, the average Impact Factor is low if many articles appear in non-journal sources, which is the case for Tsing Hua University.

CNRS has the highest average Impact Factor of the five insitutions, ahead of the two universities and two national academies, which are on par with each other. Incidentally, the French research center is the only institution to have all of its top journals in the top 30 most prolific nanoscience/ nanotechnology journals. Tohoku University and the Chinese Academy of Sciences have three of their top five journals in the top 30, and they have the second and third highest average Impact Factors out of the top five institutions. The Russian Academy of Sciences and Tsing Hua University, fourth and fifth highest average Impact Factors respectively, each have only one of their top journals in the top 30 journals overall.

Researchers from the national academies have a substantial amount of their work published in domestic journals. Four of the Russian Academy of Sciences' top five sources (*Semiconductors*, *Physics of the Solid State*, *Russian Chemical Bulletin*, and *JETP Letters*) are printed in Russia (albeit in English), and the Chinese Academy of Sciences has two top journals published on home soil (*Acta Physica Sinica* and *Chinese Physics Letters*), one in Chinese and the other in English.

The top three American institutions and the journals in which they publish most frequently are shown below for comparison.

- **University of Illinois [3.99] 461** (Applied Physics Letters [4.13] 39, Physical Review B [3.19] 35, Journal of Physical Chemistry B [4.03] 25, Langmuir [3.71] 20, Journal of Applied Physics [2.50] 14, Journal of the American Chemical Society [7.42] 14)
- **University of California-Berkeley [5.87] 427** (Nano Letters [9.85] 37, Applied Physics Letters [4.13] 33, Physical Review B [3.19] 32, Physical Review Letters [7.50] 22, Journal of Physical Chemistry B [4.03] 22)
- **University of Texas [4.43] 419** (Applied Physics Letters [4.13] 29, Physical Review B [3.19] 14, Journal of Physical Chemistry B [4.03] 14, Journal of the American Chemical Society [7.42] 13, Langmuir [3.71] 10)

The American research institutions have higher average Impact Factors than the highest average Impact Factor of the top five institutions, none of which are located in the United States. This suggests that the American institutions published articles in higher quality journals, even though their publication total was lower than other institutions. Also, all of the journals listed for these American institutions are included in the top 30 journals publishing in nanoscience/ nanotechnology. The American universities' articles focused on fundamental science, primarily physics and chemistry, and three journals from these fields (*Applied Physics Letters*, *Physical Review B*, and *Journal of Physical Chemistry B*) appear in all the rankings of the American universities.

Prolific Countries

Table 8 contains the thirty countries producing the most nanoscience/ nanotechnology research papers.

TABLE 8 – COUNTRIES PRODUCING MOST NANOSCIENCE/ NANOTECHNOLOGY PAPERS (2005)

COUNTRY	#PAPERS
USA	14750
PEOPLES R CHINA	11746
JAPAN	7971
GERMANY	5665
SOUTH KOREA	4098
FRANCE	3994
ENGLAND	2786
ITALY	2297
RUSSIA	2185
TAIWAN	2165
INDIA	2103
SPAIN	1700
CANADA	1579
NETHERLANDS	1130
POLAND	1105
AUSTRALIA	1048
SINGAPORE	1045
SWITZERLAND	1009
SWEDEN	944
BRAZIL	932
BELGIUM	712
ISRAEL	641
AUSTRIA	540
MEXICO	518
UKRAINE	502
DENMARK	448
FINLAND	428
CZECH REPUBLIC	421
TURKEY	418
GREECE	353

The output of research articles was dominated by the United States and China, the two nations accounting for 40% of the world's production. China's rise is particularly outstanding, as in 1991 the country was the ninthleading country in nanotechnology, contributing 2.7% of the research articles published worldwide. In 2005, the other key players were Japan, Germany, South Korea, and France. The three most prolific Western countries and the three most prolific Asian countries published roughly the same amount of papers, about 24000. After the six countries that stand out, three-fifths of the remaining countries are in Europe.

To identify country-country collaborations for the major research article producers, a country-country matrix was generated. The five most prolific countries, and their major collaborators, are presented (collaborator, # co-authored papers):

RESULTS FROM CO-OCCURRENCE MATRIX FOR TOP FIVE MOST PROLIFIC COUNTRIES (Number of records in common listed in the parentheses)

- **USA** (Germany 604, Peoples R China 498, Japan 441, South Korea 423, France 300);
- **Peoples R China** (USA 498, Japan 304, Germany 178, Singapore 154, South Korea 110);
- **Japan** (USA 441, Peoples R China 304, South Korea 218, Germany 144, France 124)
- **Germany** (USA 604, France 352, Russia 290, England 194, Peoples R China 178)
- **South Korea** (USA 423, Japan 218, Peoples R China 110, India 56, Russia 38, England 38)

The USA was the chief collaborator with the other four countries, and China and Japan vied for the position of second-most prolific collaborator, except for the case of Germany, where France was the second-most prolific collaborator. The above results measure the absolute value of the amount of collaboration between two countries; hence the top collaborators with the big players are very prolific countries themselves. Singapore and India are the only collaborators listed that are not in the top ten, and they worked together extensively with China and South Korea, respectively.

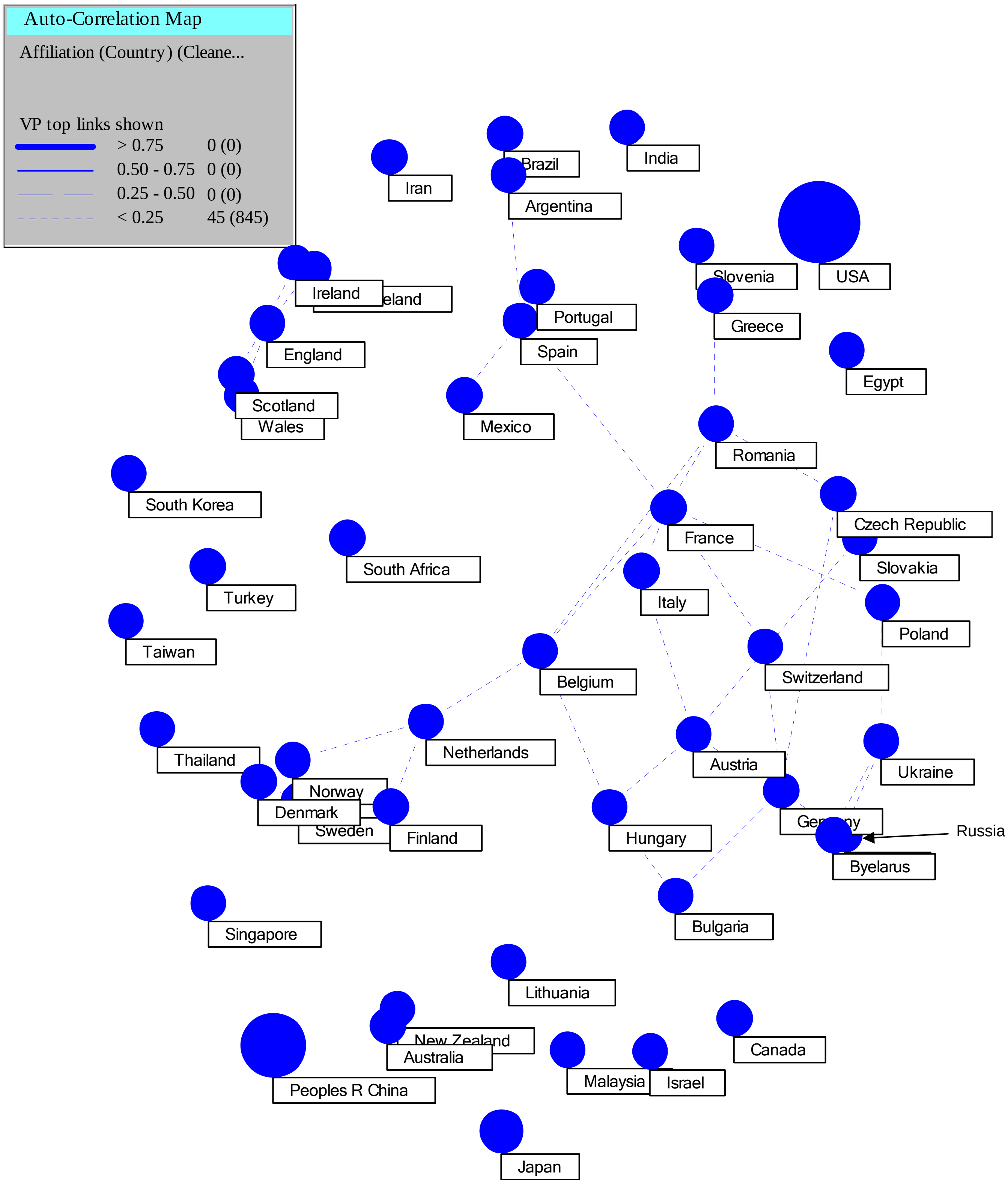
RESULTS FROM PERCENTAGE CO-OCCURRENCE MATRIX FOR TOP FIVE MOST PROLIFIC COUNTRIES (Percent of records in common listed in the parentheses)

- **USA** (Israel 18.9%, Canada 15.5%, Denmark 15.4%, Mexico 15.3%, Turkey 12.7%);
- **Peoples R China** (Singapore 14.7%, Australia 8.4%, Canada 4.2%, Japan 3.8%, Sweden 3.8%);
- **Japan** (Czech Republic 7.6%, South Korea 5.3%, Australia 4.5%, India 4.2%, England 3.7%)
- **Germany** (Austria 23.9%, Switzerland 17.2%, Czech Republic 16.6%, Ukraine 13.7%, Russia 13.3%)
- **South Korea** (USA 2.9%, Japan 2.7%, India 2.7%, Ukraine 2.2%, Russia 1.7%)

The above table shows countries that co-published a high proportion of their articles with one of the five most prolific countries. For instance, 18.9% of Israel's nanoscience/ nanotechnology articles were co-authored with the USA. This analysis takes the emphasis away from more prolific nations whose co-authorship is substantial in terms of number of papers, but less significant when measured as a fraction of that nation's total nanotechnology output.

The United States' neighbors and strategic allies published many of their research articles together with the US, and similarly Germany's top collaborators are in geographic proximity, in Central/ Eastern Europe. The percentages associated with these two countries are high, while South Korea has low percentages associated with it. Japan and China have moderate percentages associated with them, with the exception of Singapore's collaboration with China. Collaboration between these countries is given more value in this table than in the preceding table, and there are some unexpected occurrences, such as the Czech Republic's considerable cooperation with Japan.

FIGURE 5A - COUNTRY AUTO-CORRELATION MAP (fifty most prolific countries)



China’s and the USA’s global positions in nanotechnology are made clearer by the country auto-correlation map (Figure 5A). Although both publish extensively with other nations, no linkages show up on the map. The two powerhouses appear at two poles of Figure 5A, which says the US and China co-authorships are very broad and distributed, not heavily tied to any other countries relative to US and China total publications.

The only significant, although weak, connections are among European countries, and this complex web of nations roughly follows geographic lines. Norway, Denmark, Sweden, and Finland make up a Nordic group; the Netherlands, Belgium, Austria, Switzerland, and Germany constitute Central Europe; and the Eastern European group is made up of Romania, the Czech Republic, Slovakia, Poland, Ukraine, Byelarus, Russia, Bulgaria, Hungary, and Lithuania. Brazil, Argentina, Portugal, Spain, Mexico, France, and Italy compose a group of Romance language nations. The individual groups can be distinguished based on geographic and/ or linguistic similarities, but the connections stretch across, and beyond, the continent of Europe.

Outside of the network containing the other European nations, the United Kingdom’s countries (Northern Ireland, England, Scotland, and Wales) and Ireland are linked. Also, Australia and New Zealand are connected, and there is an East/ Southeast Asian group consisting of extremely weak links among South Korea, Taiwan, Thailand, and Singapore. Why is the United Kingdom not linked to the interconnected continental members of the European Union?

A more quantitative perspective on country connections can be obtained from factor analysis. Table 9 shows a seven factor matrix for the top forty countries.

TABLE 9 – SEVEN FACTOR MATRIX
(forty most prolific countries)

FACTOR	1	2	3	4	5	6	7
ENGLAND	-0.632	0.254	-0.003	-0.04	-0.109	-0.024	-0.006
SCOTLAND	-0.519	0.2	-0.028	0.059	-0.018	0.022	0.039
IRELAND	-0.295	0.083	0.01	-0.096	0.013	0.019	-0.005
AUSTRALIA	-0.226	0.064	-0.052	-0.058	0.058	-0.057	-0.037
NEW ZEALAND	-0.183	0.066	-0.006	0.013	0.022	-0.014	-0.012
IRAN	-0.129	0.061	0.009	0.039	0.002	-0.031	-0.02
PEOPLES R CHINA	-0.053	-0.547	-0.666	0.161	0.228	-0.225	-0.057
JAPAN	-0.04	-0.371	0.703	0.026	0.124	-0.112	-0.107
SOUTH KOREA	0.038	0.014	0.304	0.071	0.18	-0.102	-0.036
INDIA	-0.022	-0.046	0.205	0.036	0.005	-0.07	0.002
SWEDEN	-0.012	-0.066	-0.025	-0.541	0.053	0.096	0.01
NORWAY	-0.025	0.012	-0.027	-0.469	0.005	-0.096	0.008
DENMARK	-0.013	0.006	-0.022	-0.463	0.013	-0.01	0.03
NETHERLANDS	0.046	-0.025	-0.039	-0.376	-0.259	-0.094	-0.187
FINLAND	-0.069	-0.049	0.016	-0.232	0.039	0.117	0.025
FRANCE	0.022	-0.024	0.019	0.095	-0.532	0.082	0.019
BELGIUM	0.136	-0.04	-0.054	-0.184	-0.409	-0.108	-0.198
ITALY	-0.03	0.049	0.004	0.055	-0.37	0.02	-0.093
SPAIN	-0.077	-0.017	-0.003	-0.033	-0.344	-0.017	0.384
ROMANIA	0.019	-0.013	0.043	0.136	-0.296	-0.026	-0.196
SWITZERLAND	-0.016	0.105	-0.041	-0.022	-0.186	0.118	-0.209
GERMANY	0.013	0.047	-0.089	-0.011	-0.085	0.565	-0.094
RUSSIA	0.022	-0.007	0.03	-0.133	0.088	0.39	0.033
UKRAINE	0.031	-0.017	-0.005	-0.065	0.167	0.363	0.213
AUSTRIA	-0.003	0.019	-0.039	0.015	-0.042	0.351	-0.116
POLAND	0.084	-0.032	0.009	0.004	0.01	0.351	0.107
BULGARIA	0	-0.016	-0.015	0.064	-0.044	0.222	-0.023
GREECE	-0.034	0.049	-0.014	0.163	-0.039	0.178	-0.048
ARGENTINA	0.066	-0.01	-0.007	0.039	-0.16	-0.063	0.506
BRAZIL	0.078	0	0.019	0.037	-0.17	-0.09	0.425
MEXICO	0.076	0.005	0.011	-0.024	-0.035	-0.007	0.323
PORTUGAL	-0.08	-0.049	-0.004	-0.067	-0.073	0.095	0.306
TAIWAN	-0.04	-0.025	0.072	0.053	0.12	-0.028	0.051
USA	0.418	0.745	-0.065	-0.012	0.212	-0.185	-0.006
ISRAEL	0.103	0.104	-0.048	0.023	-0.036	0.033	-0.008
CANADA	0.002	0.149	-0.051	0.076	-0.028	-0.019	-0.028
SINGAPORE	-0.029	-0.016	-0.187	0.027	0.067	-0.084	-0.053
TURKEY	-0.065	0.082	0.021	0.079	0.025	0.05	-0.057
HUNGARY	0.052	-0.007	-0.03	-0.046	-0.102	0.131	-0.096
CZECH REPUBLIC	0.089	-0.083	0.055	0.041	-0.149	0.174	-0.129

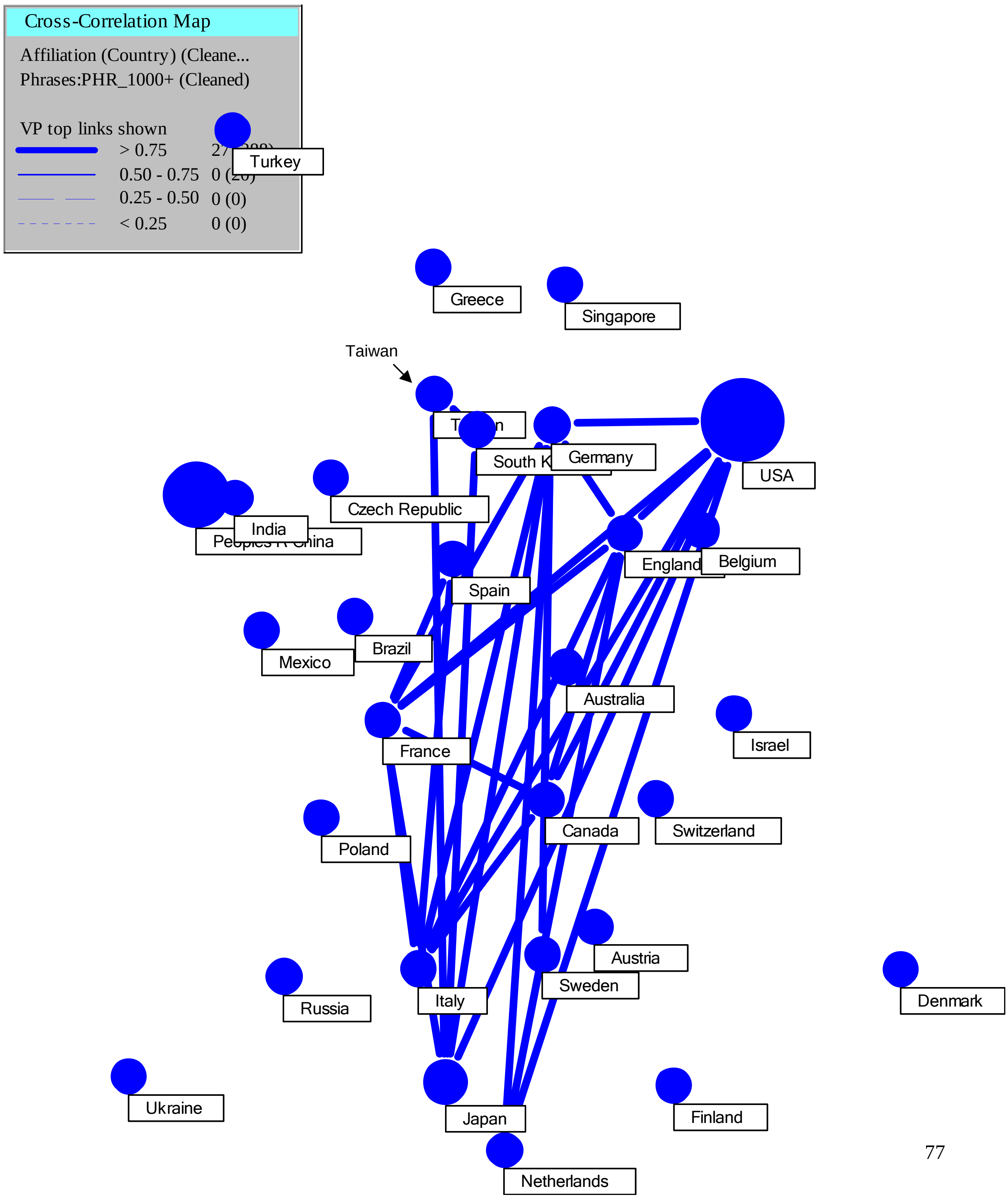
Seven groupings are shown, one for each factor.

- Factor 1 - England strongly linked to Scotland, weakly linked to Ireland and Australia, and very weakly linked to New Zealand.
- Factor 2 - China and Japan strongly linked. (East Asia)
- Factor 3 - Japan strongly linked to South Korea and weakly linked to India.
- Factor 4 - Sweden strongly linked to Norway, Denmark, and the Netherlands; and weakly linked to Finland.
- Factor 5 - France strongly linked to Belgium, Italy, and Spain; and weakly linked to Romania and the Netherlands.
- Factor 6 - Germany strongly linked to Russia, Ukraine, Austria, and Poland; and weakly linked to Bulgaria.
- Factor 7 - Argentina strongly linked to Brazil, Mexico, Portugal, and Spain.

Adding more institutions should further bring out the cooperation present in Europe. Also, the US is far on the opposite tail of the Japan/ China theme, which means that there are proportionally few American authors on papers with Japanese and Chinese authors.

Figure 5B contains a country-phrase cross-correlation map. While the US and China represent two poles as in Figure 5A, the US pole is strongly connected thematically to a densely connected network, whereas China is relatively isolated except for India. The densely connected network consists of the English-speaking North American representatives, Western/ Central European nations, and most of the East Asian allies. The Eastern European and Latin American representatives tend to be outside the dense network.

FIGURE 5B - COUNTRY-PHRASE CROSS-CORRELATION MAP (top thirty countries)



Country Technical Themes

The major Abstract phrases for the top five countries are as follows:

- **USA** (transmission electron miscroscopy [TEM], films, x-ray diffraction [XRD], materials, atomic force microscopy [AFM], particles, growth, nanoparticles, room temperature [RT], electron microscopy, water, devices, substrate, x-ray photoelectron spectroscopy [XPS], scanning electron miscroscopy [SEM], structures, thickness, proteins, diameter, silicon, nanotubes, electrons, fabrication, hydrogen [H], carbon nanotubes [CNTs], crystals, microstructures, deposits, quantum dots [QD], thin films)
- **People's Republic of China** (XRD, TEM, SEM, films, microstructures, XPS, crystals, RT, AFM, electron microscopy, Fourier-transform infrared [FTIR] spectroscopy, diameter, thickness, materials, growth, photoluminescence [PL], water, structures, particles, nanoparticles, infrared [IR], sol-gel, particle sizes, CNTs, Raman spectroscopy, mechanical properties, substrate, thermogravimetric analysis [TGA], annealing, nanowires)
- **Japan** (XRD, films, TEM, RT, thickness, AFM, diameter, particles, SEM, substrate, crystals, water, growth, materials, electron microscopy, XPS, annealing, structures, H, silicon, electrons, microstructures, PL, deposits, fabrication, nanoparticles, silicon substrates, silica, conductivity, thin films)
- **Germany** (XRD, TEM, films, AFM, materials, particles, crystals, growth, RT, electron microscopy, structures, SEM, thickness, carbon monoxide [CO], water, substrate, nanoparticles, deposits, XPS, diameter, QD, annealing, microstructures, silicon electrons, H, proteins, devices, adsorption, microscopy, thin films)
- **South Korea** (XRD, films, TEM, SEM, RT, AFM, thickness, PL, XPS, electron microscopy, microstructures, growth, annealing, optical properties, substrate, CNTs, water, devices, particles, materials, diameter, crystals, fabrication, silicon, electrical properties,

nanoparticles, mechanical properties, particle sizes, crystallinity, FTIR spectroscopy)

No connections between countries are discernible from either the top phrases of the most prolific countries or on the country-phrase cross-correlation map, which relates the 30 most prolific countries with the 1147 one-word, two-word, and three-word phrases that occur most frequently in the retrieved abstracts. Just like for insitutions, countries are striving to be leaders in all aspects of nanotechnology, so one cannot pinpoint the topics on which a certain nation focuses. One thing that is noticeable from the country-phrase cross-correlation map is the relative position of the US and China. The United States appears strongly linked to various other countries, whereas China is isolated, only having a connection with India. It cannot be said whether, for the US, the linkages are due to shared research interests or just incidental overlap in the phrases used.

Where do the leading countries publish? The leading six countries are listed below along with the five journals in which they published nanoscience/ nanotechnology articles most frequently in 2005. Each institution is listed with an average Impact Factor in square brackets (calculated in the same way as for the five leading institutions in Section 8). The total number of research articles, and the journals, are followed by their Impact Factors (in square brackets) and the number of articles published. Non-journal sources are given an Impact Factor of zero.

- **USA [4.10] 14750** (Applied Physics Letters [4.13] 862, Physical Review B [3.19] 729, Journal of Applied Physics [2.50] 517, Journal of Physical Chemistry B [4.03] 506, Journal of the American Chemical Society [7.42] 449)
- **Peoples Republic of China [1.98] 11746** (Rare Metal Materials and Engineering [0.40] 348, Materials Letters [1.30] 313, Chinese Journal of Inorganic Chemistry [0.70] 271, Journal of Physical Chemistry B [4.03] 270, Applied Physics Letters [4.13] 261)
- **Japan [2.33] 7971** (Japanese Journal of Applied Physics Part 1* [1.10] 522, Applied Physics Letters [4.13] 338, Physical Review B [3.19] 237, Journal of Applied Physics [2.50] 193, Japanese Journal of Applied Physics Part 2* [1.10] 170)
- **Germany [3.99] 5665** (Physical Review B [3.19] 377, Applied Physics Letters [4.13] 219, Journal of Applied Physics [2.50] 158,

Physical Review Letters [7.49] 142, Journal of Physical Chemistry B [4.03] 117)

- **South Korea [1.50] 4098** (Journal of the Korean Physical Society [0.83] 280, Applied Physics Letters [4.13] 170, On the Convergence of Bio-Information-, Environmental-, Energy-, Space- and Nano-Technologies, Pts 1 And 2 [0.00] 157, Thin Solid Films [1.57] 101, Japanese Journal of Applied Physics Part 1* [1.10] 85)
- **France [3.72] 3994** (Physical Review B [3.19] 227, Applied Physics Letters [4.13] 149, Journal of Applied Physics [2.50] 113, Physical Review Letters [7.49] 97, Langmuir [3.71] 78, Thin Solid Films [1.57] 78)

*Note: one SCI Impact Factor for *Japanese Journal of Applied Physics* given, no separate Impact Factors for each part.

There is a clear distinction between the three Western nations and the three Asian nations. The Western nations have average Impact Factors within 5% of 3.9, while the Asian nations are within 10% of 2.13 (excluding the non-SCI proceedings in South Korea's top five), almost a factor of two difference. Much of the difference comes from the Asian nations publishing a not-insignificant fraction of their output in domestic journals (most of which have low Impact Factors), while the Western nations publish almost exclusively in international journals. Whether this stems from problems with the English language or easier publication acceptance cannot be discerned from the present data.

Additionally, some of the Asian countries are publishing in journals whose initial access date in the SCI/ SSCI is relatively recent. For example, the median initial SCI/ SSCI access date for the five journals (above) in which the USA published nanoscience/ nanotechnology articles most frequently is 1962, whereas the median initial access date for China is 1997. This initial access date phenomenon was discovered recently in a comparison of India'a and China's published research outputs, where it was shown that for the twenty journals in which China (in aggregate) published most frequently, their median initial SCI/ SSCI access date was 1995, whereas for the twenty journals in which India (in aggregate) published most frequently, their median initial SCI/ SSCI access date was 1970.

Why is this difference in median access dates important in the present nanotechnology study, or in the India-China comparison study? These studies place some emphasis on growth in research article production. Increased production is ordinarily assumed to be due to increased research sponsorship and/ or increased research productivity. However, a neglected source of ‘increased production’ is acess to the articles of a journal that had not been accessed previously. If China, for example, is publishing a non-negligible fraction of its research output in newly-accessed relatively low Impact Factor journals (as appeared to be the case examined in the India-China comparison), then some of its apparent growth will not be in the traditional sense of increased sponsorship or productivity, but rather due to the SCI/ SSCI’s decision to access existing journals’ articles. From another perspective, the reality may be that China’s research article production may have been somewhat more competitive for decades, but was artificially suppressed by many of its journals’ non-inclusion in the SCI/ SSCI until only recently.

For example, the first journal above listed for China, Rare Metal Materials and Engineering, has been published since 1970, but was initially accessed by the SCI/ SSCI in 1997. In doing an SCI-based comparison of pre and post 1997 research article production for China, any articles published in e.g. Rare Metal Materials and Engineering would be registered as research production growth for China, even though it is in actuality a book-keeping artifice relative to growth.

***Most Cited First Authors (SCI only)

Table 10 contains the thirty first authors receiving the most total citations from the retrieved nanotechnology records along with the institution at which they work currently or worked for most recently.

TABLE 10 – MOST CITED FIRST AUTHORS

AUTHOR	#INSTANCES CITED	INSTITUTION	COUNTRY
Sheldrick, GM	2039	UNIV GOTTINGEN	GERMANY
Iijima, S	1751	HAMAMATSU UNIV	JAPAN
Wang, J	1561	*MULTIPLE*	
Wang, Y	968	*MULTIPLE*	
Chen, J	905	*MULTIPLE*	
Perdew, JP	897	TULANE UNIV	USA
Xia, YN	888	UNIV WASHINGTON	USA
Alivisatos, AP	880	UNIV CALIF BERKELEY	USA
Dresselhaus, MS	868	MIT	USA
Li, J	853	*MULTIPLE*	
Caruso, F	834	MAX PLANCK INST COLLOIDS & INTERFACES	GERMANY
Liu, Y	806	*MULTIPLE*	
Saito, R	795	TOHOKU UNIV	JAPAN
Kresse, G	781	UNIV VIENNA	AUSTRIA
Zhang, Y	729	*MULTIPLE*	
Nakamura, S	720	NICHIA CHEM IND LTD	JAPAN
Huang, MH	718	NATL TSING HUA UNIV	TAIWAN
Wang, ZL	708	GEORGIA INST TECH	USA
Li, Y	701	*MULTIPLE*	
Ulman, A	689	POLYTECH UNIV	USA
Zhang, J	688	*MULTIPLE*	
Murray, CB	688	IBM CORP	USA
Chen, Y	651	*MULTIPLE*	
Frisch, MJ	636	GAUSSIAN INC.	USA
Liu, J	625	DUKE UNIV	USA
Sun, SH	611	BROWN UNIV	USA
Inoue, A	611	TOHOKU UNIV	JAPAN
Sun, YG	608	UNIV ILLINOIS	USA
Rao, CNR	606	JAWAHARLAL NEHRU CTR ADV SCI RES	INDIA
Ajayan, PM	584	RENSSELEAR POLYTECH	USA

Of the 21 most cited first authors that were identified along with their institution, twelve are from the USA, four are from Japan, two are from Germany, and one each is from Austria, India, and Taiwan. Seventeen of the authors are from universities, three are from industry, and one is from a research institution. Past text mining studies performed by the present paper's first author have shown that cited documents tend to be at a more fundamental level than the citing papers, so the heavy contribution from universities agrees with previous text mining studies.

TABLE 11 – MOST CITED JOURNALS

JOURNAL	#INSTANCES CITED	IMPACT FACTOR	THEME
PHYS REV B	71207	3.19	PHYS
APPL PHYS LETT	68026	4.13	PHYS
J AM CHEM SOC	53417	7.42	CHEM
PHYS REV LETT	51648	7.49	PHYS
J PHYS CHEM*	45268	2.90 (A), 4.03 (B)*	CHEM
SCIENCE	41776	30.93	SCIENCE
J APPL PHYS	35439	2.50	PHYS
NATURE	34914	29.27	SCIENCE
LANGMUIR	33387	3.71	CHEM
MACROMOLECULES	24282	4.02	CHEM
CHEM MATER	21792	4.82	CHEM
J CHEM PHYS	20431	3.14	PHYS
ADV MATER	19534	9.11	MATLS
ANGEW CHEM INT EDIT	17777	9.60	CHEM
THIN SOLID FILMS	14574	1.57	MATLS
CHEM PHYS LETT	13561	2.44	PHYS
J ELECTROCHEM SOC	12929	2.19	CHEM
SURF SCI	12190	1.78	MATLS
ANAL CHEM	12040	5.64	CHEM
POLYMER	11452	2.85	MATLS
P NATL ACAD SCI USA	10723	10.23	SCIENCE
J CRYST GROWTH	9708	1.68	MATLS
INORG CHEM	9628	3.85	CHEM
CHEM REV	9366	20.87	CHEM
J CATAL	9275	4.78	CHEM
NANO LETT	8915	9.85	NANO
J MATER CHEM	8533	3.69	MATLS
CHEM COMMUN	8501	4.43	CHEM
J COLLOID INTERF SCI	8244	2.02	CHEM
J AM CERAM SOC	8025	1.59	MATLS

Table 11 contains the thirty journals most cited by the authors of the ~65000 papers retrieved for 2005. Of the top ~thirty journals in which nanotechnology authors publish and those which they cite, twenty overlap. This is consistent with past text mining studies. The very top journals on the most cited list are weighted toward physics, while the bottom journals are weighted toward chemistry. There tend to be recognizably more materials journals in the list of prolific journals than in the cited journals list. The median Impact Factor of the thirty journals in which nanotechnology authors publish most is 2.50, while the median Impact Factor of those they cite most is 4.03. However, the median Impact Factor of the journals on the most cited list but not on the most published list is 7.62.

*Note: The *Journal of Physical Chemistry* counts all papers published in the *Journal of Physical Chemistry* (which existed from 1896-1996), the *Journal of Physical Chemistry A*, and the *Journal of Physical Chemistry B* (the latter two which were created in 1997). The impact factors for both the *Journal of Physical Chemistry A* and the *Journal of Physical Chemistry B* are given.

There appear to be four major journal groups. The first group consists of the two most cited journals (Phys Rev B, Applied Physics Letters), both physics journals. The second group (Journal of the American Chemical Society, Physics Review letters, Journal of Physical Chemistry, Science) has more of a chemistry emphasis, the third group (the next eight journals on the list) is chemistry-dominated, and the fourth group (the next sixteen journals on the list) is essentially split between chemistry and materials. The general science journals have the highest Impact Factors, followed by chemistry, physics, and materials journals, in that order.

The papers in these highly cited journals were referenced by the 2005 retrieved papers. The references include both nanotechnology and non-nanotechnology papers. In the analysis of the seminal literature of nanotechnology performed by the present authors, the most highly cited nanoscience/ nanotechnology papers written from 1991-2003 were also retrieved and analyzed. Authors, journals, institutions, and countries associated with the most highly cited nanotechnology papers were identified and discussed. This analysis of highly cited nanoscience/ nanotechnology papers is included in Appendix 1.

TABLE 12 – MOST CITED DOCUMENTS

DOCUMENT	#CITES	TOTAL SCI CITES	MAX JRNL CITES
IIJIMA S, 1991, NATURE, V354, P56 ***(HELICAL MICROTUBULES OF GRAPHITIC CARBON)***	1463	5080	5080
SHELDRICK GM, 1997, SHELX-97 ***(SHELX-97) [SET OF PROGRAMS FOR CRYSTAL STRUCTURE DETERMINATION FROM SINGLE-CRYSTAL DIFFRACTION DATA]***	803	N/A	N/A
KRESGE CT, 1992, NATURE, V359, P710 ***(ORDERED MESOPOROUS MOLECULAR-SIEVES SYNTHESIZED BY A LIQUID-CRYSTAL TEMPLATE MECHANISM)***	517	4992	4992
HUANG MH, 2001, SCIENCE, V292, P1897 ***(ROOM-TEMPERATURE ULTRAVIOLET NANOWIRE NANOLASERS)***	453	1264	3549
ALIVISATOS AP, 1996, SCIENCE, V271, P933 ***(SEMICONDUCTOR CLUSTERS, NANOCRYSTALS, AND QUANTUM DOTS)***	443	2231	2693
XIA YN, 2003, ADV MATER, V15, P353 ***(ONE-DIMENSIONAL NANOSTRUCTURES: SYNTHESIS, CHARACTERIZATION, AND APPLICATIONS)***	430	840	840
PAN ZW, 2001, SCIENCE, V291, P1947 ***(NANOBELTS OF SEMICONDUCTING OXIDES)***	388	1133	3549
OLIVER WC, 1992, J MATER RES, V7, P1564 ***(AN IMPROVED TECHNIQUE FOR DETERMINING HARDNESS AND ELASTIC-MODULUS USING LOAD AND DISPLACEMENT SENSING INDENTATION EXPERIMENTS)***	387	2684	2684
BECK JS, 1992, J AM CHEM SOC, V114, P10834 ***(A NEW FAMILY OF MESOPOROUS MOLECULAR-SIEVES PREPARED WITH LIQUID-CRYSTAL TEMPLATES)***	379	3952	3952
SUN SH, 2000, SCIENCE, V287, P1989 ***(MONODISPERSE FePt NANOPARTICLES AND FERROMAGNETIC FePt NANOCRYSTAL SUPERLATTICES)***	337	1093	2171
SAITO R, 1998, PHYS PROPERTIES CARB ***(PHYSICAL PROPERTIES OF CARBON NANOTUBES) [BOOK, PUBLISHED BY IMPERIAL COLLEGE PRESS]***	334	N/A	N/A
ULMAN A, 1996, CHEM REV, V96, P1533 ***(FORMATION AND STRUCTURE OF SELF-ASSEMBLED MONOLAYERS)***	332	2087	2087
MURRAY CB, 1993, J AM CHEM SOC, V115, P8706 ***(SYNTHESIS AND CHARACTERIZATION OF NEARLY MONODISPERSE CDE (E = S, SE, TE) SEMICONDUCTOR NANOCRYSTALLITES)***	327	1812	1812
OREGAN B, 1991, NATURE, V353, P737 ***(A LOW-COST, HIGH-EFFICIENCY SOLAR-CELL BASED ON DYE-SENSITIZED COLLOIDAL TIO2 FILMS)***	326	2554	5080
BRUCHEZ M, 1998, SCIENCE, V281, P2013 ***(SEMICONDUCTOR NANOCRYSTALS AS FLUORESCENT BIOLOGICAL LABELS)***	325	1173	3549
SHANNON RD, 1976, ACTA CRYSTALLOGR A, V32, P751 ***(REVISED EFFECTIVE IONIC-RADII AND SYSTEMATIC STUDIES OF INTERATOMIC DISTANCES IN HALIDES AND CHALCOGENIDES)***	298	14724	14724
BAUGHMAN RH, 2002, SCIENCE, V297, P787 ***(CARBON NANOTUBES - THE ROUTE TOWARD APPLICATIONS)***	292	763	1278
TANS SJ, 1998, NATURE, V393, P49 ***(ROOM-TEMPERATURE TRANSISTOR BASED ON A SINGLE CARBON NANOTUBE)***	284	1402	4514
CHAN WCW, 1998, SCIENCE, V281, P2016 ***(QUANTUM DOT BIOCONJUGATES FOR ULTRASENSITIVE NONISOTOPIC DETECTION)***	283	1059	3549
ZHAO DY, 1998, SCIENCE, V279, P548 ***(TRIBLOCK COPOLYMER SYNTHESES OF MESOPOROUS SILICA WITH PERIODIC 50 TO 300 ANGSTROM PORES)***	283	1595	3549

***Most Cited Documents (SCI only)

Table 12 contains the twenty most cited documents. The column headed #CITES reflects the citations from the retrieved documents only, whereas the column headed TOTAL SCI CITES reflects citations from all documents contained in the SCI/ SSCI. Finally, the right-most column labeled MAX JRNL CITES is the maximum number of citations received by any paper published in that journal for that year. Thus, the first paper listed (published in Nature in 1991) was cited 639 times by other papers in the retrieved nanotechnology-specific database, and was cited 5080 times by all the papers in the SCI/ SSCI. The highest cited paper published in Nature in 1991 received 5080 cites.

A number of the nanotechnology papers were in fact the highest-cited papers of the year for the (high Impact Factor) journals in which they were published, which shows 1) how much of scientific research is geared towards nanotechnology and 2) the quality of the best nanotechnology papers.

Taxonomies

Knowledge of pervasive technical thrusts (and their inter-relationships) in a technical area is important from multiple perspectives. It identifies adequacies or gaps in specific areas, which are important for setting research directions. It shows which technical areas are closely integrated, allowing research environments to be restructured for exploiting these technical relationships. If the technical thrusts can be coupled to infrastructure information, as our upgraded document clustering capabilities allow, then even more powerful insights can be gleaned from the S&T taxonomies. National research priorities and strategies can be estimated by the levels of publication activity in specific sub-areas. Research thrusts can be coordinated more closely with use of organizational information.

The present section presents four methods for categorizing the technical thrusts of the retrieved 2005 database. Each method provides a unique perspective on the technical structure, and all four methods should be viewed as complementary.

1. Document Clustering

The first method, document clustering, groups the retrieved records with Abstracts by text similarity of the Abstracts, and is the most detailed of the four approaches. It provides bibliometrics at each taxonomy node, and shows very specific technical areas where each country concentrates its nanotechnology investment. In this section, the lowest level of detail is supplied for the sixteen Level 4 clusters. For detailed analysis of the full 256 elemental clusters, see Appendix 7.

TABLE 13 – FOUR LEVEL HIERARCHICAL TAXONOMY

Quantum Phenomena, Optics, Electronics, Magnetism, Tribology, and Films (32983 Rec)	Quantum Phenomena, Optics, Electronics, Magnetism, and Tribology (26077 Rec)	Quantum Phenomena (3326 Rec)	Quantum Dots (2028 Rec)
			Quantum Wells, Wires, and States (1298 Rec)
		Optics, Electronics, Magnetism, and Tribology (22751 Rec)	Optics and Electronics (16432 Rec)
			Magnetism and Tribology (6319 Rec)
	Films (6906 Rec)	Thin Films (4760 Rec)	Properties of Thin Films (2251 Rec)
			Applications of Thin Films (2509 Rec)
		Deposition of Films (2146 Rec)	Deposition of Thin Films (1752 Rec)
			Diamond Films (394 Rec)
Nanotubes, Nanomaterials, Nanoparticles, Polymers, Composites, Metal Complexes, and Bionanotechnology (31742 Rec)	Nanotubes (3211 Rec)	Multi-walled Nanotubes (2350 Rec)	Applications of Carbon Nanotubes (474 Rec)
			Multi-walled Nanotubes (1876 Rec)
		Single-walled Nanotubes (861 Rec)	Single- and Double-walled Nanotubes (447 Rec)
			Single-walled Nanotubes (414 Rec)
	Nanomaterials, Nanoparticles, Polymers, Composites, Metal Complexes, and Bionanotechnology (28531 Rec)	Nanomaterials, Nanoparticles, Polymers, Composites, and Metal Complexes (22686 Rec)	Nanomaterials and Nanoparticles (14263 Rec)
			Polymers, Composites, and Metal Complexes (8423 Rec)
		Bionanotechnology (5845 Rec)	DNA (775 Rec)
			Proteins and Cellular Components (5070 Rec)

Table 13 is a four level hierarchical taxonomy of the global nanoscience and nanotechnology literature. In each succeeding level, the categories are bifurcated. Categories with no shading are those in which the USA has the most publications. Categories with solid shading denote China publication lead, and categories with diagonal shading denote Japan publication lead. Light shading means category leader has 100-125% of USA publications; medium shading 125-150%; dark shading >150%.

In the first level (leftmost column), the total retrieved records are divided into two technical categories. One category (Quantum Phenomena, Optics, Electronics, Magnetism, Tribology, and Films) focuses mainly on physical phenomena, whereas the other category (Nanotubes, Nanomaterials, Nanoparticles, Polymers, Composites, Metal Complexes, and Bionanotechnology) focuses on materials and structures. The two categories are about the same size.

The primarily phenomena category sub-divides into two categories, with the larger category (phenomena) being roughly four times the size of the smaller category (films). The materials and structures category likewise divides into two asymmetric categories, with the smaller sub-category focusing on nanotubes and the nine times larger category focusing on all other structures and materials. China has a modest publications lead in this latter category.

At the fourth level, China out-publishes the USA in:

- Properties of Thin Films (modestly, 2251 rec)
- Diamond Films (modestly, 394 rec)
- Applications of Carbon Nanotubes (strongly, 474 rec)
- Multi-Walled Nanotubes (modestly, 1876 rec)
- Nanomaterials and Nanoparticles (noticeably, 14263 rec)
- Polymers, Composites, and Metal Complexes (noticeably, 8423 rec)

Also at this level, Japan out-publishes the USA in Deposition of Thin Films.

A more detailed description of the fourth level follows. The elemental clusters of each of the sixteen fourth level categories are bulletized. Selected metrics of each elemental cluster (a novel feature of our upgraded clustering algorithm) are displayed. While the US is the overall leader in nanotechnology, there are elemental clusters in which other countries out-produce the US, sometimes markedly so. The detailed results down to the 256 elemental clusters are presented in Appendix 7.

Specifically, out of the 256 elemental clusters, the US leads in 168, many times very heavily. China leads in 70 (many times very heavily), Japan leads in 15 (rarely heavily), and India, South Korea, and Spain each lead in one. The metrics of the following sixteen level 4 categories show the broad nanotechnology areas where each country is strong.

CATEGORY 1 ***(6 leaf clusters)***

Quantum Dots (2028 REC)

(Leading authors for this category include Hopkinson M, Arakawa Y, Bimberg D, and Lee JI. The major journals are all physics-related: Physical Review B (dominant), Applied Physics Letters, Physica e-Low-Dimensional Systems & Nanostructures, Physical Review Letters, Journal of Applied Physics. USA is dominant (In this section, ‘dominant, is used when a country or institution has about twice the number of publications as its closest competitor, ‘very dominant’ signifies about three times the number of publications, and ‘extremely dominant’ is about four or more times the number of publications.), followed by

Germany (In this section, 'followed by' is used when the first country or organization has a noticeable advantage over the succeeding country, but somewhat less than double the frequency difference), Japan, China. Main institutions are Chinese Academy of Science (CAS), Russian Academy of Science (RAS), University of Tokyo, CNRS. Leading USA institutions include UCSB.)

- Investigation of electronic transport properties of quantum dots, focusing on Kondo and Fano effects (192 Records) Cluster 83

(USA leader, with Germany and China following. German institutions leading: University Karlsruhe; Ruhr University Bochum; Shanghai Jiao Tong University; Polish Academy of Science; CNRS. USA institutions include MIT.)

- Spin in quantum dots, especially electron spin, spin-orbit interactions, spin dynamics, and spin relaxation; properties of quantum dots in magnetic fields (274 Records) Cluster 78

(USA more dominant, with Germany and China following. Strong USA institutional leadership. UC Santa Barbara tied for lead with Ohio University. Other leading USA institutions include Harvard, US Navy [NRL], Suny-Buffalo.).

- Optical properties of quantum dots, namely exciton states and dynamics, fabrication and use of quantum dot lasers (401 Records) Cluster 116

(USA dominant, followed by Germany/ England/ China. Top single institutions are University of Cambridge, University of Sheffield, University of Michigan. USA leaders also include UCSB, University of Texas. Concentrated British effort.)

- Self-assembly, growth, and properties of quantum dots, especially CdSe and Ge/Si quantum dots (577 Records) Cluster 120

(USA dominant, followed by Germany, Japan, China. Main institutions are almost exclusively non-universities: Russian Academy of Science (RAS), Chinese Academy of Science (CAS), University of Tokyo, Tokyo Institute of Technology, CNRS, CEA. USA leaders include UCLA, UCB.)

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- Quantum dots, particularly CdSe, GaAs, and InAs quantum dots, and their photoluminescence and emission properties (239 Records) Cluster 48

(USA moderately dominant, with Japan, Korea, and China close behind. Chinese, Korean and Russian institutes lead. USA leaders include Notre Dame University, Virginia Commonwealth University.)

- Engineering and properties of quantum dots, especially InAs, GaAs, and InAs/GaAs, many of which are grown on GaAs layers/ matrices (345 Records) Cluster 39

(USA/ Japan/ Germany essentially tied for lead. University Tokyo/ CAS essentially tied for institutional lead. USA leaders include University of New Mexico.)

CATEGORY 2 - 508A1b (4 leaf clusters)

Quantum Wells, Wires, and States (1298 REC)

(Leading authors in this category are Pessa M, Pfeiffer LN, and Hopkinson M. Two journals stand out: Physical Review B and Applied Physics Letters. USA is dominant, followed by Germany, China, Japan, Russia. Leading institutions include RAS, CAS, CNRS, University of Sheffield, University of Tokyo. Leading USA institutions include UCSB, University of Arkansas.)

- Quantum wells containing combinations of gallium, indium, arsenic, nitrogen, and aluminum, especially those grown by molecular beam epitaxy (265 Records) Cluster 146

(USA/ Japan tied for country lead. RAS/ CAS are institutional leaders. USA leaders include University of Arkansas. Applied physics journals predominate, as was the case for the previous Quantum Dot clusters.)

- Quantum wells, especially intersubband absorption and transitions (326 Records) Cluster 133

(USA dominant, with many countries vying for second place [Germany/ England/ Japan/ Russia/ China/ France]. RAS institutional leader. USA leaders include UCSB, University of Iowa, University of Arizona, Stanford University.).

- Quantum wires, including those with impurities (133 Records) Cluster 72

(USA leader, followed by China, Germany, Japan. Many institutions making first appearance in results. Trakya University and Yerevan State University are leading new institutions, and USA leaders include University of Illinois, Stevens Institute of Technology, Arizona State University, and Argonne National Labs.).

- Quantum states and systems (329 Records) Cluster 223

(USA dominant; China, Germany follow. Main institutions are RAS, Tsing Hua University, CAS. Leading USA institutions include Princeton University, UCSB, University of Arkansas.).

CATEGORY 3 - 508A2a (67 leaf clusters)

Optics and Electronics (16432 REC)

(All leading authors have Asian names. Metrics may be for more than one author. Leading journals include Applied Physics Letters (dominant), followed by Physical Review B, Journal of Applied Physics, Journal of Physical Chemistry B, Journal of Crystal Growth. USA dominant, followed by Japan, China, followed by Germany, followed by South Korea, France.

However, Japan and China each led in seven elemental clusters. Japan: surface treatments; dye-sensitized films; silicon carbide structure growth, silicon-containing substances; silicide-containing substrates/layers/films; particle beam irradiation; magnetic tunnel junctions/ magnetoresistance. China: rare earth ion luminescence (very dominant); rare earth ion phosphorence (very dominant); optical activity; zinc oxide films fabrication (dominant); zinc oxide films growth (dominant); zinc oxide nanostructures (dominant); nanowires (China-USA dominant).

Leading institutions include CAS (dominant), RAS, CNRS. Leading USA institutions include UCB, University of Illinois.)

- Fabrication and characterization of vertical-cavity surface-emitting lasers and detection using them (72 Records) Cluster 2

(USA leading; Taiwan, Germany follow. Two new institutions leading: Tampere University of Technology; National Chiao Tung University. American leaders include University of Illinois, Stanford University, University of Arizona.).

- Devices related to quantum wells, especially quantum cascade lasers and quantum well infrared photodetectors (115 Records) Cluster 119

(USA leader, followed by Germany. Main institutions are CAS, RAS. Leading USA institutions: University of Wisconsin, Lehigh University.).

- Lasers, focusing on diode lasers, waveguide lasers, and optically pumped lasers (275 Records) Cluster 152

(Countries: USA, Germany. Institutions: CAS, RAS. USA leaders: USAF, University of Central Florida, UCSB, Stanford.).

- Applications of lasers, especially YAG laser irradiation and laser ablation to prepare materials (325 Records) Cluster 196

(Country: USA dominant, Japan. Institution: CAS, RAS, Osaka University. Substantial representation of American institutions: University of Texas, LLNL, UCI, Washington State University, USN (NRL), Colorado State University.).

- Studies of femtosecond pulse lasers, especially enhancement of laser pulses, creation of 3d nanostructures, and ablation processes (243 Records) Cluster 144

(Countries: USA, Germany. Institutions: RAS, CAS. American: University of Michigan.).

- Photonic, especially two-photonic, effects: photon absorption and fluorescence, as well as detection (153 Records) Cluster 145

(All previous leading journals have been applied physics related. Present journal leaders: Journal of Physical Chemistry, Optics Letters. Countries:

USA, followed by Germany, France, Japan. Institutions: University of Tokyo, University of Grenoble, UCB (only USA institution represented).

- Fabrication and structural/ optical properties of photonic crystals, especially photonic band gap features (238 Records) Cluster 76

(Countries: USA, Japan. Institutions: CNRS, Technical University Denmark, Moscow Lomonosov State University, RAS. No USA representation among leaders.).

- Optical waveguides, especially propagation of light through waveguides (139 Records) Cluster 79

(Countries: USA, followed by Japan, France. Institutions: University Trent, Polytechnic Milan, CAS, CNR. No USA representation among leaders.).

- Design, fabrication, and characterization of gratings, such as Bragg gratings, or structures containing gratings, primarily for optical applications (103 Records) Cluster 40

(Countries: USA prominent, followed by China, Japan, France, Korea. Institutions: Paul Scherrer Institute, MIT, Electronics and Telecommunications Research Institute. Other USA leaders are UCSB, University of Arizona.).

- Optical properties of nanostructures/ nanomaterials, optical materials and devices, and optical microscopy studies (359 Records) Cluster 236

(Countries: USA very dominant, followed by Japan, France, Germany. Institutions: CAS, Chalmers University Technology, CNRS. Leading USA institutions include University of Central Florida, University of Arizona, Northwestern University.).

- Optical nonlinearities in nanostructures and investigation of second harmonic generation (105 Records) Cluster 128

(Countries: USA, followed by a second tier of Japan and Russia, followed by a third tier of Germany, China, France. Institutions: RAS, CAS, Univerdsity Angers, Moscow Lomonosov State. USA leaders: University of Texas.).

- Plasmons: surface-plasmon resonance technology, surface dynamics, surface-plasmons in metallic structures, Raman scattering experiments, and studies of plasmons by finite difference time domain method (336 Records) Cluster 169

(Country: USA dominant, followed by France, Japan, Germany. Institutions: University Maryland, University Aalborg, RAS, Northwestern University. USA leaders also include UCB, Argonne National Lab.)

- Measurement and detection using optical instruments, with focus on the instrument parameters and features, especially mirrors and lenses (314 Records) Cluster 247

(Countries: USA dominant, followed by Japan, Germany, China. Journals: mainly optics and instrumentation journals. Institutions: NASA, Tsing Hua University, RAS, CAS. Other leading USA institutions include US Army, University Colorado, Caltech, University of Central Florida, UCI, UCB, Northwestern University, University Washington, MIT.)

- Imaging using various forms of electron microscopy, including SEM, STEM, and TEM, as well as atomic force microscopy (178 Records) Cluster 189

(Countries: USA dominant; Germany, Japan, next tier. Institutions: University Melbourne, UCB, ORNL, University Osaka. Other USA institutions include NIST, BNL, Northwestern University.)

- Machining, cutting, grinding, polishing of materials, especially surfaces, and characterization of the materials after these processes (86 Records) Cluster 109

(Countries: Japan, followed by USA, China tied for second. Very applied literature. Institutions: Harbin Institute of Technology, followed by Tohoku University and Singapore Institute of Manufacturing Technology tied for second. USA institutions far behind include Purdue University, Penn State University, ORNL.)

- Modeling, design, and simulation of processes and systems at the nanoscale; measurement and minimization, control, and correction of errors (325 Records) Cluster 252

(Countries: USA dominant; followed by Japan, followed by Korea and China. Institutions: Tohoku University, followed by Nanyang Technological University, MIT, Chalmers University Technology. Other leading USA institutions include Penn State University, George Washington University, University of Texas, University of Illinois.).

- Nanomechanical systems, including actuators, resonators, hard disk drives, sensors, and motors (211 Records) Cluster 213

(Countries: USA dominant, followed by Japan and Korea. Institutions: Yonsei University, Ohio State University, Nanyang Technological University, Boston University. Other USA includes UCB, Goergia Institute of Technology.).

- Applications of atomic force microscopy and similar methods of nanomanipulation, with focus on tips and cantilevers, namely their uses and responses to different influences (241 Records) Cluster 154

(Countries: USA dominant, with Germany and Japan the second tier. Institutions: UCB, Tel Aviv University, University Munster, Georgia Institute of Technology. Other USA include North Carolina State University, University of Illinois, Iowa State University, ORNL.)

- Atomic force microscopy to measure, fabricate, and manipulate, with focus on rough surfaces (237 Records) Cluster 214

(Countries: USA dominant, followed by Japan, Germany, China. Institutions: CAS, University Tokyo, Osaka University, USAF, University Cambridge, Tsing Hua University, Max Plank Institute for Polymer Research. Other USA include University of Utah, University of South Carolina.).

- Probing polymer/ molecular chain properties and surface interactions, especially by means of atomic force microscopy (AFM) (274 Records) Cluster 245

(Countries: USA dominant, followed by Japan, Germany, China. Institutions: CAS, Max Plank Institute of Polymer Research, Kyoto University. Other USA include Harvard University, University of Massachusetts, Columbia University, VPI, University of Utah.).

- Molecular dynamics simulations and models of physical and biological systems (241 Records) Cluster 234

(Countries: USA predominant, followed by Germany and Japan. Institutions: National University of Singapore, University of Wisconsin, Northwestern University. Other USA include USAF, University of Washington, University of Illinois.).

- Models and simulations, especially Monte Carlo and molecular dynamics simulations, of systems and comparison to experiments or other models (578 Records) Cluster 254

(Countries: USA dominant, followed by Germany, Japan, France. Institutions: RAS, CAS, University of Michigan, CNRS. Other USA include University of Illinois.).

- Phonon scattering, transport, and states; phonon-electron interactions; Raman scattering; related topics concerning vibrational modes and acoustics (176 Records) Cluster 167

(USA dominant, China, France next tier. Institutions: CAS, University Lyon, Pusan National University, MIT, CRNS. Other USA include University of Illinois, UCB, Ohio State University, University of Texas, UC Riverside, Penn State University.).

- Electronic properties, structures, and states; energy transfer, levels, and loss; band gap properties; and spectroscopic studies (325 Records) Cluster 246

(Countries: USA, followed by Germany, Japan. Institutions: Tsing Hua University, CNRS, RAS, CAS, UCB. Other USA include Cornell University).

- Density functional theory, with focus on its use for condensed matter, atomic, molecular, and chemical physics calculations, especially to study nanoclusters (266 Records) Cluster 215

(Countries: USA dominant, followed by Germany, China, Japan. Institutions: Forschungszentrum Karlsruhe, Tsing Hua University, University Oslo, Osaka University. USA includes UCB.)

- Nanosized clusters, including their structures and properties, density functional theory calculations, molecular dynamics simulations, and their interactions with compounds and each other (251 Records) Cluster 197

(Countries: USA dominant, followed by second tier China, Japan, Germany. Institutions: CAS, CNRS, University Karlsruhe, Forschungszentrym Karlsruhe. USA include Georgia Institute of Technology, VCU.).

- Scanning tunneling microscopy studies (268 Records) Cluster 161

(Countries: USA, closely followed by Japan, then by Germany. Institutions: University of Tokyo, UCI, RAS, Free University of Berlin, CNRS. Other USA include Northwestern University and UCB.)

- Studies of individual molecules, especially on surfaces and in organic materials, with the aid of scanning tunneling microscopy (332 Records) Cluster 227

(Countries: USA dominant, followed by Japan and Germany. Institutions: CAS, CNRS, University of Texas, Kyoto University. Other USA include UCB, Princeton University, Arizona State University, University of Pittsburgh.)

- Fluorescence/ luminescence properties, of dyes for instance, and their applications, especially to sensors (112 Records) Cluster 192

(Countries: USA, followed by China and Germany. Institutions: MIT, followed closely by CAS and Anhui Normal University. Other USA include UCSB, UCLA, University of Massachusetts, University of Maryland.).

- Improvement of solar cells by dye-sensitized films (especially TiO2 films) or nanostructures (92 Records) Cluster 18

(Countries: Japan dominant, followed by China, USA, Switzerland, Germany. Sri Lanka next, but far behind. Institutions: Swiss Federal

Institute of Technology, CAS, National Institute of Advanced Industrial Science and Technology, Osaka University. USA includes NREL, UCB.).

- Ring compounds, especially porphyrins, fullerenes, and their derivatives, with emphasis on reactions, synthesis, and structure of these compounds (332 Records) Cluster 250

(Countries: Japan and USA essentially tied. Well behind are China, Germany, Russia. Institutions: RAS, CAS, Tokyo Institute of Technology, Tohoku University, Gunma University. USA includes University of Massachusetts, UCR.).

- Chemical studies of bonding (especially hydrogen bonding), host-guest interactions, and other molecular interactions involved in structure and assembly, with focus on supramolecular structures and macrocycles (246 Records) Cluster 230

(Countries: USA, well ahead of China, Japan, Germany. Institutions: CAS, UCLA, University Twente. Other USA includes UCB, University of Utah.).

- Self-assembly, formation of supramolecular structures, aggregation, and block copolymers (694 Records) Cluster 210

(Countries: USA dominant, China, Japan, Germany. Institutions: CAS dominant, Northwestern University. Other USA include University of Michigan, Georgia Institute of Technology, University of Massachusetts, UCLA.).

- Self-assembled monolayers (SAMs), especially gold and alkanethiol SAMs, (294 Records) Cluster 50

(Countries: USA dominant, followed by Japan, Germany, South Korea, China. Institutions: University of Heidelberg, Korea Advanced Institute S&T, University of Washington, Kyoto University. Other USA include Penn State, Clemson University, University of Houston).

- Self-assembled monolayers (SAMs), especially gold and alkanethiol SAMs, as well as Langmuir-Blodgett monolayers/ films (335 Records) Cluster 168

(Countries: USA dominant, followed by Japan, Germany, China. Institutions: CAS, UCLA, University of Alberta, National Institute of Advanced Industrial S&T. Other USA include Pacific Northwest National Lab, Northwestern University).

- Studies of surfaces (especially copper, gold, and silver-containing surfaces), focusing on the effects of cluster formation and deposition on surfaces and the use of scanning tunneling microscopy to characterize surfaces (STM) (220 Records) Cluster 244

(Countries: USA, Japan, Germany. Institutions: National Institute of Materials Science, University of Tokyo, CAS. Other USA include University of Pittsburgh, UCSB).

- Layers, emphasizing properties of thickness and deposition, as well as interactions at the interfaces/ barriers (325 Records) Cluster 253

(Countries: USA, Japan, Germany, China. Institutions: CAS, National Chiao Tung University, RAS. Other USA include University of Illinois, UCSD, Georgia Institute of Technology, University of Wisconsin).

- Growth of layers/ films, especially InN and GaAs, by means of molecular beam epitaxy, chemical vapor deposition, and similar deposition techniques (264 Records) Cluster 205

(Countries: USA, Japan, Germany. Institutions: RAS, CNRS, CAS. Other USA include Arizona State University, University of Houston).

- Growth of crystals and islands, emphasizing growth parameters and properties of the products (269 Records) Cluster 229

(Countries: USA, China, Japan, Germany, France. Institutions: Shandong University, CAS, CNRS. USA includes Sandia National Laboratories).

- Silicon carbide (SiC), emphasizing growth of desired structures by epitaxy or chemical vapor deposition (CVD) and issues concerning defects on the products (174 Records) Cluster 58

(Countries: Japan, USA, Germany. Institutions: Kyoto University, Linkoping University, Technical University Ilmenau. Other USA include University of South Carolina, Rensselaer Polytechnic Institute, US Navy.).

- Silicon-containing substances, emphasizing processes on and interactions with silicon surfaces and scanning tunneling microscopy to characterize the substances (228 Records) Cluster 131

(Countries: Japan, USA, Germany. Institutions: Tohoku University, Osaka University University, University oif Illinois, CAS. Other USA include Arizona State University, University of Wisconsin.).

- Silicon, silica, and silicide-containing substrates/ layers/ films: their properties and processes that occur on them (461 Records) Cluster 190

(Countries: Japan, USA, China, Germany, South Korea. Institutions: Nanjing University, National Tsing Hua University, CNR, Tohoku University, National Chiao Tung University. No USA institutions among leaders.).

- Growth and characterization of silicon-germanium (SiGe) structures and their application to circuits, with focus on strained/ strain-relaxed SiGe layers (113 Records) Cluster 36

(Countries: USA, Japan, Taiwan, Germany. Institutions: RAS, CAS, National Tsing Hua University. Other USA include MIT, University of Illinois.).

- Germanium-based substances, including germanium nanocrystals, islands, and substrates, as well as heterostructures containing silicon (176 Records) Cluster 42

(Countries: USA dominant, China, Germany, Japan, France. Institutions: National University Singapore, Arizona State University, CAS, CEA. Other USA include University of Texas, Oak Ridge National Labs.).

- Ion implantation to modify or create materials, including nanocrystals, sometimes accompanied by or followed by annealing, thermal or laser (354 Records) Cluster 117

(Countries: USA, China, Japan, Germany. Institutions: Tsing Hua University, CAS, CNRS, CNR, Australian National University).

- Applications of ion/ electron beam/ irradiation techniques, including focused ion beam (FIB) technology, ion and electron-beam-induced deposition, and ion-beam milling (200 Records) Cluster 178

(Countries: Japan, USA. Institutions: National Institute of Materials Sciences. USA includes Arizona State University).

- Lithography and etching, including nanoimprint lithography and electron-beam lithography and focusing on nanopatterning (166 Records) Cluster 149

(Countries: USA, Japan, South Korea. Institutions: University of Wisconsin, Hewlett-Packard Laboratories. University of New Mexico, University of Michigan).

- Etching, especially plasma etching and reactive ion etching (282 Records) Cluster 113

(Countries: USA, Japan, Korea. Institutions: Sungyunkwan University, CAS, Tohoku University. USA includes University of Maryland).

- Hafnium dioxide (HfO2), hafnium-containing, and oxide films, compounds, and layers, with emphasis on dielectric properties, fabrication by atomic layer deposition (ALD), and use as gate dielectrics (195 Records) Cluster 111

(Countries: USA, South Korea. Institutions: Soeul National University, University of Helsinki, National Chiao Tung University, Nanjing University. USA include IBM Corp., Freescale Semiconductor, Inc.).

- Gate dielectrics and metal-oxide semiconductor field-effect transistors (MOSFETs), emphasizing those made from silica (SiO2), hafnium dioxide (HfO2), silicon, and silicides (152 Records) Cluster 139

(Countries: USA, Japan, South Korea, Singapore. Institutions: Imec, University of Texas, National University of Singapore. Other USA include North Carolina State University, Rutgers State University, UCSB, International Sematech.).

- Field transistors, single-electron transistors, electron mobility transistors, and similar electronic devices, with emphasis on design and properties of gates (243 Records) Cluster 122

(Countries: USA, Japan, South Korea. Institutions: IBM Corp., University of Florida. Other USA include University of Illinois, Purdue University, UCLA.).

- Metal-oxide semiconductor field-effect transistors (MOSFETs) and silicon-on-insulator (SOI) devices (128 Records) Cluster 60

(Countries: USA, Japan, Taiwan, South Korea. Institutions: National Chiao Tung University, National University of Singapore. USA include Purdue University, University of Texas, University of Florida, United Microelectronic Corp., IBM Corp.).

- Electronic devices, circuits, and complementary metal-oxide semiconductor (CMOS) systems, emphasizing performance as measured by frequency, power, current, and voltage (331 Records) Cluster 224

(Countries: USA very dominant, Taiwan, Japan. Institutions: National Chiao Tung University dominant, Purdue University, National Nano Device Labs. Other USA include University of Florida, UCSB, Intel Corp., Hewlett-Packard Labs, University of Texas, UCLA, IBM Corp, Caltech, University of Illinois).

- Modeling and design of electronic devices, including properties of those based on junctions (molecular junctions, metal junctions, Josephson junctions, and Schottky barriers), electron transport properties, current/ voltage characteristics, negative differential resistance (NDR) (407 Records) Cluster 243

(Countries: USA dominant, Japan, Germany. Institutions: RAS, University of Illinois, Northwestern University, Delft University of Technology, CAS. Other USA include Ohio State University, University of Texas.).

- Properties and fabrication of magnetic tunnel junctions (MTJs) and investigation of magnetoresistance (121 Records) Cluster 53

(Countries: Japan, USA. Institutions: Tohoku University, Osaka University, National Institute of Advanced industrial S&T, Korea University, Japan S&T Agency. No USA institutional representation.).

- Field-emission properties of materials, especially carbon nanotubes (CNTs) and nanowires (180 Records) Cluster 95

(Countries: USA, China in first tier, followed by South Korea and Japan. Institutions: CAS, Peking University. USA include Vanderbilt University, University of North Carolina).

- Upconversion emission/ luminescence properties and spectroscopic studies of rare earth ions (Er3+, Yb3+, and Tm3+), especially in doped crystals and glass ceramics (82 Records) Cluster 27

(Countries: China completely dominant. Institutions: CAS, followed by City University Hong Kong. No USA institutional representation.).

- Phosphorescence and luminescence of materials containing rare earth ions (especially Eu3+), with focus on synthesis by combustion method and from percursors (107 Records) Cluster 98

(Countries: China completely dominant; South Korea distant second. Institutions: CAS, followed by Tongji University, followed by Tsing Hua University).

- Studies on optical activity (emission, luminescence, photoluminescence, and fluorescence), especially in nanocrystals and thin films, and factors that affect activity (326 Records) Cluster 219

(Countries: China, USA, followed by Japan. Institutions: CAS dominant, followed by RAS, University of Hong Kong. USA includes Pacific Northwest National Labs.).

- Light-emitting diodes (LEDs), including organic LEDs and emphasizing construction and optimization of LEDs (263 Records) Cluster 89

(Countries: USA, China, followed by Taiwan, South korea, followed by japan. Institutions: CAS, National Chiao Tung University, National Cheng

Kung University, Jilin University. USA include University of Florida, UCSB, University of South Carolina).

- Multiple quantum wells (MQWs), especially GaN, InGaN, and GaN/InGaN, and focusing on structural and photoluminescence properties (151 Records) Cluster 61

(Countries: USA, South Korea. Institutions: Polish Academy of Sciences, National Cheng Kung University, Gwangju Institute of S&T. USA include UCSB, Cornell University.).

- Gallium nitride (GaN) films, layers, and structures, primarily grown by vapor-phase/ molecular-beam epitaxy and chemical vapor deposition, as well as gallium heterostructures, especially those containing sapphire (270 Records) Cluster 74

(Countries: USA, Japan, China. Institutions: CAS, Chonbuk National University, National Cheng Kung University. USA include VCU, UCSB, UCB, SUNY Albany.).

- Nitride (AlGaN, GaN, AlGaN/GaN, and AlN) structures grown and/or used for applications using ohmic contact, high-electron-mobility transistors (HEMTs), and heterojunction field-effect transistors (HFETs) (100 Records) Cluster 41

(Countries: USA, Japan, South Korea, Taiwan. Institutions: Nagoya institute of Technology, Gwangju Institute of S&T, National Cheng Kung University. USA include University of Illinois, University of Florida, Sandia National labs, Penn State University, Georgia Institute of Technology).

- Zinc oxide (ZnO) thin films, emphasizing fabrication by magnetron sputtering, deposition, and annealing; doped ZnO films; and optical properties of ZnO films (254 Records) Cluster 62

(Countries: China dominant, followed by Japan, Korea, USA. Institutions: CAS dominant, followed by Shandong University, Chonnam National University. No USA institutional presence.).

- Zinc oxide (ZnO) thin films, emphasizing growth by deposition, doped ZnO films, and emission/ magnetic/ optical/ electronic properties of ZnO films (70 Records) Cluster 7

(Countries: China dominant, followed by South Korea, India, Japan. Institutions: CAS, Zhejiang University, Nanyang Technological University. No USA institutional presence.).

- Zinc oxide (ZnO) nanowires and other nanostructures, focusing on growth, emission and pholuminescence properties, doped zinc nanostructures, and nanowire arrays (304 Records) Cluster 67

(Countries: China dominant, followed by USA, South Korea, followed by Japan, Taiwan. Institutions: CAS dominant, followed by University S&T China, Hanyang University, Zhejiang University. USA includes University of Florida.).

- Nanowires: growth by vapor deposition, nanowire arrays, silicon nanowires, single crystal nanowires (645 Records) Cluster 100

(Countries: China, USA dominant, followed by Japan, South Korea, Taiwan. Institutions: CAS dominant, followed by Peking University, National Institute of Material Science, University S&T China, National Tsing Hua University, Nanjing University. USA include UCB, Penn State University.).

CATEGORY 4 - 508A2b (24 leaf clusters)

Magnetism and Tribology (6319 REC)

(Same problem with Asian names as previous category. Leading journals again physics-dominated, and include Physical Review B, Journal of Applied Physics, Journal of Magnetism and Magnetic Materials, Applied Physics Letters. Leading countries include USA, followed by China, Japan, followed by Germany, followed by France.

Japan leads in two elemental cluster categories, and China leads in eight categories. Japan: Iron-Platinum thin films; grain boundary phenomena. China: amorphous and crystalline iron and cobalt alloys; mechanical Mg/Cu/Ag/Ti/Zi alloy properties; Ni/Cu/Sn/Ti/Zi alloys metallurgy; composite material alloys; coating deposition properties (dominant);

nanotribology; corrosion-resistant steel surfaces (dominant); corrosion mechanisms and protection.

Leading institutions include CAS (dominant), RAS, Tohoku University. Leading USA institutions include ORNL.)

- Spin, emphasizing properties and applications of qubits, spin-orbit interactions (SOIs) (especially Rashba SOIs), and studies of spin relaxation and polarization (139 Records) Cluster 55

(Countries: USA dominant, followed by Japan, Germany, China. Institutions: RAS, University of Toronto, Tohoku University, CAS. USA include SUNY Buffalo, U Iowa, UCSB, UCB).

- Spin polarization, spin-orbit interactions, spin dynamics, spin-dependent transport, and other spin-related phenomena as exhibited in and influenced by magnetic (especially ferromagnetic) fields and structures (481 Records) Cluster 141

(Countries: USA, Japan, Germany. Institutions: CAS, Osaka University, CNRS. USA includes Argonne National Lab.).

- Superconductors, superconducting materials, and superconducting devices; vortex states, dynamics, and effects (188 Records) Cluster 159

(Countries: USA, Japan, Germany. Institutions: Katholieke University of Leuven, Tohoku University, RAS, Argonne National Lab. Other USA includes University of Illinois).

- Applications and effects of external magnetic fields, especially magnetoresistance, ferrofluids, and uses of nanowires (418 Records) Cluster 162

(Countries: USA, Japan, followed by China, Germany, followed by France, Russia. Institutions: National Institute of Materials Science, RAS, Tohoku University. USA includes MIT).

- Magnetic properties of magnetic nanostructures (including arrays, films nanoparticles, nanotubes) and nanomaterials, emphasizing magnetic anisotropy, coercivity, magnetization reversal (657 Records) Cluster 171

(Countries: USA, followed by Japan, China, Germany. Institutions: CAS, CNRS, RAS, CSIC. Other USA include Argonne National Lab, UCSB, Georgia Institute of Technology, University of Texas).

- Properties of ferromagnetic and antiferromagnetic materials, especially manganese and iron compounds (355 Records) Cluster 193

(Countries: USA, Japan, followed by China, Germany. Institutions: CAS, Tohoku University, Polish Academy of Sciences. USA includes University of Notre Dame).

- Magnetic properties of thin films (especially iron and cobalt films), focusing on anisotropy, coercivity, and preparation of films by sputtering, annealing, and deposition processes (266 Records) Cluster 181

(Countries: USA, China, Japan. Institutions: RAS, CAS, Tokyo Institute of Technology. USA include University of Alabama, ORNL.).

- Iron-platinum (FePt) thin films, emphasizing their magnetic properties, fabrication, and the effect of annealing (53 Records) Cluster 0

(Countries: Japan, USA, China, Taiwan, Singapore. Institutions: Data Storage Institute, University of Minnesota. Other USA includes University of Nebraska, University of Delaware).

- Amorphous and crystalline alloys (especially iron and cobalt), with emphasis on their magnetic properties, annealing processes, preparation by milling, and iron and cobalt (347 Records) Cluster 187

(Countries: China, Japan, USA, Poland. Institutions: CAS, Warsaw University of Technology, Tohoku University, RAS. No USA institutional presence.).

- Alloys (especially magnesium, copper, titanium, silver, and zirconium), focusing on structural and mechanical properties, effects of temperature, and corrosion resistance (520 Records) Cluster 160

(Countries: China, USA, followed by Japan, Germany, France. Institutions: CAS, Tohoku University, RAS. USA includes UC Davis.).

- Alloys (especially nickel, copper, tin, titanium, and zirconium), emphasizing fusible/ eutectic alloys, formation of alloys, and mechanical/ structural characterization (139 Records) Cluster 123

(Countries: China, Japan, South Korea, USA. Institutions: CAS, Sungkyunkwan University. USA includes UCLA.)

- Preparation, reactions, and structure of composite materials, especially copper, nickel, and silver alloys (222 Records) Cluster 242

(Countries: China, USA, Japan, Germany. Institutions: Tohoku University, CAS, National Institute of Material Science, Harbin Institute of Technology. USA include University of Wisconsin, Washington State University.).

- Coatings formed by deposition, especially chemical vapor deposition and thermal and plasma spraying, emphasizing their properties, particularly hardness, wear/ corrosion resistance, and magnetic properties (487 Records) Cluster 150

(Countries: China dominant, followed by Germany and England, followed by Japan, Korea, France, Poland. Institutions: CAS dominant, Xian Jiaotong University, Harbin Institute of Technology. No USA institutional presence.).

- Nanotribological studies, focusing on friction, sliding, adhesive, and wear behavior (99 Records) Cluster 47

(Countries: USA dominant, Japan, China. Institutions: Ohio State University extremely dominant. Other USA includes Georgia Institute of Technology.).

- Nanotribological studies, emphasizing wear behavior (especially steel substrates and silicon carbide [SiC] composites) and including analyses of sliding and abrasion (154 Records) Cluster 34

(Countries: China, USA, followed by England. Institutions: CAS, Tsing Hua University. USA include University of Wisconsin, University of Texas.).

- Fabrication and characteristics of corrosion-resistant steel surfaces and layers (210 Records) Cluster 157

(Countries: China dominant, USA, Japan. Institutions: CAS, Tsing Hua University, National Institute of Materials Science. USA include ORNL, Northeastern University.).

- Corrosion mechanisms and protection/ inhibition, especially of steel, zinc, and iron surfaces (76 Records) Cluster 66

(Countries: China, India, USA. Institutions: CAS, University of Delhi. USA includes BNL.).

- Crack, fatigue, and fracture processes, behavior, and mechanisms, emphasizing on analysis with scanning electron microscopy (210 Records) Cluster 118

(Countries: USA, Japan, China, followed by Germany. Institutions: CAS dominant. USA include Princeton University, Georgia Institute of Technology.).

- Materials subject to stress and strain, focusing on welded materials, residual stresses, effects of loading, and stress relaxation (131 Records) Cluster 115

(Countries: USA, China, Japan, France. Institutions: Kyoto Institute of Technology, CAS. USA include Colorado School of Mines, USAF, University of Michigan, University of Dayton.).

- Nanoidentation, especially to test hardness, elasticity/ plasticity, and mechanical properties of materials (278 Records) Cluster 140

(Countries: USA, followed by China, Japan. Institutions: CAS, Tsing Hua University, University Poitiers, ORNL, CNRS. Other USA include UCB, OSU, University of Tennessee, University of Illinois, UCSF).

- Deformation behavior, shear bands, and related mechanical properties of materials and microstructures (239 Records) Cluster 112

(Countries: USA, China, followed by Russia, Germany, followed by Japan, South Korea, Poland. Institutions: CAS, RAS, UFA State Aviation Technical University. USA include UCD, JHU, University of Tennessee).

- Dislocations, deformation, (crystal) twinning, and stress/ strain in materials, particularly crystals (147 Records) Cluster 86

(Countries: USA dominant, China, followed by Germany, France. Institutions: CAS, Paul Scherrer Institute, LANL. Other USA include LLNL, MIT, UCB, Georgia Institute of Technology, University of Illinois, SNL, Ohio State University, North Carolina State University.).

- Grain boundary characteristics and processes, including diffusion, segregation, fracture, and growth (220 Records) Cluster 52

(Countries: Japan, USA, followed by Germany, China, France. Institutions: University of Tokyo, RAS, Tohoku University, National Institute of Materials Science. USA includes UCB, ORNL.).

- Effects of and influences on grain size, emphasizing grain growth, texture characterization, and effect of annealing (283 Records) Cluster 166

(Countries: USA, China, followed by Japan, Germany. Institutions: CAS, RAS, CNR. USA include UCD, UCB.)

CATEGORY 5 - 508B1a (9 leaf clusters)

Properties of Thin Films (2251 REC)

(Same problem with Asian names. Leading journals are still physics-dominated, but now include a surface chemistry focus as well. They include Thin Solid Films (dominant), Langmuir, Applied Physics Letters, Applied Surface Science, Journal of Physical Chemistry B, Journal of Applied Physics, Surface & Coatings Technology, Physical Review B. Leading countries include China, USA, Japan, followed by Germany, South Korea.

Japan is dominant in two elemental clusters, China in four. Japan: YBCO films; indium tin oxide films. China: multi-layer film deposition; layered double hydroxides; magnetron sputtering films; film growth and characterization.

Leading institutions include CAS (extremely dominant), National Institute of Advanced Industrial S&T, Tsing Hua University, Kyoto University, University of Tokyo, Tohoku University. Leading USA institutions include University of Illinois.)

- Thin films and processes related to film thickness, including dewetting, deposition, and growth (411 Records) Cluster 225

(Countries: USA dominant, followed by China, Japan, Germany. Institutions: CAS, University of Illinois, Tsing Hua University. Other USA include UCB, University of Texas, ORNL.)

- Films, focusing on polymer and polyimide films, mechanical and optical properties (such as the refractive index), effects of irradiation, and conductivity (558 Records) Cluster 251

(Countries: USA, China, Japan. Institutions: CAS, Tohoku University, Tsing Hua University, Tokyo Institute of Technology. USA includes University of Illinois.)

- Properties and fabrication by deposition of multilayer films, especially Langmuir, Blodgett, Langmuir-Blodgett, and polyelectrolyte films (231 Records) Cluster 200

(Countries: China, USA, Japan. Institutions: CAS, NE Normal University, Kyoto University. USA includes UCB.).

- Preparation, characterization, and applications of layered double hydroxides (LDHs) (47 Records) Cluster 8

(Countries: China, Brazil. Institutions: Beijing University of Chemical Technology.).

- YBCO (YBa2Cu3O7-x) films, emphasizing YBCO conductors and growth of buffer layers, especially CeO2 (59 Records) Cluster 16

(Countries: Japan, China, USA. Institutions: National Institute of Advanced Industrial S&T, ISTEC. USA include USAF, ORNL, ANL, University of Houston, University of Dayton.).

- Indium tin oxide (ITO) thin films, focusing on transparency, transmittance, and resistivity of ITO films (95 Records) Cluster 33

(Countries: Japan, China, USA, Taiwan, South Korea. Institutions: University of Hong Kong, Osaka University).

- Oxide (especially WO3 and SnO2) films, emphasizing formation of anodic films, use as gas sensors, and electrochemical applications (238 Records) Cluster 209

(Countries: USA, China, Japan. Institutions: University of Mnachester, Keio University, Hokkaido University, Harbin Institute of Technology, CAS. USA includes Texas A&M.).

- Preparation of films by magnetron sputtering, especially titanium (Ti), titanium nitride (TiN), and aluminium nitride (AlN) films (230 Records) Cluster 172

(Countries: China, USA, followed by South Korea, Japan, followed by Taiwan, Germany, France. Institutions: CAS, Sungyunkwan University, Shanghai Jiao Tong University, National Cheng Kung University).

- Growth and characterization of films, focusing on effects of annealing, deposition, and copper, silicon, and gallium nitride films (382 Records) Cluster 231

(Countries: China, USA, Japan. CAS dominant, Yonsei University, University of Tokyo, Kyoto University, Indian Institute of Technology, Bulgarian Academy of Sciences. USA presence not shown.).

CATEGORY 6 - 508B1b ***(7 leaf clusters)***

Applications of Thin Films (2509 REC)

(Leading journals include Thin Solid Films, Applied Physics Letters (essentially tied), Journal of Applied Physics. Leading countries include USA, China, Japan, South Korea.

However, Japan, China, South Korea, India each lead in one elemental cluster. Japan: PZT thin films. China: pulsed laser deposition-grown thin films. South Korea: Ferroelectric thin films. India: optical and band gap properties of thin films.

Leading institutions include CAS (dominant), Tokyo Institute of Technology, National Institute of Advanced Industrial S&T. No leading USA institutional presence.)

- Thin film transistors (TFTs), especially pentacene and organic thin film transistors (OTFTs) (93 Records) Cluster 28

(Countries: USA, South Korea, Japan. Institutions: Yonsie University, Tokyo Institute of Technology, Xerox Research Center Canada, University of Minnesota. Other USA include University of Kentucky, Stanford University, RPI, Oregon State University, Northwestern University.).

- Thin films, emphasizing fabrication by deposition, sensor and device applications, and optical properties (395 Records) Cluster 222

(Countries: USA, Japan, China, followed by South Korea, Germany. Institutions: CAS, Osaka University, Nagoya University, Korea Institute of S&T. USA include Stanford University, Penn State University.).

- Thin films, focusing on optical and band gap properties, absorption, and preparation by deposition, annealing, and evaporation (329 Records) Cluster 180

(Countries: India, followed by China, followed by USA, South korea, France. Institutions: Shivaji University, CAS, University National Autonoma Mexico, Bharathiar University. USA include Northwestern University.).

- Thin films, emphasizing orientation of films, silicon films, and preparation by deposition, magnetron sputtering, and annealing (959 Records) Cluster 217

(Countries: USA, China, Japan. Institutions: CAS dominant, Nanyang Technological University, National Tsing Hua University, National Institute of Advanced Industrial S&T. USA includes Penn State University.).

- Ferroelectric thin films (including platinum [Pt], BST, BLT, and silica [SiO2] films), with emphasis on polarization, orientation, and dielectric/ ferroelectric properties (258 Records) Cluster 132

(Countries: South Korea, Japan, China, followed by USA. Tokyo Institute of Technology, Hynix Semiconductor, Inc., National Institute of Advanced Industrial S&T, Korea Advanced Institute S&T. USA includes Caltech.).

- Pb(ZrTi)O-3 (PZT) thin films, emphasizing ferroelectric properties and orientation control (122 Records) Cluster 10

(Countries: Japan, South Korea, China. Institutions: CAS, Tokyo Institute of Technology, National Institute of Advanced Industrial S&T.).

- Characterization of thin films grown by pulsed laser deposition (PLD), especially SrTiO3 films (353 Records) Cluster 137

(Countries: China, USA, Japan, followed by South Korea, Germany, France. Institutions: CAS dominant, Nanjing University, Tokyo Institute of Technology, Hong Kong Polytechnical University. USA include USN, UCB, USAF.).

CATEGORY 7 - 508B2a (6 leaf clusters)

Deposition of Thin Films (1752 REC)

(Leading authors include Soga, T, Adhikary, S, Jimbo, T, Rusop, M. The main journals include Thin Solid Films (dominant), Journal of Applied Physics, Surface & Coatings Technology. Leading countries include Japan, USA, China, followed by South Korea.

Japan is dominant in two categories, and China is dominant in one category. Japan: carbon thin films; diamond-like carbon coatings. China: silicon films.

Leading institutions include CAS, followed by Sungkyunkwan University, RAS. No USA presence in leading institutions.)

- Studies on silicon, especially porous and amorphous silicon, silicon nanocrystals, silicon nitride materials, and silicon wafers (222 Records) Cluster 176

(Countries: USA, China, followed by Japan, Germany, France, South Korea, Russia. Institutions: CNRS, CAS, RAS. USA includes NREL.).

- Silicon films (some hydrogenated and/or amorphous) prepared primarily by chemical vapor deposition (405 Records) Cluster 170

(Countries: China, USA, Japan. Institutions: CAS, Sungyunkwan University, Nankai University. USA include MIT, NREL.).

- Chemical vapor deposition (CVD), focusing on techniques (such as metal organic CVD), growth of films from certain precursors, and properties of deposited films (461 Records) Cluster 216

(Countries: USA, Japan, followed by China, South Korea. Institutions: Tokyo Institute of Technology, RAS, University of Illinois, University of Shizuoka, Tohoku University. Other USA include University of Maryland, Penn State University.).

- Plasma polymerization, treatment, and ion implantation and deposition (242 Records) Cluster 156

(Countries: USA, Japan, South Korea, China, Germany. Institutions: Sungyungwan University, National University of Singapore, Nanyang Technological University. USA include USAF, University of Michigan.).

- Carbon thin films, focusing on preparation by deposition and sputtering, amorphous carbon and carbon nitride films, and characterization, especially of bonding properties (297 Records) Cluster 163

(Countries: Japan, China. Institutions: Nagoya Institute of Technology dominant, CAS, Chubu University. No USA presence shown.).

- Diamond-like carbon (DLC) coatings, emphasizing preparation by deposition and/or plasma ion implantation and Raman studies (125 Records) Cluster 17

(Countries: Japan, China. Institutions: CAS, Sungyunkwan University, Chuba University. No USA presence shown.).

CATEGORY 8 - 508B2b (2 leaf clusters)

Diamond films (394 REC)

(Leading journals include Diamond and Related Materials (very dominant), Thin Solid Films, Applied Physics Letters, Journal of Applied Physics. Leading countries include China, USA, followed by Japan.

China dominant in one category. China: diamond films (CVD).

Leading institutions include RAS, CAS, followed by Shanghai University, Osaka University. Leading USA institutions include Michigan State University.)

- Diamond films, emphasizing chemical vapor deposition (CVD), nanocrystalline, and boron-doped diamond films (219 Records) Cluster 26

(Countries: China, followed by Japan, USA. Institutions: Shanghai University, RAS, CAS. USA includes Michigan State University.).

- Chemical vapor deposition (CVD) diamond films, emphasizing plasma CVD, growth, and interactions with silicon (175 Records) Cluster 138

(Countries: USA, followed by China, Japan. Institutions: RAS, CAS, National Chiao Tung University. USA include Ohio State university, UCLA.).

CATEGORY 9 - 509A1a (1 leaf cluster)

Applications of Carbon Nanotubes (474 REC)

(Leading journals include Diamond and Related Materials, followed by Applied Physics Letters, Carbon, Journal Of Physical Chemistry B. Leading countries include China, USA, followed by South Korea, followed by Japan. Leading institutions include CAS (dominant), Sungkyunkwan University, Seoul National University, Tsing Hua University, Hunan University, Zhejiang University. No USA presence in leading universities.)

- Carbon nanotubes (CNTs), especially application to electrodes and catalysts, CNT composites, and preparation of aligned CNTs (474 Records) Cluster 37

(Countries: China, followed by USA, South korea, followed by japan. Institutions: CAS dominant, followed by Sungyunkwan University. USA includes PNNL.).

CATEGORY 10 - 509A1b (6 leaf clusters)

Multi-walled Nanotubes (1876 REC)

(Leading authors include Bando, Y, Golberg, D, Li, Y. Leading journals include physics and chemistry topics: Physical Review B, Applied Physics Letters, Carbon, Nanotechnology, Journal of the American Chemical Society, Journal of Physical Chemistry B. Leading countries include China, USA (very dominant) followed by Japan, followed by South Korea, Germany.

However, China leads in three clusters. China: MWNTS (very dominant); naotube template synthesis; MWCNTS.

Leading institutions include CAS (dominant), Tsing Hua University, RAS, Nanjing University, Zhejiang University, Peking University, University S&T China. Leading USA institutions include NASA, University of Illinois).

- Multi-walled (carbon) nanotubes (MWNTs), including composites and surface, magnetic, and structural properties (240 Records) Cluster 14

(Countries: China very dominant, USA, South Korea. Institutions: CAS dominant, Zhejiang University, Nanjing University.).

- Nanotubes, emphasizing template synthesis, especially of titanium dioxide (TiO2), titania, and titanate nanotubes; nanowires; and nanotube arrays (517 Records) Cluster 183

(Countries: China, followed by USA, followed by Japan. Institutions: CAS, followed by RAS, Tsing Hua University, Nanjing University. USA include CUNY Hunter College, University of Florida.).

- Boron nitride nanotubes (BNNTs) and nanohorns, emphasizing electronic properties (59 Records) Cluster 5

(Countries: USA, China, Japan. Institutions: Osaka University, University S&T China, UCB, National Institute of Materials Science. Other USA include University of Illinois, Clemson University.).

- Multi-walled carbon nanotubes (MWCNTs), focusing on electronic, mechanical, and structural properties (140 Records) Cluster 32

(Countries: China, USA. Institutions: CAS dominant, Tsing Hua University, Sungyunkwan University, National University of Singapore. Other USA include UNC, RPI, ORNL, MIT).

- Carbon nanotubes, including composites, nanotube bundles, conductance, and application to electrodes and transistors (283 Records) Cluster 96

(Countries: USA dominant, China, South Korea. Institutions: CAS dominant, Tsing Hua University, RPI, Osaka University, NASA, Chung Ang University. Other USA include UCSD, Georgia Institute of Technology, University of Texas.).

- Carbon nanotubes (CNTs), including single-walled and multi-walled CNTs and emphasizing electronic and structural properties (637 Records) Cluster 105

(Countries: USA, followed by China. Institutions: CAS, RAS, Tsing Hua University. USA include University of Illinois, NASA, ORNL, MIT.).

CATEGORY 11 - 509A2a (2 leaf clusters)

Single and Double-walled Nanotubes (447 REC)

(Leading authors include Kataura, H, Iijima, S, Lee, YH, Sauvajol, JL Leading journals include Physical Review B, Journal of Physical Chemistry, Chemical Physics Letters, Nano Letters, Carbon, Journal of the American Chemical Society. Leading countries include USA (dominant), Japan, China, followed by Germany, France, England, South Korea, Italy. Leading institutions include University Montpellier, Rice University, University of

Illinois, Tohoku University, Sungkyunkwan University, Osaka University, CAS.)

- Single-walled carbon nanotubes (SWCNTs), including surface/ structural properties and Raman studies (139 Records) Cluster 30

(Countries: USA, Japan. Institutions: University of Vienna, Tohoku University. USA include University of Notre Dame, University of Texas, New Jersey Institute of Technology.).

- Single- and double-walled carbon nanotubes, including nanotube films, integration of nanoparticles into nanotubes, and electronic/ structural properties (308 Records) Cluster 31

(Countries: USA dominant, China, followed by Japan. Institutions: Rice University, University of Montpellier, University of Illinois. Other USA include University of Pennsylvania, University of Delaware, MIT.).

***CATEGORY 12 - 509A2b** (2 leaf clusters)*

Single-walled Nanotubes (414 REC)

(Leading authors include Li, F, Dresselhaus, MS, Smalley, RC, Haddon, RC, Cheng, HM. Leading journals include Journal of Physical Chemistry B, Physical Review B, Applied Physics Letters, Journal of the American Chemical Society, Chemical Physics Letters, Carbon, Nanotechnology. Leading countries include USA (dominant), China, Japan. Leading institutions include Rice University, CAS, Peking University, Tohoku University, UCR, NASA, MIT. Other leading USA institutions include University of Pennsylvania, University of Illinois, USN, Georgia Institute of Technology.)

- Single-walled (carbon) nanotubes (SWNTs), including nanotube thin films, surface and structural properties, and interaction of nanoparticles with nanotubes (274 Records) Cluster 6

(Countries: USA dominant, China, Japan. Institutions: CAS, Rice University, UCR, Peking University. Other USA include Penn State University, USN, NASA, University of Pennsylvania.).

- Single-walled (carbon) nanotubes (SWNTs), emphasizing electrode applications, nanotube films, and surface/ structural properties (140 Records) Cluster 9

Countries: USA very dominant, Japan, China. Institutions: Rice University, MIT, Tohoku University, Peking University, NASA, Georgia Institute of Technology. Other USA include Yale, Rochester Institute of Technology, University of Pennsylvania, University of Illinois, NREL, University of Texas.).

CATEGORY 13 - 509B1a (58 leaf clusters)

Nanomaterials and Nanoparticles (14263 REC)

(The chemistry and materials-dominated leading journals include Journal of Physical Chemistry B, Langmuir, Chemistry of Materials, Materials Letters. Leading countries include China, followed by USA, followed by Japan, followed by Germany, South Korea, France. China leads in 39 clusters, many dominant.

China: adsorption; activated carbon applications; carbon-containing materials' physical properties; fibers; lithium-ion batteries (dominant); electrochemistry (dominant); electrode behaviour (dominant); mesoporous silica materials synthesis; mesoporous silica materials properties (dominant); porous materials geometry; MCM mesoporous silicas applications (dominant); zeolites (dominant); MCM/ Palladium catalysts (dominant); Al_2O_3/ Ni/ Co catalysts (dominant); TiO_2 films applications; TiO_2 films preparation; photocatalyutic TiO_2 (dominant); visible light photocatalysis (dominant); sol-gel synthesis (dominant); powder preparation; high-energy ball milling; sintering, emphasizing spark plasma; sintering, including liquid phase (dominant); ceramics-ZrO_2, YSZ, Al_2O_3, SiC (dominant); ceramic dielectric properties; glass ceramics; nanorod synthesis (dominant); ZnO/ GaN nanorods (dominant); nanobelts (dominant); synthesis of nanostructures-especially hydrothermally (very dominant); hydrothermal/ solvothermal synthesis of crystals (very dominant); phosphate and calcium compounds; SiO_2/ TiO_2 nanoparticles (dominant); magnetic particles; magnetic properties of nanoparticles; core-shell nanostructures and hollow nanospheres; TiO_2/ CdS/CdSe nanoparticles and nanocrystals; Ag nanoparticles; Ag and Au nanoparticles.

Leading institutions include CAS (very dominant), Tsing Hua University, RAS, Zhejiang University, University S&T China, CSIC, CNRS, Nanjing University. No USA presence in leading institutions.)

- Adsorption, focusing on removal of material from solution, measuring adsorption capacity, and adsorption by bentonites (65 Records) Cluster 94

(Countries: China, USA. Institutions: CAS, University of Kerala, National University of Singapore.).

- Applications of activated carbon, porous carbon, and carbon aerogels, especially for adsorption and as capacitors (182 Records) Cluster 106

(Countries: China, Japan, USA, followed by France, South Korea. Institutions: CSIC, National Institute of Materials Science, CNRS. USA includes ORNL.).

- Graphite, carbon black, fullerenes, carbon fibers, and other carbon-containing materials, emphasizing their magnetic/optical/surface properties and electrochemical applications (444 Records) Cluster 221

(Countries: China, USA, Japan. Institutions: CAS, National University of Singapore, CNRS. USA includes University of Texas.).

- Growth, catalytic applications, and properties of carbon nanofibers (CNFs) and carbon supports (110 Records) Cluster 25

(Countries: USA, Japan, Korea, China. Institutions: Shinshu University, University Utrecht, University of Strasbourg, Norwegian University of Science and Technology. USA include ORNL, University of Texas, University of Tennessee, University of Pennsylvania, University of Akron.).

- Preparation of materials, especially nanofibers, by electrospinning (91 Records) Cluster 71

(Countries: USA, followed by South Korea, China. Institutions: National University of Singapore, University of Washington, University of Akron, Seoul National University. Other USA include Penn State University, Ohio State University, University of Florida.).

- Fibers, emphasizing electrospun fibers, cellulose, and morphology and strength of fibers (164 Records) Cluster 46

(Countries: China, USA, followed by Japan, South Korea. Institutions: CAS, Inha University, Donghua University, Chulalongkorn University. USA include Drexel University, VPI, University of Nebraska, University of Massachusetts.).

- Lithium-ion (especially LiCoO2 and lithium-nickel) batteries, with emphasis on enhancement of capacity and cycle-ability (345 Records) Cluster 129

(Countries: China dominant, Japan, USA. Institutions: Hanyang University, Wuhan University, CAS, Zhejiang University.).

- Electrochemical studies and applications, focusing on electrode/ electrolyte properties and applications, capacitors, and hydrogen storage (216 Records) Cluster 204

(Countries: China dominant, Japan, USA. Institutions: CAS, Zhejiang University, Nankai University, Tsing Hua University, Harbin Institute of Technology.)

- Electrode (especially gold) behavior and applications to biosensors (especially glucose and enzyme) and immunosensors (227 Records) Cluster 184

(Countries: China dominant, USA, followed by Japan. Institutions: SW China Normal University, Nanjing University, Hunan University, CAS. USA include PNNL, Arizona State University, University of Illinois.).

- Nano silica particles, emphasizing coating applications, effects of particle size, dispersion, and aggregation (130 Records) Cluster 103

(Countries: USA, China, Japan. Institutions: Fudan University, Tokyo University Agriculture and Technology, CAS. USA include University of Kentucky, Clarkson University, University of Illinois.).

- Characteristics and synthesis of silica-containing materials, with focus on gels, films, surfaces, monoliths, and porous silica (153 Records) Cluster 121

(Countries: USA, China, Japan. Institutions: CAS, Fudan University. USA includes USAF.).

- Mesoporous silica materials, emphasizing methods of synthesis, as well as adsorption properties (262 Records) Cluster 90

(Countries: China, followed by Japan, USA. Institutions: CAS, Jilin University, Fudan University. USA include Iowa State University, University of Akron.).

- SBA-15, SBA-1, and other mesoporous silica materials, focusing on adsorption properties and functionalization of SBA-15 with acid (90 Records) Cluster 20

(Countries: China dominant, USA. Institutions: CAS, Fudan University, Ben Gurion University Negev. USA include UCLA, UCB.).

- Nanoporous, mesoporous, and porous materials, with emphasis on determination and control of pore size, evaluation of surface area, alumina and silica materials, and adsorption properties (292 Records) Cluster 185

(Countries: China, USA, followed by Japan. Institutions: CAS, University of Queensland, Kent State University, Beijing University of Chemical Technology. Other USA include University of Kentucky, University of Iowa, UCB.).

- Synthesis and characterization of MCM mesoporous silicas and use as molecular sieves and catalysts (147 Records) Cluster 19

(Countries: China dominant, USA, Germany, India, France. Institutions: CAS, National Taiwan University, Jilin University. USA includes Yale University.).

- Zeolites (especially ZSM-5, silicalite-1, and MFI), with emphasis on ion exchange, adsorption and acid properties, and synthesis, particularly hydrothermally (145 Records) Cluster 29

(Countries: China dominant, USA, Germany, Japan. Institutions: Fudan University, University of Stuttgart, University of Iowa, Jilin University. Other USA includes UCR.).

- Oxidation and reduction reactions, emphasizing the catalysts involved (particularly CeO2) and their catalytic activity (470 Records) Cluster 237

(Countries: USA, China, followed by Italy, Japan, Germany. Institutions: CAS, University of Trieste, Nankai University. USA includes UCB.).

- Catalysts (especially MCM-incorporated, palladium, and heterogeneous catalysts), especially studies on catalytic activity/selectivity, surface area, and hydrogenation/dehydrogenation reactions (554 Records) Cluster 153

(Countries: China dominant, USA, India, Germany. Institutions: CAS, SIC, National Chemistry Lab.).

- Catalysts (especially gamma-Al2O3, nickel, and cobalt catalysts), emphasizing activity, structure, and formation of catalysts; steam reforming of methanol; and hydrogenation reactions (222 Records) Cluster 102

(Countries: China dominant, USA, Japan, Spain, France. Institutions: CAS, Tsing Hua University, CSIC. USA includes VPI.).

- Platinum (Pt) and platinum-ruthenium (PtRu) catalysts, emphasizing their electrochemical applications, including methanol and other fuel cells, methanol electro-oxidation, and reduction reactions (270 Records) Cluster 87

(Countries: USA, China, followed by Japan. Institutions: CAS dominant, University of Illinois, Tsing Hua University. Other USA include University of Texas, University of Wisconsin, BNL.).

- Platinum (Pt) and iron-platinum (FePt) nanoparticles, focusing on electrocatalytic activity (especially for oxygen reduction), size-dependent effects/processes, and synthesis (especially by polyol process) of nanoparticles (109 Records) Cluster 80

(Countries: USA, Japan, China. Institutions: CAS, Tokyo Institute of Technology, Osaka University. USA include UCB, LANL, USC, UCD.).

- Titanium dioxide (TiO_2) films, including sol-gel derived and nanocrystalline films, use in dye-sensitized solar cells, photocatalytic activity, and preparation by deposition (141 Records) Cluster 124

(Countries: China, followed by Japan. Institutions: CAS, Zhejiang University, Institute of Fundamental Studies.).

- Preparation of titanium dioxide (TiO_2) thin films by sol-gel process or deposition, photocatalytic activity of TiO_2 films, and doped TiO_2 films (105 Records) Cluster 24

(Countries: China, followed by South Korea. Institutions: CAS dominant, Zhejiang University, Seoul National University, UNAM.).

- Anatase and rutile titanium dioxide (TiO_2), emphasizing photocatalytic use and characterization of TiO_2 nanoparticles (379 Records) Cluster 107

(China dominant, Japan, USA, South Korea. Institutions: CAS, Tianjin University, Kyoto University, Tsing Hua University. USA includes ORNL.).

- Studies on photocatalytic activity, such as photocatalytic degradation, of titanium dioxide (TiO_2), primarily under visible light irradiation (224 Records) Cluster 65

(Countries: China very dominant, Japan, South Korea. Institutions: CAS, University of Osaka Prefecture, Zhejiang University, Kyoto University.).

- Preparation of materials (including powders, silica (SiO_2), and particles) by sol-gel synthesis and subsequent characterization, especially using x-ray diffraction (XRD) (429 Records) Cluster 199

(Countries: China dominant, USA, India. Institutions: National Chemistry lab, CAS, Shandong University.).

- Preparation and characterization of powders, emphasizing studies of particle size, synthesis by combustion process or co-precipitation method, and x-ray diffraction (XRD) analyses (491 Records) Cluster 208

(Countries: China, South Korea, India, followed by USA, Japan. Institutions: CAS, National Chemistry Lab, Tsing Hua University.).

- High-energy ball milling, focusing on production of materials (especially nanocrystalline powders), phase formation/transformation, and studies on magnesium hydride (MgH2) (200 Records) Cluster 49

(Countries: China, followed by Japan, USA. Institutions: CAS, RAS. USA includes UCD.).

- Sintering (especially spark plasma sintering) to produce and modify materials, including ceramics and magnesium diboride (MgBr2) materials (143 Records) Cluster 198

(China, followed by USA, Japan. Institutions: CAS dominant, Polish Academy of Sciences, UCD, National Institute of Materials Science.).

- Sintering (including spark plasma and liquid phase sintering) of powders, ceramics, nanocomposites, and alumina-based materials, with emphasis on densification and microstructure of products (200 Records) Cluster 101

(Countries: China dominant, Japan, USA, South Korea. Institutions: CAS, Lehigh University, Hanyang University. Other USA includes Penn State University.).

- Ceramics made of zirconia (ZrO2) and yttrium stabilized zirconia (YSZ), alumina (Al2O3), and silicon carbide (SiC), focusing on mechanical properties and microstructural characterization (255 Records) Cluster 211

(Countries: China dominant, USA, followed by Japan, France. Institutions: CAS, RAS, Tsing Hua University.).

- Dielectric (especially ferroelectric and piezoelectric) properties of ceramics, emphasizing glass and barium-titanate (BaTiO3) based materials (192 Records) Cluster 155

(Countries: China, India, USA. Institutions: Indian Institute of Technology, CAS, Tsing Hua University.).

- Glass ceramics, including cordierite and various ceramic oxides (Na_2O, SiO_2, and CaO), focusing on crystallization, nucleation, and heat treatment (78 Records) Cluster 59

(Countries: China, followed by France, Russia. Institutions: CAS, Tsing Hua University. USA includes UCD.).

- Synthesis of nanorods (especially cadmium-sulfide [CdS]), with focus on hydrothermal fabrication, transmission electron microscopy (TEM) studies, and characterization of length and diameter (132 Records) Cluster 68

(Countries: China very dominant, USA. Institutions: University S&T China, CAS, Zhejiang University, Nanjing University.).

- Zinc oxide (ZnO), as well as gallium nitride (GaN), nanorods, emphasizing growth, nanorod arrays, and field emission properties (123 Records) Cluster 12

(Countries: China dominant, South korea, USA, followed by Taiwan, Japan. Institutions: CAS, Zhejiang University, National Tsing Hua University. USA includes University of Florida.).

- Nanobelts (especially gallium oxide [Ga_2O_3], zinc oxide [ZnO], and silicon nitride [Si_3N_4]) and nanoribbons, emphasizing growth, fabrication by thermal evaporation, and photoluminescence and emission properties (49 Records) Cluster 13

(Countries: China dominant, USA, South Korea. Institutions: CAS, Inha University, Georgia Institute of Technology. Other USA include UCF, University of Texas, University of Pittsburgh.).

- Synthesis (especially hydrothermally) of nanostructures and subsequent analysis using transmission electron microscopy (TEM) and x-ray diffraction (XRD) (270 Records) Cluster 218

(Countries: China very dominant, USA, Japan. Institutions: CAS, University S&T China, followed by Shandong University, Nanjing University.).

- Hydrothermal/solvothermal synthesis and morphology of nanocrystals, crystalline materials, and nanowires (302 Records) Cluster 249

(Countries: China very dominant, USA, followed by Japan, India. Institutions: University S&T China, CAS. USA includes University of Texas.).

- Reaction, surface, phase, and temperature dynamics/behavior of oxides, systems affected by water, and aqueous solutions (648 Records) Cluster 255

(Countries: USA, China, followed by Japan, France, Germany. Institutions: RAS, CSIC, CAS, CNRS. USA include University of Illinois, UCLA, University of Wisconsin.).

- Ferrous substances (especially ferrihydrites and iron oxides, namely goethite and hematite), characterized by Mossbauer spectroscopy and used for dechlorination, arsenic removal, and chemical reduction (162 Records) Cluster 173

(Countries: USA, followed by China, France, Germany, Canada. Institutions: CAS, University of New South Wales, RAS, CSIC, CNRS, CNR. USA include UCB, NASA.).

- Studies on minerals (especially calcite, smectite, illitite, and fly ash), emphasizing leaching/sorption behavior and weathering (260 Records) Cluster 233

(Countries: USA dom, Germany, France, followed by China, Spain, Japan, Canada. Institutions: Stanford, RAS, CNRS, CAS. Other USA include USGS, UCB, University of New Mexico, Washington State University, University of Michigan.).

- Biofilms and other biological systems at the nanoscale, focusing on adhesive behavior, applications of/to bacteria, biofilm formation, surface properties, and electron microscopy studies (182 Records) Cluster 226

(Countries: USA dominant, Germany, Japan, England. Institutions: University of Toronto, CAS. USA include USDA ARC, University of

Minnesota, University of Massachusetts, Montana State University, Medical College of Wisconsin, Case Western Reserve, USDA, University of Texas.).

- Phosphate and calcium compouns (especially calcium phosphates, such as apatite and hydroxyapatite [HAP]), emphasizing studies on cements, bone and bone-like material, and enamel (226 Records) Cluster 194

(Countries: China, followed by USA, Japan, Germany, England. Institutions: Sichuan University, CAS, University of Bristol. USA includes NIST.).

- Soot, flame-synthesized particles, and humic substances, emphasizing aggregation, particle size, analysis using fractionation (125 Records) Cluster 186

(Countries: USA dominant, Germany. Institutions: University of Kentucky, University of Naples Federico, University of Delaware, Technical University of Munich, ETH. Other USA include University of Minnesota, ANL, University of Washington, University of Utah.).

- Aerosols and other fine/ultrafine particles, with emphasis on nucleation and measuring particle size, mass, and concentration, especially in the atmosphere (251 Records) Cluster 126

(Countries: USA dominant, Germany, followed by Finland, Japan. Institutions: University of Helsinki, followed by University of Minnesota. Other USA include USC, University of Colorado, UCLA, UCD, PNNL.).

- Investigations on particle size, focusing on determination of particle size distribution, particles prepared by precipitation method, dispersion of particles, and barium titanate (BaTiO3) particles and powders (380 Records) Cluster 212

(Countries: USA, China, followed by Japan, Germany, followed by South Korea, Taiwan. Institutions: CAS, Zhejiang University, University Erlangen Nurnberg. USA include University of Connecticut, Rutgers State University.).

- Studies on nano-sized particles, characterized by size, surface characteristics, shape, and morphology (580 Records) Cluster 238

(Countries: USA, followed by Japan, China, Germany, followed by Korea, France. Institutions: Osaka University, CAS. USA include University of Texas, University of Alabama, University of Maryland.).

- Nanoparticles (especially silica [SiO2] and titanium dioxide [TiO2]), emphasizing preparation, surface modification, and core/shell composites (125 Records) Cluster 164

(Countries: China dominant, USA, South Korea. Institutions: CAS, Zhejiang University, Tsing Hua University. USA include US Army, University of New Orleans, University of Maryland, University of Kentucky.).

- Colloidal particles, spheres, suspensions, and crystals, emphasizing particle size, hollow spheres, stabilization, dispersion, and latex materials (258 Records) Cluster 228

(Countries: USA, China, followed by Germany, Japan, South Korea. Institutions: CAS, Rice University, RAS. Other USA include University of Washington, Georgia Institute of Technology, Texas A&M.).

- Magnetic particles, focusing on ferrites (such as Fe304 and Fe2O3) and ferrofluids, superparamagnetic particles, particle size, and Mossbauer spectroscopy (178 Records) Cluster 179

(Countries: China, USA, Japan. Institutions: CAS, University of Sao Paulo, Indian Institute of Technology, Tohoku University. USA includes University of Alabama.).

- Magnetic properties of nanoparticles, emphasizing iron oxide (especially magnetite [Fe3O4] and hematite [Fe2O3]) nanoparticles and superparamagnetic particles (237 Records) Cluster 175

(Countries: China, USA, followed by South Korea. Institutions: CAS, University of Brasilia, University S&T China, CNRS. USA includes University of New Orleans.).

- Core-shell nanostructures and hollow nanospheres, made of silver (Ag), bimetallic material, and silica (211 Records) Cluster 70

(Countries: China, followed by USA. Institutions: CAS, followed by University S&T China, Nanjing University, National University of Singapore. USA include University of Notre Dame, University of Washington, UCSB, UCB, Northwestern University).

- Titanium dioxide (TiO2), cadmium sulfide (CdS), cadmium selenide (CdSe), and solid lipid nanoparticles and nanocrystals (138 Records) Cluster 147

(Countries: China, followed by USA, followed by Japan, Germany. Institutions: ANL, Zhejiang University, Tatung University, National Taipei University of Technology, Free University of Berlin. Other USA include UCB, Stanford University.).

- Nanoparticles, including particle size, synthesis, metal and silica nanoparticles, surface properties, dispersion, reactions, and stabilization (930 Records) Cluster 239

(Countries: USA, China, followed by Japan, followed by France, Germany. Institutions: CAS dominant, RAS, CNRS, Seoul National University, National University of Singapore. USA include Texas A&M University, University of Illinois.).

- Gold nanoparticles and nanorods, emphasizing plasmon and surface properties, stabilization, synthesis, and application to electrodes (334 Records) Cluster 104

(Countries: USA, China, Japan. Institutions: CAS dominant, University of Tokyo, University of Melbourne, Indian Institute of Technology.).

- Gold nanoparticles, focusing on surface properties studied by surface-enhanced Raman scattering (SERS), self-assembly of monolayers and other structures, and electrode applications (221 Records) Cluster 158

  (Countries: USA, China, followed by Japan. Institutions: CAS, Seoul National University, Hunan University. USA include University of Washington, University of South Caroline, University of Massachusetts, UCB, Stanford University.).

- Silver (Ag) nanoparticles, with emphasis on surface-enhanced Raman scattering (SERS) studies (122 Records) Cluster 75

(Countries: China, USA, South Korea, Japan. Institutions: CAS dominant, Seoul National University, Jilin University. USA include University of Washington, University of Chicago, Purdue University, Penn State University.).

- Silver (Ag), gold, and gold-silver nanoparticles, including surface-enhanced Raman scattering, reduction behavior, effect of ions, and surface properties (294 Records) Cluster 56

(Countries: China, followed by USA, followed by India. Institutions: CAS dominant, RAS, National Chemical Lab. USA include Clemson University, University of Washington, University of Maryland, ORNL.).

CATEGORY 14 - 509B1b (35 leaf clusters)

Polymers, Composites, and Metal Complexes (8423 REC)

(Leading (chemistry) journals include Polymer, Macromolecules, followed by Journal of Applied Polymer Science, followed by Langmuir, followed by Inorganic Chemistry, Journal of Polymer Science Part A-Polymer Chemistry, Chemistry of Materials. Leading countries include China, USA (dominant), followed by Japan, Germany. China leads in 19 (many dominant), and Spain, Japan, each lead in one.

Spain: structure of metal complexes, especially arene complexes and those containing Cl, the hemilabile ligand, amines, and Zr. Japan: crystal structure, examined by XRD and single crystal methods. China: copolymers; latex particles, gels (dominant); polymer creation by atom transfer radical polymerization; graft polymers (dominant); structural properties of starch; polyaniline; polymer blends; rubber and other elastomeric blends (dominant); improving nanocomposite mechanical properties; epoxy resins and composites (dominant); montmorillonites (dominant); nanocomposites; phase formation and transitions in powders; synthesis and characterization of diterpinoid, cyclodextrin, and peptide compounds; structural characterization and synthesis of compounds, emphasizing crystallography and NMR spectroscopy (dominant); crystal structure using single crystal XRD; crystal and bond structure of coordination polymers, complexes, and hydrates (very dominant); metal complexes and coordination polymers, especially Ni complexes, chelates, and pyridines (very dominant); metal complexes and coordination polymers, especially Pt and Cl complexes (dominant).

Leading institutions include CAS, followed by RAS, followed by University S&T China, followed by Jilin University, Zhejiang University. No USA presence in leading institutions.)

- Poly(ethylene oxide) (PEO), poly(ethylene glycol) (PEG), and poly(lactic acid) (PLA), focusing on films and surfaces made from these polymers (168 Records) Cluster 63

(Countries: USA, China, followed by Germany, Korea. Korea Research Institute Chemical Technology, Max Planck Institute Polymer Research, CAS. USA include University of Massachusetts, SUNY Buffalo.).

- Micelles, emphasizing polymer and block micelles, core-shell nanostructures, drug delivery/release applications, and light-scattering studies (148 Records) Cluster 44

(Countries: USA, China. Institutions: CAS, Washington University, University S&T China, Seoul National University, Kyoto Institute of Technology.).

- Synthesis and characterization of block copolymers (including di-, tri-, and star-block copolymers), focusing on polystyrene block copolymers, morphology, differential scanning calorimetry studies, and atom transfer radical polymerization (294 Records) Cluster 77

(Countries: USA dominant, China, Japan, Germany, Korea. Institutions: University of Minnesota, University of Massachusetts, Tokyo Institute of Technology, CAS. Other USA include UCB, University of Southern Mississippi, UCSB.).

- Copolymers, emphasizing graft, diblock, and triblock copolymers; polymers made of styrene and methacrylate; and differential scanning calorimetry (DSC) studies (341 Records) Cluster 143

(Countries: China, followed by USA, followed by Japan. Institutions: CAS Zhejiang University. USA include ANL, VPI, University of Minnesota.).

- Poly(methyl methacrylate) (PMMA) and poly(2-hydroxyethyl methacrylate) (PHEMA) (121 Records) Cluster 88

(Countries: USA, followed by China, Japan. Institutions: University of Southern Mississippi. Other USA include Georgia Institute of Technology, University of Massachusetts, University of Illinois.).

- Latex particles, hydrogels, microgels, core-shell particles, and substances made of acrylate poly(N-isopropylacrylamide) (PNIPAM) (135 Records) Cluster 151

(Countries: China dominant, USA. Institutions: University S&T China, Max Planck Institute Colloids and Interfaces, Fudan University, CAS. USA include Cornell University, University of Notre Dame.).

- Creation of polymers by means of atom transfer radical polymerization, emulsion polymerization, and ring-opening polymerization (295 Records) Cluster 202

(Countries: China, followed by USA, followed by Japan. Institutions: Eindhoven University of Technology, National University of Singapore, CAS.).

- Graft polymers, including synthesis, grafting of polymer brushes to surfaces, grafted silica, and polyethylene terephthalate (PET) (132 Records) Cluster 69

(Countries: China dominant, Japan, France, USA. Institutions: CAS, Hebei University, Niigata University.).

- Molecular and structural properties of starches (including flour, potatoes, corn, wheat, and rice and banana starches), emphasizing characteristics of starch granules and biodegradation of starch and substances based on starches (49 Records) Cluster 1

(Countries: China, Poland, France. Institutions: Polish Academy of Science, RAS, CSIC, CAS. USA includes Washington State University.).

- Dendrimers, emphasizing poly(amidoamine) (PAMAM), porphyrin, and carbosilane dendrimers; changes over generations; and dendrimers with mesogenic terminal groups (49 Records) Cluster 3

(Countries: USA dominant, France, Japan, Germany. Institutions: University of Michigan, Central Michigan University, Montana State University.).

- Hybrid materials and composites (especially polymers and films), including polyurethane, polyimides, poly(dimethylsiloxane) (PDMS), organic-inorganic materials, and silica-based substances (273 Records) Cluster 248

(Countries: USA, China, followed by South Korea, Japan, Taiwan. Institutions: CAS, followed by Zhejiang University, Yonsei University, University S&T China, Tatung University. USA include VPI, University of Missouri.).

- Differential scanning calorimetry (DSC) to characterize materials (especially polymers), including effects of molecular weight, studies on glass transitions, and phase behavior (268 Records) Cluster 232

(Countries: USA, China, Japan, Germany. Institutions: CAS, University of Paris, University of Akron, Tokyo Institute of Technology. Other USA include UCSB, University of Cincinnati.).

- Polymer properties, focusing on conducting polymers, polymer surfaces and films, influence of nanoparticles, and liquid crystals (694 Records) Cluster 235

(Countries: USA dominant, Japan, China, Germany. Institutions: Kyoto University, CAS, RAS, Max Planck Institute Polymer Research, Eindhoven University of Technology: USA include MIT, University of Massachusetts, Georgia Institute of Technology.).

- Polymer electrolytes, emphasizing poly(ethylene oxide) (PEO) and poly(3,4-ethylenedioxythiophene) (PEDOT), conductivity studies, and application to lithium batteries (113 Records) Cluster 73

(Countries: USA, China, South Korea. Institutions: Korea Advanced Institute of S&T, Zhejiang University, Shanghai Jiao Tong University. USA includes University of Tulsa.).

- Polyaniline (PANI) focusing on dodecylbenzene sulfonic acid doped polyaniline (PANI-DBSA), synthesis of conducting PANI materials, and nanofibers of PANI (67 Records) Cluster 15

(Countries: China, USA, India. Institutions: Drexel University, Xinjiang University, National Central University, Jilin University. Other USA include University of Texas, UCLA.).

- Polymer blends (especially poly(vinyl chloride) (PVC), poly(vinyl alcohol) (PVA), and poly(styrene) blends), emphasizing morphology, miscibility, melt blending, and shear studies (150 Records) Cluster 114

(Countries: China, USA, Japan. Institutions: CAS, Sichuan University, Tsing Hua University, CNR.).

- Rubber and other elastomeric blends, emphasizing nitrile-butadiene rubber (NBR), ethylene-propylene diene terpolymer (EPDM) blends, rubber/silica nanocomposites, nano-calcium carbonate (CaCO3) composites, and measurement/comparison of mechanical properties (117 Records) Cluster 84

(Countries: China dominant, India, USA. Institutions: Indian Institute of Technology, Beijing University of Chemical Technology, CAS, University Sains Malaysia. USA includes SUNY Stony Brook.).

- Strengthening and improvement of mechanical and tensile properties of nanocomposites (especially polypropylene) by using filler and reinforcing with fibers (237 Records) Cluster 206

(Countries: China, USA. Institutions: University of Wisconsin, SUNY Stony Brook, Michigan State University, University of Cincinnati.).

- Investigation of resin-dentin interfaces and other studies on adhesive resin cements, including determination of bond strength and factors affecting self-etching primer bonding systems (85 Records) Cluster 35

(Countries: USA, Japan, China. Institutions: Tokyo Medical and Dental University, Medical College of Georgia, University of Hong Kong, University of Turku. Other USA includes UCSF.).

- Epoxy resins and composites, including polyhedral oligomeric silsesquioxane (POSS) composites and reinforced epoxy resins, as well as bisphenol-A glycidol ether (DGEBA) epoxy resin (129 Records) Cluster 38

(Countries: China dominant, USA, Italy, Germany. Institutions: Shanghai Jiao Tong University, University S&T China, Iran Polymer and Petrochemical Institute. USA include Georgia Institute of Technology, Case Western Reserve University, Michigan State University.).

- Clay materials and nanocomposites (including montmorillonites, organoclays, layered silica nanocomposites, and polypropylene- and epoxy-clay nanocomposites), emphasizing exfoliation degree and mechanism, preparation by melt intercalation, dispersion, and mechanical properties (429 Records) Cluster 43

(Countries: USA, followed by China, followed by South Korea, Taiwan, France, Japan. Institutions: Marquette University, CAS, Inha University. Other USA include University of Akron, Michigan State University, NIST.).

- Montmorillonites (MMTs) (especially MMT nanocomposites), emphasizing intercalation, exfoliation, and thermal properties (133 Records) Cluster 21

(Countries: China dominant, South Korea, USA, Japan. Institutions: CAS, University S&T China, Shanghai Jiao Tong University, Korea Research Institute of Chemical Technology.).

- Nanocomposites (including layered silicate and layered double hydroxide [LDH] nanocomposites), organoclays, and organic montmorillonites (OMMTs), emphasizing preparation, exfoliation, intercalation, and enhanced properties, especially thermal properties (445 Records) Cluster 188

(Countries: China, USA, followed by South Korea, Japan. Institutions: CAS dominant, University S&T China, NAS Ukraine, RAS. USA include SUNY Stony Brook.).

- Phase formation, transitions, and behavior in powders, cubic solids, and crystals, as explored by x-ray powder diffraction (296 Records) Cluster 241

(Countries: China, followed by India, Japan, Germany. Institutions: RAS, CAS, University S&T China, Bhabha Atomic Research Center.).

- Structural studies, emphasizing crystal structure, x-ray powder diffraction, and structure refinement (278 Records) Cluster 220

(Countries: USA, Germany, Japan, Ukraine, France. Institutions: Volyn State University dominant, Polish Academy of Science, Moscow Lomonosov State University, University of Munster.).

- Crystal structure, examined by x-ray diffraction and single crystal methods (388 Records) Cluster 240

(Countries: Japan, USA, followed by China, Germany. Institutions: RAS, CAS, Osaka University, Tokyo Institute of Technology.).

- Structure, synthesis, and characterization of compounds (especially diterpenoids, cyclodextrin, and peptides), with emphasis on isolation from other materials, crystal structure, x-ray diffraction studies, and preferred conformations (102 Records) Cluster 127

(Countries: China, Japan, USA, Germany. Institutions: CAS, RAS, University of Padua.).

- Structural characterization and synthesis of compounds, emphasizing crystallography (especially single crystal x-ray diffraction) and NMR spectroscopy (280 Records) Cluster 203

(Countries: China dominant, USA, Germany. Institutions: RAS, CAS, Qingdao University S&T, Nankai University. USA includes University of Texas.).

- Crystal structure at the resolution of a few angstroms using single crystal x-ray diffraction (574 Records) Cluster 108

(Countries: China, followed by USA, followed by Russia, Germany, France. Institutions: CAS, RAS, Moscow Lomonosov State University, Jilin University, Nanjing University. USA includes University of North Texas.).

- Crystal and bond structure of coordination polymers, complexes, hydrates, and other compounds, emphasizing studies on hydrogen bonds and single crystal x-ray diffraction (306 Records) Cluster 148

(Countries: China very dominant, Germany, USA, France. Institutions: CAS, Jilin University, Nankai University, Nanjing University.).

- Metal complexes and coordination polymers, especially copper (Cu), cadmium (Cd), and pyridyl compounds, with emphasis on synthesis and crystal structure (205 Records) Cluster 125

(Countries: China very dominant, USA, Germany, Spain. Institutions: CAS dominant, Nanjing University, University of Barcelona, Nankai University.).

- Metal complexes and coordination polymers, focusing on structure and reactivity, especially of nickel (Ni) complexes, chelates, and pyridines (237 Records) Cluster 136

(Countries: USA, China, Germany. Institutions: RAS, Nankai University, CAS. USA includes University of South Carolina.).

- Metal complexes and coordination polymers, emphasizing structure, reactivity, NMR spectroscopy, and synthesis, especially of platinum (Pt) and chlorine (Cl) complexes (647 Records) Cluster 207

(Countries: China dominant, USA, Germany, Japan, Russia. Institutions: RAS, CAS, followed by Nanjing University, CNR.).

- Structure, reactions, and synthesis of metal complexes, especially arene complexes and those containing chlorine (Cl), the hemilabile ligand, amines, and zirconium (Zr) (126 Records) Cluster 23

(Countries: Spain, USA, China. Institutions: RAS, University of Zaragoza, University Alcala de Henares. USA Include University of North Texas, University of Houston.).

- Ruthenium (Ru) complexes (especially those containing bipyridine, triphenylphosphine [PPh3], and chlorine [Cl]), including investigations of structure, reactivity, and synthesis, as well as x-ray diffraction studies (112 Records) Cluster 45

(Countries: USA dominant, Japan, Switzerland, Italy, Germany. Institutions: National Taiwan University, CNR. USA include University of Miami, University of South Carolina.).

CATEGORY 15 - 509B2a ***(2 leaf clusters)***

DNA (775 REC)

(Leading authors include Wang, L, Seela, F, Mao, CD, Knoll, W, Dekker, C, Yan, H, Mirkin, CA. Leading (chemistry) journals include Langmuir, followed by Journal of the American Chemical Society, Nano Letters, Analytical Chemistry, Nucleic Acids Research. Leading countries include USA (dominant), China, Japan, followed by Germany. Leading institutions include CAS (dominant), University of Tokyo, Purdue University, UCB, RAS, University of Illinois. Other USA institutions include Northwestern University, Arizona State University, Duke University, University of Wisconsin.)

- DNA studies, emphasizing self-assembly of DNA molecules, DNA-directed assembly of nanostructures (especially nanoparticles), evaluation of protein-DNA binding, and gene delivery (554 Records) Cluster 54

(Countries: USA dominant, Japan, China, Germany. Institutions: CAS dominant, RAS, University of Tokyo. USA include Purdue University, University of Wisconsin, University of Illinois, UCB, Duke University.).

- Detection of DNA, emphasizing hybridization detection, use of microarrays, interaction of DNA with gold nanoparticles, DNA biosensors, and DNA immobilization (221 Records) Cluster 92

(Countries: USA dominant, China, followed by Germany, Japan. Institutions: SE University, University of New South Wales, Northwestern University, Max Planck Institute of Polymer Research, Institute for Materials Research and Engineering. Other USA include University of Rochester, UCI, UCB, USN, University of Maryland, University of Illinois).

CATEGORY 16 - 509B2b ***(24 leaf clusters)***

Proteins and Cellular Components (5070 REC)

(Leading journals include Langmuir, Biomaterials, Journal Of Biological Chemistry, followed by Biophysical Journal, Analytical Chemistry, Journal of Controlled Release. Leading countries include USA (very dominant), Japan, Germany, China.

However, China is dominant in two clusters. China: biomaterials, bioactive substances, and biodegradable composites; preparation and investigation of membranes, emphasizing proton conductivity, permeability studies, filtration applications, preparation by grafting, sulfonated membranes, and methanol fuel cell applications.

Leading institutions include CAS, National University of Singapore, followed by University of Texas, Osaka University, Harvard University. Other USA institutions include University of Illinois, Northwestern University, University of Michigan, University of Pennsylvania, Johns Hopkins University, NCI.)

- Protein studies, focusing on surface interactions (especially protein adsorption and adhesion), unfolding and refolding, and related atomic force microscopy studies, especially of bovine serum albumin (BSA), poly(ethylene glycol) (PEG), and fibrinogen (212 Records) Cluster 177

(Countries: USA dominant, Germany, Japan, Switzerland, England, China. Institutions: Tokyo Institute of Technology, ETH, McMaster University, CAS. USA include University of Illinois, University of Washington, University of Texas, UCLA, UCB).

- Protein studies, focusing on structure and function, namely binding domain features, alteration of protein binding, protein-protein interactions, fluorescent proteins, and proteomics (594 Records) Cluster 174

(Countries: USA very dominant, Germany, Japan, followed by England, Italy, China, France, South Korea. Institutions: University of Texas, CAS, Osaka University, University of Illinois. Other USA include UCSD, UCLA, Harvard University, Vanderbilt University, UCB).

- Analysis and adjustment of immunoassays, including fluoroimmunoassays and immunoglobulin (especially IgG) studies (221 Records) Cluster 165

(Countries: USA dominant, China, Japan. Institutions: Tsing Hua University, University of Twente, University of Turku. USA include Northwestern University, US Navy.).

- Biosensors and immunosensors based on surface plasmon resonance (SPR) (140 Records) Cluster 91

(Countries: USA, followed by Japan, China, Germany. Institutions: Kyushu University, Arizona State University, Northwestern University, CAS. Other USA include Purdue University, USDA ARS).

- Analysis of protein binding, including effects of inhibitors, investigation of binding sites/domains, and surface plasmon resonance analysis to determine binding properties (337 Records) Cluster 182

(Countries: USA very dominant, Japan, Germany, England, followed by France, Sweden. Institutions: NCI, University of Oxford, CNRS, Scripps Research Institute, Lund University, CAS. Other USA include University of Pittsburgh, University of Pennsylvania, University of Illinois, NIAID, University of Washington).

- Receptor/ ligand interactions, emphasizing receptor structural characteristics, recognition, regulation, and ligand activity, including affinity of agonists and antagonists (88 Records) Cluster 51

(Countries: USA very dominant, England, Germany, Japan. Institutions: University Aarhus, University of Cambridge, University of Pennsylvania, University of Massachusetts, Merck Research Labs, CAS. Other USA include Purdue University).

- Peptides, emphasizing binding properties, peptide-membrane interactions, structure, mass spectrometry of peptides, antimicrobial peptides, and identification of peptides by means of chromatography (166 Records) Cluster 57
- (166 Records)

(Countries: USA very dominant, Japan, followed by Germany, Canada, Australia, China. Institutions: MIT, Weizmann Institute of Science, Harvard University. Other USA include University of Wisconsin, University of Minnesota, Scripps Research institute, Rice University, Northwestern University, Vanderbilt University, University of Texas).

- Fibrils (especially amyloid and collagen fibrils), focusing on formation by aggregation, role of amyloids in neural conditions (especially Alzheimer's disease), and structure (102 Records) Cluster 11

(Countries: USA very dominant, England, Japan. Institutions: University of Cambridge, Osaka University, NIDDKD, Japan S&T Agency. Other USA include JHU, Baylor College of Medicine, Arizona State University, UCLA).

- Viruses and RNA, focusing on structure determination, capsid properties, and sequencing (129 Records) Cluster 110

(Countries: USA very dominant, Japan, Germany, France, China, England. Institutions: UCI, Scripps Research Institute, UCD, National Institute Infectious Diseases, CAS. Other USA include Vanderbilt University, University of Texas, UCSD, Texas A&M.).

- Gene expression and gene delivery for therapeutic benefit, focusing on nanoparticles as non-viral vectors for gene delivery, analysis of gene expression data, and DNA transfection systems (157 Records) Cluster 130

(Countries: USA very dominant, South Korea, Japan, China, Germany, France. Institutions: National University of Singapore, Dankook University, Institute of Bioengineering and Nanotechnology. USA include University of Utah, University of Texas, University of Tennessee.).

- Treatment and risk prediction of cancer and cardiovascular disease (CVD), focusing on evaluation of lymphatic system (especially sentinel lymph nodes [SLNs]), especially for patients with breast cancer (88 Records) Cluster 64

(Countries: USA very dominant, England, Netherlands. Institutions: Massachusetts General Hospital, Harvard University, University of Utah, University of Barcelona, Hospital Clinia Barcelona. Other USA include University of Texas, MIT, Brigham and Women's Hospital, Boston University, Beth Israel Decaoness Medical Center).

- Studies of tumors and the brain, with emphasis on liposomal and nanoparticle-based delivery (especially of drugs), nanostructure-aided magnetic resonance imaging of cells, and crossing of the blood-brain barrier (208 Records) Cluster 201

(Countries: USA very dominant, China, Japan, Germany, South Korea, France. Institutions: Washington University, CAS, University of Paris, University of Michigan, EWHA Women's University. Other USA include University of Pennsylvania, Ohio State University, Massachusetts General Hospital, University of Utah, University of Missouri, University of Kentucky, Rice University).

- Cellular function and processes, focusing on endothelial and epithelial cells, cellular response to gene expression, induction and inhibition of apoptosis, and studies on cancer and tumor cells (339 Records) Cluster 191

(Countries: USA dominant, Germany, South Korea, Japan, China. Institutions: Harvard University, Wonkwang University, Kyung Hee University, JHU. Other USA include University of Florida, University of Pennsylvania, University of Michigan, University of Missouri, UCLA.).

- Investigation of cell surface and plasma membrane (especially of bacteria), focusing on cell adhesion, labeling for detetion, imaging techniques, and intercellular transfer (608 Records) Cluster 195

(Countries: USA very dominant, Japan, Germany, followed by China, France, England. Institutions: University of Tokyo, Harvard University, University of Texas, National University of Singapore, CNRS. Other USA include JHU, Stanford University, University of Wisconsin, University of Washington, University of Pennsylvania, MIT).

- Connective and anatomical support tissue (especially bone and its main component, collagen), focusing on studies on osteoblasts, cell proliferation, and orthopedic implants (226 Records) Cluster 135

(Countries: USA dominant, Japan, China, Singapore. Institutions: National University Singapore, Sichuan University, MIT. Other USA include University of Michigan, Harvard University, Northwestern University, JHU, UCLA).

- Biomaterials, bioactive substances, and biodegradable composites (especially chitosan, poly(lactide-co-glycolide) [PLGA], alginate, and poly(lactic acid)), focusing on microspheres and encapsulation, tissue engineering scaffolds, and hydrogels (119 Records) Cluster 134

(Countries: China dominant, USA, South Korea, Japan. Institutions: National University Singapore, Zhejiang University, Sichuan University, CAS. USA includes Lousiana Technical University.).

- Preparation and investigation of membranes, emphasizing proton conductivity, permeability studies, filtration applications, preparation by grafting, sulfonated membranes, and methanol fuel cell applications (253 Records) Cluster 82

(Countries: China dominant, USA, Japan, South Korea. Institutions: National University Singapore, CAS, Zhejiang University.).

- Lipid (especially phospholipid) bilayers, focusing on properties of vesicles, channel interactions, membrane binding, and dipalmitoyl phosphatidylcholine (DPPC) and cholesterol structures (231 Records) Cluster 142

(Countries: USA very dominant, Germany, France, Japan. Institutions: University of Illinois, University of Munster, RAS, CAS. Other USA include UCR, Stanford University, UCLA, Cornell University).

- Drug delivery systems, focusing on drug release, especially of nanoparticles and from nanocapsules (219 Records) Cluster 97

(Countries: USA, China, followed by India, South Korea, Japan. Institutions: National University of Singapore, Institute of Bioengineering and Nanotechnology, Bharati Vidyapeeth Deemed University. USA includes University of Notre Dame).

- Drug delivery systems, emphasizing targeting of cancer cells, oral delivery, and lipid and nanoparticle-based carriers (169 Records) Cluster 93

(Countries: USA very dominant, Germany, India. Institutions: University of Michigan, University of Frankfurt, University of Texas, University of Nebraska. Other USA include Washington University, NCI, Wayne State University, University of Washington.).

- Ethical, health, and social issues of nanotechnology (especially biological applications), weighing the risks and benefits to the public (142 Records) Cluster 81

(Countries: USA very dominant, Germany. Institutions: NSF, UCSD, NCI. Other USA include University of Wisconsin, UCB, Cornell University, University of Texas, University of Pennsylvania, University of Michigan, UCSB, Thomas Jefferson University, SNL).

- Network and self-organization processes, with emphasiss on self-organizing neural networks, self-organized maps (SOMs), and learning systems (132 Records) Cluster 99

(Countries: USA very dominant, China, Japan, Germany. Institutions: Riken, Northwestern University. Other USA include University of Massachusetts, University of Florida, Rice University, Ohio University, North Carolina State University, Boston University, Arizona State University).

- Microtubule motor proteins (kinesin and dynein), with models and analysis of movement mechanism (106 Records) Cluster 22

(Countries: USA very dominant, Japan, England, China. Institutions: University of Illinois, University of Tokyo, CAS. Other USA include University of Washington, University of Texas, University of Michigan, UCSC, UCSD, UCI.).

- Microfilament proteins (myosin and actin), emphasizing dynamics of muscle contraction and function of myosin heads (84 Records) Cluster 4

(Countries: USA dominant, England, followed by France, Japan, Germany. Institutions: University of Vermont, University of London, University of Florence, RAS, Osaka University, NHIBI, National Institute of Medical Research, European Synchrotron Radiation Facility. Other USA include Yale University, University of Pennsylvania, University of Massachusetts).

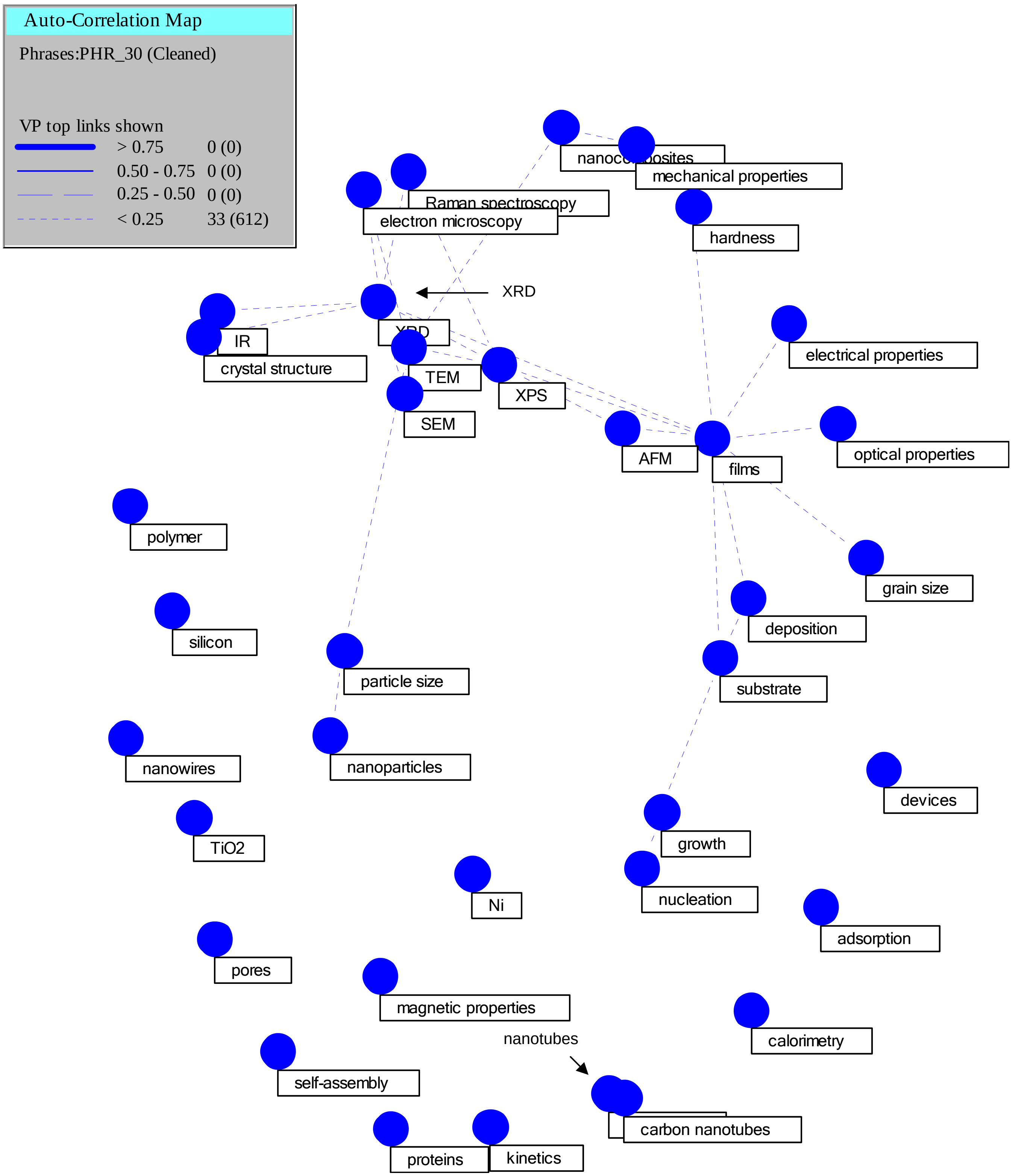
2. Phrase Auto-Correlation

The TechOasis (SEARCH, 2006) software generates phrases by Natural Language Processing. A meticulous extraction of high technical content phrases is then performed by human expert analysts. Thirty high frequency technical phrases are shown in Figure 6 (an auto-correlation map). The proximity of the phrases and the strength of the linkages is determined by their co-occurrence frequencies in the Abstracts.

Figure 6 contains two major groups. One group is related to instruments or measurement techniques at the nanoscale. It includes Raman spectroscopy, electron microscopy, XRD (x-ray diffraction), TEM (transmission electron micrscopy), XPS (x-ray photoelectron spectroscopy), and SEM (scanning electron microscopy), and the quantities they measure (particle size, crystal structure, mechanical properties). The phrases were compiled so that each acronym encompasses the technique, the instrument, and all other relevant phrases, e.g. TEM refers both to transmission electron microscopy and microscope, among other phrases.

The other major group is centered on films deposition, substrate, growth, nucleation, electrical properties, optical properties, hardness, AFM (atomic force microscopy)). Although AFM also measures nanoscale quantities and is weakly linked to XPS in the first group, it is included in the same group as films because this group has to do with manipulation, as well as measurement. Also, nanocomposities, mechanical properties, and hardness form a group; growth and nucleation are weakly linked; and nanotubes and carbon nanotubes are connected. There is some linkage between the two major groups.

Figure 6 – PHRASE AUTO-CORRELATION MAP (top thirty phrases)



3. Factor Matrix

Table 14 shows a factor matrix of the same thirty technical phrases that were mapped in Figure 6. Based on the groupings in the auto-correlation map, a six factor matrix was generated. Seven groupings are shown, the first five of which correspond to the groupings seen in Figure 6.

- XRD strongly linked to TEM, SEM, and XPS; and weakly linked to Raman spectroscopy and electron microscopy. Measurement is the focus of this group, as each term describes a method of observing nanoscale properties and phenomena. TEM and SEM both fit under the general heading of electron microscopy.
- Films strongly linked to deposition, substrate, and AFM; and weakly linked to electrical properties. This group emphasizes the formation of thin films and their properties.
- Nanotubes strongly linked to carbon nanotubes and weakly linked to nanowires.
- Mechanical properties strongly linked to hardness and nanocomposites. This is significant because it shows what critical features of nanocomposites are primarily being measured and evaluated by researchers today. Electrical, optical, and magnetic properties all show up in the top 30 phrases, but none are linked to nanocomposites.
- Nucleation strongly linked to growth and very weakly linked to nanoparticles and kinetics.
- Crystal structure strongly linked to magnetic properties and grain size and weakly linked to IR.
- Adsorption strongly linked to proteins.

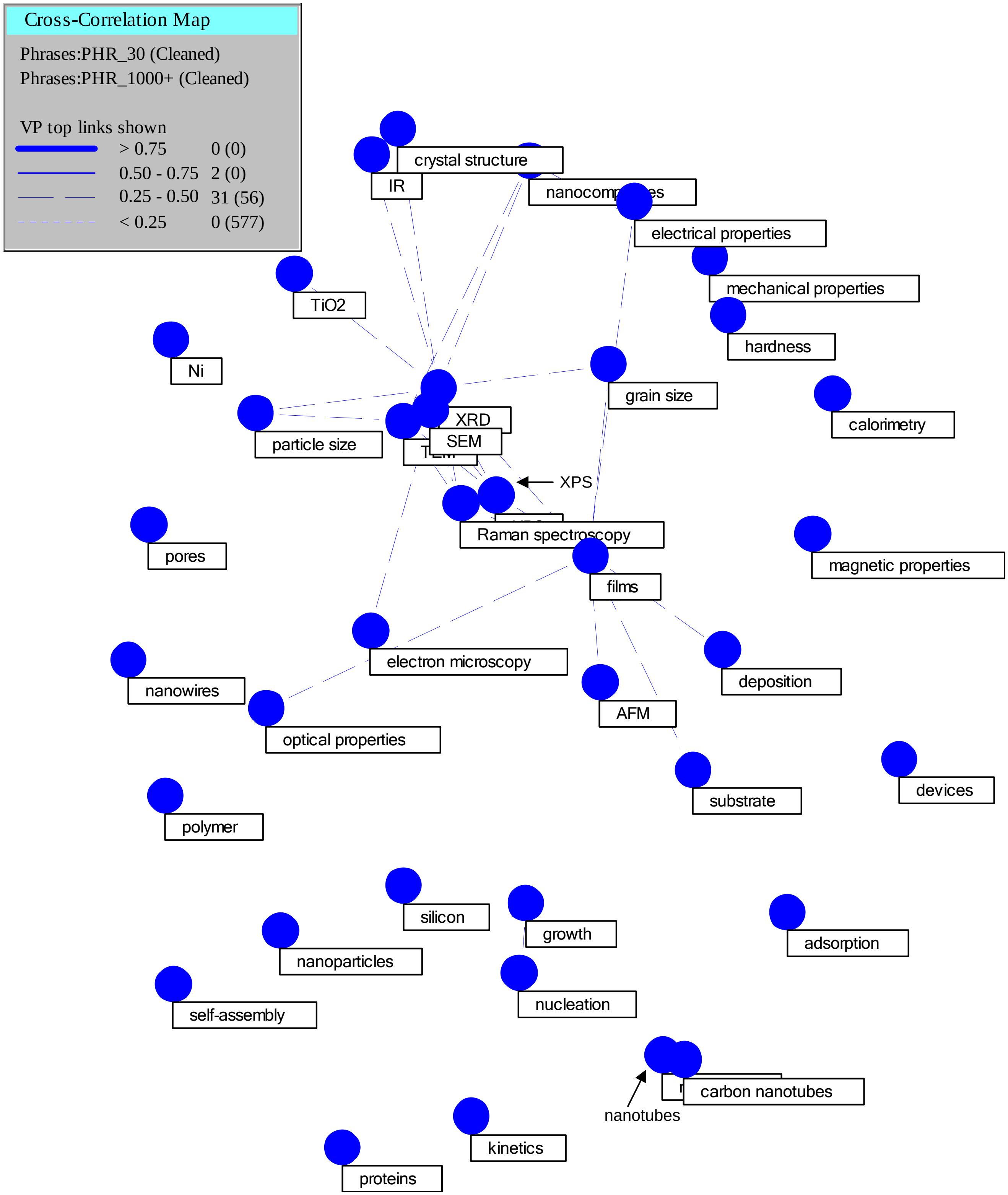
TABLE 14 - PHRASE SIX FACTOR MATRIX (top thirty phrases)

FACTOR	1	2	3	4	5	6
XRD	0.674	0.023	0.009	-0.05	0.016	0.234
TEM	0.588	-0.145	-0.073	-0.081	-0.158	0.1
SEM	0.45	0.029	-0.023	-0.062	0.034	0.147
XPS	0.391	0.267	0.035	0.112	0.142	-0.227
RAMAN SPECTROSCOPY	0.265	0.18	-0.222	0.014	0.095	-0.063
ELECTRON MICROSCOPY	0.242	0.089	-0.036	-0.101	-0.063	-0.175
FILMS	0.11	0.623	0.067	-0.062	0.051	0.062
DEPOSITION	-0.009	0.403	-0.022	0.027	-0.089	-0.009
SUBSTRATE	-0.045	0.375	0.028	-0.018	-0.149	-0.01
AFM	0.174	0.36	0.072	-0.029	0.036	-0.242
ELECTRICAL PROPERTIES	-0.024	0.247	-0.035	0.008	0.082	0.17
NANOTUBES	-0.023	-0.012	-0.735	-0.026	0.008	-0.017
CARBON NANOTUBES	-0.04	0.006	-0.705	-0.025	0.045	-0.04
NANOWIRES	0.016	-0.025	-0.249	0.072	-0.18	0.131
MECHANICAL PROPERTIES	-0.011	0.019	-0.018	-0.722	0.048	0.009
HARDNESS	-0.048	0.172	0.049	-0.603	0.059	0.051
NANOCOMPOSITES	0.115	-0.211	-0.05	-0.427	-0.051	-0.037
NUCLEATION	-0.034	0.08	-0.019	-0.018	-0.67	-0.01
GROWTH	-0.015	0.225	-0.075	0.036	-0.66	0.043
NANOPARTICLES	0.107	-0.196	0.025	0.01	-0.224	-0.101
KINETICS	0.033	-0.021	0.094	-0.004	-0.204	-0.22
CRYSTAL STRUCTURE	0.053	-0.043	0.043	0.102	0.096	0.362
MAGNETIC PROPERTIES	0.009	-0.013	0.02	0.039	-0.077	0.343
GRAIN SIZE	0.001	0.146	0.072	-0.146	-0.01	0.326
IR	0.152	-0.085	0.014	0.093	0.104	0.253
NI	0.043	0.009	-0.037	0.058	-0.013	0.195
OPTICAL PROPERTIES	0.022	0.184	0.002	0.031	0.003	0.045
PARTICLE SIZE	0.214	-0.204	0.101	0.019	-0.18	0.037
SILICON	-0.017	0.207	-0.025	0.001	-0.013	0.01
DEVICES	-0.142	0.028	-0.039	0.045	0.104	0.007
TIO2	0.19	0.009	0.056	0.074	0.037	-0.053
PORES	0.087	-0.012	-0.04	0.029	-0.074	-0.093
SELF-ASSEMBLY	-0.037	-0.036	0.034	0.037	-0.05	-0.111
CALORIMETRY	0.07	-0.096	0.06	-0.164	-0.042	-0.159
POLYMER	0.067	-0.089	-0.019	-0.16	0.011	-0.237
PROTEINS	0	-0.042	0.022	0.059	0	-0.311
ADSORPTION	0.064	0.022	-0.029	0.135	0.08	-0.369

4. Phrase-Phrase Correlation Map

The final taxonomy (Figure 7) shows the thirty phrases mapped not by co-occurrence with each other, as was the case in the auto-correlation map, but by their co-occurrence with common phrases. In contrast with the auto-correlation map, the two main groups are merged more closely, with instrumentation assuming the central network role. Small groups that were attached weakly on the periphery of the auto-correlation map (e.g., growth-nucleation, nanocomposites-mechanical properties) or individual themes that were connected weakly at the periphery (e.g., nanoparticles) are now isolated in the cross-correlation map.

FIGURE 7 - PHRASE-PHRASE CROSS-CORRELATION MAP



NANOTECHNOLOGY INSTRUMENTATION

In the updated nanotechnology study, all of the technical structural analyses of the total nanotechnology database, including the phrase correlation mapping, the factor analysis, and the document clustering taxonomy, show instrumentation playing a central role in nanoscience and nanotechnology research. The objectives of this section are to examine the nanotechnology instrumentation literature in depth, and show how suites of instruments are used in concert, especially in relation to measurements on common materials, properties, phenomena, and nanostructures. An overview of the instrumentation effort is presented first, followed by a summary of results. The full study's details are contained in Appendix 5.

There are four main sub-sections to Appendix 5. The first lists the key nanotechnology instruments, and emphasizes those used most frequently. The second presents key findings of co-occurrence matrices, showing the relation of the major nanotechnology instruments to materials, properties, phenomena, and nanostructures. The third presents correlation mapping of the nanotechnology instruments to each other, especially how they relate to common materials, properties, phenomena, and nanostructures. Included in this section is a factor matrix analysis, which presents a more quantitative description of the relationships shown on the maps. The fourth presents a hierarchical taxonomy (generated by document clustering) of all the retrieved nanotechnology records related to instrumentation, with metrics provided at every taxonomy node.

Instrumentation Overview

The instrumentation literature associated with nanoscience and nanotechnology research was examined. Of the ~65000 nanotechnology records for 2005 retrieved from the SCI/SSCI, about ~27000 of those were identified as instrumentation-related. All the diverse instruments were identified, and the relationships among the instruments, and among the instruments and the quantities they measure, were obtained. Metrics associated with research literatures for specific instruments/ instrument groups were generated. The detailed analysis and results are presented in Appendix 5. A brief summary of results follows.

Instrumentation Summary

A wide variety of instruments are used in nanoscience and nanotechnology research. Key among these instruments are XRD, electron microscope variants, atomic force microscopy, scanning tunneling microscopy, and spectroscopy variants.

Key materials, properties, phenomena, and nanostructures measured by the leading instruments are as follows:

- Materials: TiO_2, Ti, Si, SiO_2, and polymers
- Properties: Morphology/ surface morphology, thickness/diameter/particle size, surface roughness/surface area, mechanical properties/optical properties/thermal properties, crystal structure/crystallinity
- Phenomena: Deposition, oxidation, crystallization, catalytic activity, nucleation, adsorption, polymerization, adhesion, decomposition/ degradation
- Thin films, nanocomposites, nanowires, nanotubes, monolayers/self-assembled monolayers

Key findings from the correlation maps are as follows:

- Instrumentation auto-correlation map showed that the main network is in x-ray diffraction and electron microscopy. This is an indication that a well-equipped chemistry and/or material science laboratory usually contains a variety of instruments for characterizing various material properties. The instrument factor matrix showed similar grouping of a diversity of instruments in the same laboratory.
- Instrumentation-materials cross-correlation map showed that the main group consisted of electron microscopes and variants. Many of the instruments are used to characterize materials of interest to semiconductor and microelectronics research.
- Similarly, the instrumentation-properties cross-correlation map is focused mostly on the electronic properties of materials of interest to microelectronics research such as electron microscopy and atomic force microscopy.
- Same instruments are used to investigate the growth and fabrication phenonema in the instrumentation-phenomena cross-correlation map.
- Because of the dominance of nanoelectronics research, many nanostructures are focused on electronic applications and thus the

Instrumentation-nanostructures cross-correlation map also showed the emphasis on instruments for characterizing the electronic structures.

The hierarchical taxonomy offered the following insights:

- In this nanotechnology instrumentation study, ***China produced about 25% more papers than the USA***. By contrast, in the full nanotechnology study, the USA produced about 25% more papers than China.
- Much of China's over-production occurred in the XRD-related categories, but there was some over-production in the transmission electron microscopy and NMR-calorimetry related categories as well.
- USA dominance appears to be in atomic force microscopy areas
- Because of the large Chinese and South Korean contributions to the nanotechnology instrumentation literature, author name analysis at aggregate levels is not effective; these Asian names are usually monosyllable, many times with no middle names. Due to the relatively high frequency of paper publications, there is good possibility that the same last name represents multiple authors. Potential name disambiguation is under study.
- Even though the USA has a large presence overall, relatively few USA institutions are listed among the most prolific in the nanotechnology instrumentation papers. The Asian and European efforts appear concentrated in relatively few but large institutions.

NANOTECHNOLOGY APPLICATIONS

Applications Overview

The Applications literature associated with nanoscience and nanotechnology research was derived from the ~65000 nanotechnology records for 2005 retrieved from the SCI/SSCI. Through visual inspection of the ~65000 records' Abstract phrases, all the diverse non-medical Applications were identified, and the relationships among the Applications, both direct and indirect, were obtained. The medical applications were identified through a fuzzy clustering process. Metrics associated with research literatures for specific Applications/ Applications groups were generated. A detailed analysis of the approach and results is presented in Appendix 6. A brief summary of the results follows.

Applications Results

The study has identified the main nanotechnology Applications, both medical and non-medical, as well as the related science and infrastructure. These relationships will allow the potential user communities to become involved with the Applications-related science and performers at the earliest stages, to help guide the science conversion towards specific user needs most efficiently.

The pervasive materials, materials properties, phenomena, and nanostructures related to the most frequently mentioned <u>non-medical</u> nanotechnology Applications were identified, as follows:

- *TiO2, Pt, Si, gold, and polymers tend to stand out as the most pervasive material types*
- *Morphology, thickness /diameter/particle size, optical properties, catalytic performance, and electrochemical properties tend to stand out as the most pervasive material properties*
- *Deposition, absorption, oxidation, immobilization, catalysis, degradation, and self-assembly tend to stand out as the most pervasive nanoscale phenomena*
- *Thin films, nanowires, nanotubes (especially carbon), and self-assembled monolayers tend to stand out as the most pervasive nanostructures*

The pervasive instrumentation, materials, structures, and phenomena related to the most frequently mentioned nanotechnology medical applications were identified, as follows:

- **Instrumentation:** *surface plasmon resonance, atomic force microscopy, scanning electron microscopy, transmission electron microscopy, differential scanning calorimetry, x-ray photoelectron spectroscopy, fourier transform infrared spectroscopy, quartz crystal microbalance, magnetic resonance imaging, confocal laser scanning, enzyme linked immunosorbent assay, laser scanning microscopy, x-ray diffraction, mass spectrometry.*

- **Materials:** *protein, DNA, peptides, drugs, bovine serum albumin, poly ethylene glycol, single stranded DNA, double stranded DNA, green fluorescent protein, lipids, human serum albumin, Escherichia Coli, antibodies, tissues, enzymes, genes, oligonucleotides, gold, nucleic acid.*

- **Structures:** *cells, membranes, surfaces, nanoparticles, self-assembled monolayers, cell surfaces, endothelial cells, receptors*

- **Phenomena:** *fluorescence, interaction, polymerase chain reaction, dynamic light scattering, resonance energy transfer, particle size, drug release, cell adhesion, binding, affinity, gene expression, transfection efficiency*

Maps were constructed to show groupings of related Applications into broader thematic areas. An autocorrelation map of the most widely referenced <u>non-medical</u> Applications showed five weakly-connected sub-networks:

- Electronic Devices and Components
- Optical Switching
- Tribology and Corrosion
- Optoelectronic Sensors
- Electrochemical Conversion and Catalysis

A <u>medical</u> Applications categorization constructed from visual inspection of the fuzzy clustering categories showed five thematic categories:

- Cancer Treatment
- Sensing and Detection
- Cells
- Proteins
- DNA

Factor analyses were performed to show non-medical thematic areas from a slightly different perspective. A six factor analysis showed the following themes:

- Factor 1: Optoelectronics
- Factor 2: Tribology
- Factor 3: Lithography
- Factor 4: Control Systems
- Factor 5: Devices
- Factor 6: Microsystems

The main non-medical Applications thrusts identified above were augmented by important, but non-networked thrusts, and the nine resulting themes were related to science and infrastructure by co-occurrence matrices. Also, the total non-medical Applications were combined into one unit, and related to science and infrastructure by co-occurrence matrices. For non-medical Applications:

- The USA leads in total Applications publications and in six out of nine themes in the high-tech research areas such as devices, sensors, and lithography. China leads in publications in three traditional area themes such as catalysis, tribology, and electrochemistry.
- In total Applications, two of the top three institutions are Chinese. However, the USA is well represented by the large University of California and University of Illinois state university systems.
- Applied Physics Letters appears in the top layer in seven of the nine themes and is by far the leader in total Applications publications. Journal of Physical Chemistry B appears in four of the nine themes, as does Journal of Applied Physics.
- For total Applications, the key underlying science areas include XRD, TEM, films, SEM, XPS, electron microscopy, AFM, fabrication, thickness, growth, hydrogen, substrate, carbon nanotubes,

microstructures, nanoparticles, particles, diameter, TiO2, deposits, coatings, electrodes, silicon, CO, infrared spectroscopy FTIR, electrons, biosensors, catalytic activity, oxidation, silica, thin films, nanotubes, silicon substrates, PL, photocatalytic activity, crystals, Raman spectroscopy, mechanical properties, particle sizes, proteins, catalysis, sol-gel, gold, storage, metals, optical properties, annealing, adsorption, platinum, polymer, corrosion, quantum dots.

- Instrumentation and the associated growth of nanostructures dominate the science efforts at present.

For medical Applications, analysis of nineteen thematic categories obtained from fuzzy clustering of the total 2005 nanotechnology database revealed the following:

- The USA is the publication leader in total Health types, and in all the thematic areas as well, most by a wide margin. China was the second most prolific in seven thematic areas, Japan in six, Germany in four, and England in two.
- The University of California system led in five clusters, the Chinese Academy of Science led in four, and the National University of Singapore led in three. The University of California and the Chinese Academy of Science were the most prolific in the non-medical Applications as well, but their orders were reversed. The National University of Singapore is a prolific contributor, especially in pharmaceuticals and biomaterials.
- The journal Langmuir contains the most articles in total Health, and is in the top layer of ten of nineteen themes. The only journals in common in the top layers of Applications and Health are Langmuir and Journal of Physical Chemistry B.
- For total Health, the key underlying science areas include cells, proteins, DNA, membranes, binding, drugs, fluorescence, peptides, nanoparticles, detection, lipids, antibodies, immobilization, tissues, receptors, enzymes, genes, drug delivery, self assembly, cell surface, detection limit, escherichia coli, amino acid, molecular weight, particle size, real time, serum albumin, drug release, cell line, cell adhesion, dna molecules, endothelial cells, surface plasmon resonance, atomic force microscopy, scanning electron microscopy, transmission electron microscopy, differential scanning calorimetry, x-ray photoelectron spectroscopy, bovine serum albumin, poly

ethylene glycol, single stranded dna, double stranded dna, green fluorescent protein, fourier transform infrared spectroscopy, quartz crystal microbalance, polymerase chain reaction, self assembled monolayer, magnetic resonance imaging, confocal laser scanning, dynamic light scattering, enzyme linked immunosorbent assay, resonance energy transfer, extracellular matrix, laser scanning microscopy, human serum albumin, and poly lactic acid.

Thus, the instrumentation and nanostructure growth science areas still play a key role, but unique health-related issues/ phraseology such as proteins, drugs, antibodies, bacteria, DNA, peptides, tissues, collagen, genes, etc, are strong science interests that focus on the unique aspects of Health nanotechnology research.

SUMMARY AND CONCLUSIONS

Overview

An extensive nanotechnology/ nanoscience-focused query (300+ terms) was applied to the SCI/ SSCI database. The nanotechnology/ nanoscience research literature technical structure (taxonomy) was obtained using computational linguistics, document clustering, and factor analysis. The nanotechnology/ nanoscience research literature infrastructure (prolific authors, key journals/ institutions/ countries, most cited authors/ journals/ documents) for each of the clusters generated by the document clustering algorithm was obtained using bibliometrics.

A novel addition was the use of phrase auto-correlation maps to show technical thrust areas based on phrase co-occurrence in Abstracts, and the use of phrase-phrase cross-correlation maps to show technical thrust areas based on phrase relations due to the sharing of common co-occurring phrases. The use of factor matrices quantified further the strength of the linkages among institutions and among countries, and validated the co-publishing networks shown graphically on the maps.

The ~400 most cited nanotechnology papers since 1991 were grouped, and their characteristics generated. This allowed the most cited papers' characteristics to be delineated from overall nanotechnology papers' characteristics.

The instrumentation literature associated with nanoscience and nanotechnology research was examined. About 65000 nanotechnology records for 2005 were retrieved from the Science Citation Index/ Social Science Citation Index (SCI/SSCI), and ~27000 of those were identified as instrumentation-related. All the diverse instruments were identified, and the relationships among the instruments, and among the instruments and the quantities they measure, were obtained. Metrics associated with research literatures for specific instruments/ instrument groups were generated.

The Applications literature associated with nanoscience and nanotechnology research was examined. Through visual inspection of 60000 of the Abstract phrases of the same downloaded 2005 records, all the diverse non-medical Applications were identified, and the relationships among the non-medical Applications, both direct and indirect, were obtained. Metrics associated with research literatures for specific Applications/ Applications groups were generated.

For medical Applications, a fuzzy clustering algorithm (where a record could be assigned to multiple clusters) was applied to the downloaded 2005 records. A sub-network that encompassed all the medical Applications was identified. Again, metrics associated with research literatures for specific medical applications were generated.

Results

1. INFRASTRUCTURE

1.1. Country Publications

- Global nanotechnology research article production has exhibited exponential growth for more than a decade.
- The most rapid growth over that time period has come from East Asian nations, notably China and South Korea.
- Some of this apparent rapid growth (in China for example) is partially due to 1) a country's researchers publishing a non-negligible fraction of total papers in domestic low Impact Factor journals, and 2) these journals being accessed recently by the SCI/ SSCI, rather than due to growth based on increased sponsorship or productivity.
- China's representation in high Impact Factor journals is small, but increasing
- From 1998 to 2002, China's ratio of high impact nanotechnology papers to total nanotechnology papers doubled, placing China at parity for this metric with the advanced nations of Japan, Italy, and Spain.
- The US remains the leader in aggregate nanotechnology research article production
- In some selected nanotechnology sub-areas, China has achieved parity or taken the lead.
- South Korea started even further behind than China in both total nanotechnology publications and highly cited papers, but they have advanced rapidly to become second-tier contenders in total and highly cited papers.

1.2. Country Citations

- There is a clear distinction between the publication practices of the three most prolific Western nations and the three most prolific East Asian nations. The Western nations publish in journals with almost twice the weighted average Impact Factors of the East Asian nations. Much of the difference stems from the East Asian nations publishing a non-negligible amount in domestic low Impact Factor journals, while the Western nations publish in higher Impact Factor international journals.
- Two countries that lead in production of the most cited nanotechnology papers are the US (126) and Germany (31). The US and Germany account for forty percent of the most cited nanotechnology papers
- The high paper volume production East Asian countries of China and South Korea account for two percent of the most cited nanotechnology papers.
- Despite the increased paper productivity from East Asian countries, the US continues to generate the most cited nanotechnology papers.

1.3. Institution and Journal Citations

- Of the thirty institutions publishing the most nanotechnology papers, four are from the US, whereas of the twenty-five institutions producing the most cited nanotechnology papers, twenty-one are in the US.
- The top-tier institutions producing cited papers are Harvard University (27), University of California Berkeley (23), Rice University (17), University of California Santa Barbara (16).
- The two journals that overwhelmingly contain the most cited nanotechnology papers since 1991 are Science (56) and Nature (37).

1.4. Country Collaborations

- The dominant country co-publishing network is a complex web of mainly European nations roughly following geographic lines: Nordic, Central Europe, Eastern Europe, and a Western Europe/ Latin

American group of Romance language nations. There is also a UK component country network, but it is not linked to the interconnected continental members of the European Union.

- Correlation of countries by common thematic interest shows two major poles: US and China. The US pole is strongly connected thematically to a densely connected network of English-speaking North American representatives, Western/ Central European nations, and most of the East Asian allies. China is relatively isolated except for India, and the Eastern European and Latin American representatives are outside the main network as well.

1.5. Institutional Collaborations

- The main institution co-publishing groups are East Asian: one each from China, Japan, and South Korea.
- Publication connectivity among institutions is much weaker than common interest or citation connectivity.
- Cross-Correlation of institutions by the journals they cite reveals four nationality-based (or locality-based) clusters: Chinese, Japanese, American, and European. Institutions from the same nationality group cite the same focused journals (primarily, but not exclusively, domestic).
- Cross-Correlation of institutions by documents they cite reveals ***only the Chinese institutions constitute a strongly-connected network***.

2. TECHNICAL STRUCTURE

The total retrieved nanotechnology database for 2005 was examined from four perspectives to identify pervasive thematic thrusts: document clustering, autocorrelation mapping, factor analysis, cross correlation mapping. Each perspective provided valuable insights on the fundamental nanotechnology literature structure.

2.1. Document Clustering

The database was divided into 256 thematic clusters by the clustering algorithm. The USA produced most papers in 169 thrusts, China led in 70, Japan led in 15, and India, South Korea, and Spain each led in one.

A hierarchical taxonomy was constructed from these 256 elemental clusters. Of the taxonomy's sixteen fourth level categories, China was the publication leader in six. Specifically, China led in: Properties of Thin Films; Diamond Films; Applications of Carbon Nanotubes; Multi-Walled Nanotubes; Nanomaterials and Nanoparticles; and Polymers, Composites, and Metal Complexes. Essentially, China led in the materials and nanostructures component of the database, whereas the USA led in the Physical Science phenomena and biomedical components.

2.2. Autocorrelation Analysis

A map of the thirty highest frequency technical phrases showed the nanotechnology database divided into two major thematic groups. One was focused on instrumentation, and the other on structures that the instruments measure. The largest structures network was Films (deposition, nucleation, growth, electrooptical properties, mechanical properties), and there were Nanoparticle, Crystal, and Nanocomposite sub-networks linked to the instrumentation core as well.

2.3. Factor Analysis

A factor matrix of the retrieved database showed seven major thematic groups: Instrumentation; Film Formation and Properties; Nanotubes and nanowires; Nanocomposite Mechanical Properties; Growth and Nucleation; Crystal Structure; and protein Adsorption.

2.4. Cross-Correlation Analysis

A phrase-phrase map showed the two main thematic thrusts of 1) instrumentation and the quantities they measure (particle size, crystal structure, grain size, electrical properties), and 2) films and their related phenomena (deposition, optical properties). In this structure, Atomic Force Microscopy is the only instrument located within the Film group.

3. INSTRUMENTATION

A wide variety of instruments are used in nanoscience and nanotechnology research. Key among these instruments are XRD, electron microscope variants, atomic force microscopy, scanning tunneling microscopy, and spectroscopy variants.

3.1. Measured Quantities

Key materials, properties, phenomena, and nanostructures measured by the leading instruments are as follows:

- Materials: TiO2, Ti, Si, SiO2, and polymers
- Properties: Morphology/ surface morphology, thickness/diameter/particle size, surface roughness/surface area, mechanical properties/optical properties/thermal properties, crystal structure/crystallinity
- Phenomena: Deposition, oxidation, crystallization, catalytic activity, nucleation, adsorption, polymerization, adhesion, decomposition/ degradation
- Thin films, nanocomposites, nanowires, nanotubes, monolayers/self-assembled monolayers

3.2. Instrument Correlations

Key findings from the instrumentation correlation maps are as follows:

- Instrumentation auto-correlation map showed that the main network is in x-ray diffraction and electron microscopy. This is an indication that a well-equipped chemistry and/or material science laboratory usually contains a variety of instruments for characterizing various material properties. The instrument factor matrix showed similar grouping of a diversity of instruments in the same laboratory.
- Instrumentation-materials cross-correlation map showed that the main group consisted of electron microscopes and variants. Many of the instruments are used to characterize materials of interest to semiconductor and microelectronics research.
- Similarly the instrumentation-properties cross-correlation map is focused mostly on the electronic properties of materials of interest to microelectronics research such as electron microscopy and atomic force microscopy.
- Same instruments are used to investigate the growth and fabrication phenonema in the instrumentation-phenomena cross-correlation map.
- Because of the dominance of nanoelectronics research, many nanostructures are focused on electronic applications and thus the Instrumentation-nanostructures cross-correlation map also showed the emphasis on instruments for characterizing the electronic structures.

3.3. Instrument Taxonomy

The hierarchical taxonomy offered the following insights:

- In this nanotechnology instrumentation study, ***China produced about 25% more papers than the USA***. By contrast, in the full nanotechnology study, ***the USA produced about 25% more papers than China.***
- Much of China's over-production occurred in the XRD-related categories, but there was some over-production in the transmission electron microscopy and NMR-calorimetry related categories as well.
- USA dominance appears to be in atomic force microscopy areas
- Because of the large Chinese and South Korean contributions to the nanotechnology instrumentation literature, author name analysis at aggregate levels is not effective; these Asian names are usually monosyllable, many times with no middle names. Due to the relatively high frequency of paper publications, there is good possibility that the same last name represents multiple authors. Potential name disambiguation is under study.
- Even though the USA has a large presence overall, relatively few USA institutions are listed among the most prolific in the nanotechnology instrumentation papers. The Asian and European efforts appear concentrated in relatively few but large institutions.

4. APPLICATIONS

The studies also identified the main nanotechnology Applications, both medical and non-medical, as well as the related science and infrastructure. These relationships will allow the potential user communities to become involved with the Applications-related science and performers at the earliest stages, to help guide the science conversion towards specific user needs most efficiently.

4.1. Non-Medical Applications

Related Science – Most Frequently Mentioned Non-medical Applications

The pervasive materials, materials properties, phenomena, and nanostructures related to the ***most frequently mentioned*** non-medical nanotechnology Applications were identified, as follows:

- *TiO2, Pt, Si, gold, and polymers tend to stand out as the most pervasive material types*
- *Morphology, thickness /diameter/particle size, optical properties, catalytic performance, and electrochemical properties tend to stand out as the most pervasive material properties*
- *Deposition, absorption, oxidation, immobilization, catalysis, degradation, and self-assembly tend to stand out as the most pervasive nanoscale phenomena*
- *Thin films, nanowires, nanotubes (especially carbon), and self-assembled monolayers tend to stand out as the most pervasive nanostructures*

Applications Thrust Areas – Auto-Correlation

Maps were constructed to show groupings of related non-medical Applications into broader thematic areas. An autocorrelation map of the most widely referenced non-medical Applications showed five weakly-connected sub-networks:

- Electronic Devices and Components
- Optical Switching
- Tribology and Corrosion
- Optoelectronic Sensors
- Electrochemical Conversion and Catalysis

Applications Thrust Areas – Factor Analysis

Factor analyses were performed to show non-medical Applications thematic areas from a slightly different perspective. A six factor analysis showed the following themes:

- Factor 1: Optoelectronics
- Factor 2: Tribology
- Factor 3: Lithography
- Factor 4: Control Systems

- Factor 5: Devices
- Factor 6: Microsystems

Applications Thrust Areas – Factor Analysis and Visual Inspection

The main non-medical Applications thrusts identified above were augmented by important, but non-networked thrusts, and the nine resulting themes were related to science and infrastructure by co-occurrence matrices. Also, the total non-medical Applications were combined into one unit, and related to science and infrastructure by co-occurrence matrices. For non-medical Applications:

- The USA leads in total non-medical Applications publications and in six out of nine themes in the high-tech research areas such as devices, sensors, and lithography. China leads in publications in three traditional area themes such as catalysis, tribology, and electrochemistry.
- In total non-medical Applications, two of the top three institutions are Chinese. However, the USA is well represented by the large University of California and University of Illinois state university systems.
- Applied Physics Letters appears in the top layer in seven of the nine themes and is by far the leader in total non-medical Applications publications. Journal of Physical Chemistry B appears in four of the nine themes, as does Journal of Applied Physics.
- For total non-medical Applications, the key underlying science areas include XRD, TEM, films, SEM, XPS, electron microscopy, AFM, fabrication, thickness, growth, hydrogen, substrate, carbon nanotubes, microstructures, nanoparticles, particles, diameter, TiO_2, deposits, coatings, electrodes, silicon, CO, infrared spectroscopy FTIR, electrons, biosensors, catalytic activity, oxidation, silica, thin films, nanotubes, silicon substrates, PL, photocatalytic activity, crystals, Raman spectroscopy, mechanical properties, particle sizes, proteins, catalysis, sol-gel, gold, storage, metals, optical properties, annealing, adsorption, platinum, polymer, corrosion, quantum dots. Instrumentation and the associated growth of nanostructures dominate the science efforts at present.

4.2. Medical Applications

Related Science – Most Frequently Mentioned Medical Applications

The pervasive instrumentation, materials, structures, and phenomena related to the most frequently mentioned nanotechnology medical applications were identified, as follows:

- Instrumentation: *surface plasmon resonance, atomic force microscopy, scanning electron microscopy, transmission electron microscopy, differential scanning calorimetry, x-ray photoelectron spectroscopy, fourier transform infrared spectroscopy, quartz crystal microbalance, magnetic resonance imaging, confocal laser scanning, enzyme linked immunosorbent assay, laser scanning microscopy, x-ray diffraction, mass spectrometry.*

- Materials: *protein, DNA, peptides, drugs, bovine serum albumin, poly ethylene glycol, single stranded DNA, double stranded DNA, green fluorescent protein, lipids, human serum albumin, Escherichia Coli, antibodies, tissues, enzymes, genes, oligonucleotides, gold, nucleic acid.*

- Structures: *cells, membranes, surfaces, nanoparticles, self-assembled monolayers, cell surfaces, endothelial cells, receptors*

- Phenomena: *fluorescence, interaction, polymerase chain reaction, dynamic light scattering, resonance energy transfer, particle size, drug release, cell adhesion, binding, affinity, gene expression, transfection efficiency*

Applications Thrust Areas – Visual Inspection

A medical Applications categorization constructed from visual inspection of the fuzzy clustering categories showed five thematic categories:

- Cancer Treatment
- Sensing and Detection
- Cells
- Proteins
- DNA

Applications Thrust Areas – Fuzzy Clustering

For medical Applications, analysis of nineteen thematic categories obtained from fuzzy clustering of the total 2005 nanotechnology database revealed the following:

- The USA is the publication leader in total Health types, and in all the thematic areas as well, most by a wide margin. China was the second most prolific in seven thematic areas, Japan in six, Germany in four, and England in two.
- The University of California system led in five clusters, the Chinese Academy of Science led in four, and the National University of Singapore led in three. The University of California and the Chinese Academy of Science were the most prolific in the non-medical Applications as well, but their orders were reversed. The National University of Singapore is a prolific contributor, especially in pharmaceuticals and biomaterials.
- The journal Langmuir contains the most articles in total Health, and is in the top layer of ten of nineteen themes. The only journals in common in the top layers of Applications and Health are Langmuir and Journal of Physical Chemistry B.
- For total medical applications, the key underlying science areas include cells, proteins, DNA, membranes, binding, drugs, fluorescence, peptides, nanoparticles, detection, lipids, antibodies, immobilization, tissues, receptors, enzymes, genes, drug delivery, self assembly, cell surface, detection limit, escherichia coli, amino acid, molecular weight, particle size, real time, serum albumin, drug release, cell line, cell adhesion, DNA molecules, endothelial cells, surface plasmon resonance, atomic force microscopy, scanning electron microscopy, transmission electron microscopy, differential scanning calorimetry, x-ray photoelectron spectroscopy, bovine serum albumin, poly ethylene glycol, single stranded DNA, double stranded DNA, green fluorescent protein, fourier transform infrared spectroscopy, quartz crystal microbalance, polymerase chain reaction, self assembled monolayer, magnetic resonance imaging, confocal laser scanning, dynamic light scattering, enzyme linked immunosorbent assay, resonance energy transfer, extracellular matrix, laser scanning microscopy, human serum albumin, and poly lactic acid.

Thus, the instrumentation and nanostructure growth science areas still play a key role, but unique health-related issues/ phraseology such as proteins, drugs, antibodies, bacteria, DNA, peptides, tissues, collagen, genes, etc, are strong science interests that focus on the unique aspects of nanotechnology medical research.

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APPENDICES

APPENDIX 1 - THE SEMINAL LITERATURE OF NANOSCIENCE/ NANOTECHNOLOGY RESEARCH
(SCI DATABASE ONLY)

BACKGROUND

The global nanotechnology research literature has two main components: spatial and temporal. The spatial component covers present-day nanotechnology research being conducted globally. Most of the main body of this report uses the literature analysis technique of text mining to assess the characteristics of (mainly) the existing global nanotechnology literature. This is a quantity-based approach, which reflects the volume of literature production.

The present Appendix examines the temporal component. It uses complementary text mining techniques to identify and retrieve the high impact (seminal) nanotechnology literature over a span of time. This can be viewed as a quality-based approach, which reflects the impact the vintage literature has had on modern day nanotechnology research.

Both the temporal and spatial components need to be understood for full comprehension of global nanotechnology research, and for the establishment of strategic nanotechnology policy. Assessment tools and processes have advanced sufficiently to allow an integrated picture of nanotechnology to be obtained.

Two main approaches to identifying seminal nanotechnology documents are shown in this Appendix. The first approach (Section 1.1) examines all the references in the 64737 record retrieved 2005 nanotechnology database, then extracts the highest frequency references using our Citation-Assisted Background (CAB) approach. These references will include both nanotechnology documents as well as non-nanotechnology documents. The second approach (Section 1.2) examines all the nanotechnology documents published between 1991 and 2005, extracts the sub-set with the highest number of citations, and performs a text mining analysis of that sub-set to obtain characteristics of the most cited nanotechnology documents. While there will obviously be some overlap between the documents identified in both approaches, there are some substantial differences.

Section 1.3 provides additional perspectives on the most cited nanotechnology documents literature. In particular, it identifies the relationship between document production and seminal paper production for countries and institutions. For the USA, an important finding is identification of the core institutions that are producing the bulk of the seminal documents. For other countries, their seminal paper production is more closely normalized to their total nanotechnology paper production.

1.1. Seminal Nanoscience/ Nanotechnology Literature Determination using Citation-Assisted Background (CAB)

INTRODUCTION

Research is a method of systematically exploring the unknown to acquire knowledge and understanding. Efficient research requires awareness of all prior research and technology that could impact the research topic of interest, and builds upon these past advances to create discovery and new advances. The importance of this awareness of prior art is recognized throughout the research community. It is expressed in diverse ways, including requirements for Background sections in journal research articles, invited literature surveys in targeted research areas, and required descriptions of prior art in patent applications.

For the most part, development of Background material for any of the above applications is relatively slow and labor intensive, and limited in scope. Background material development usually involves some combination of manually sifting through outputs of massive computer searches, manually tracking references through multiple generations, and searching one's own records for personal references. The few studies that have been done on the adequacy of Background material in documents show that only a modest fraction of relevant material is included (e.g., MacRoberts and MacRoberts, 1989, 1996; Liu, 1993).

Typically missing from standard Background section or review article development, as well as in the specific examples cited above, is a systematic approach for identifying the key documents and events that provided the groundwork for the research topic of interest. The present section presents such a systematic approach for identifying the key documents, called Citation-Assisted Background (CAB), and applies it to the area of nanotechnology research.

For nanotechnology specifically, the burgeoning global interest has been accompanied by numerous surveys and reviews of the technical literature. There are numerous books (e.g., Bhushan's Handbook of Nanotechnology [Bhushan, 2004]; Goddard's Handbook on Nanoscience, Engineering, and Technology [Goddard, 2002]; Freitas' multi-volume set on nanomedicine [Freitas, 1999, 2003]; see Appendix 1A for more complete listing of Reference Books), review articles (e.g., Kricka's multi-lingual survey of nanotechnology books and patents [Kricka and Fortina, 2002]; Simon's review of the science and potential applications of nanotechnology [Simon, 2005]), and reports (e.g., The Royal Society's comprehensive review on nanoscience and nanotechnologies [Dowling et al, 2004]; Colton's in-depth review of nanoscale measurements and manipulation [Colton, 2004]) that cover various sub-sets of nanotechnology.

Every published research review on nanotechnology typically covers a limited subset of the technology rather than the total discipline. None of these published reviews has the spatial and temporal breadth of coverage of the present Appendix, none uses a query of the extent and complexity of the present Appendix, and none uses the systematic approach described here to insure that all highly cited articles related to the discipline of interest are identified. In the present Appendix, we describe a systematic approach to insure that all highly cited seminal articles related to nanotechnology are identified.

CONCEPT DESCRIPTION

The CAB concept (Kostoff and Shlesinger, 2005b) identifies the seminal Background documents for a research area using citation analysis. CAB rests on the assumption that a seminal document for a specific research area will typically have been referenced positively by a substantial number of people who are <u>active researchers in that specific area</u>. Implementation of the CAB concept then requires the following steps:

- The research area of interest must be defined clearly
- The documents that define the area of interest must be identified and retrieved
- The references most frequently used in these documents must be identified and selected

- These critical references must be analyzed, and integrated in a cohesive narrative manner to form a comprehensive Background section or separate literature survey

These required steps are achieved in the following manner.

1. The research topic of interest is defined clearly by the researchers who are documenting their study results. In our present text mining study of nanotechnology, the topical area was defined to include development and use of techniques to study physical phenomena and construct structures in the physical size range of 1-100 nanometers (nm), as well as the incorporation of these structures into applications.
2. The topical definition is sharpened further by the development of a literature retrieval query. In the nanotechnology text mining study, the literature retrieval query was based on 300+ search terms (Appendix 2).
3. The query is entered into a database search engine, and documents relevant to the topic are retrieved. In the present nanotechnology text mining study, 64737 documents were retrieved from the Web version of the SCI/ SSCI for the year 2005. The SCI/ SSCI was used because it is the only major research database to contain references in a readily extractable format.
4. These documents are combined to create a separate database, and all the references contained in these documents are extracted. Identical references are combined, the number of occurrences of each reference is tabulated, and a table of references and their occurrence frequencies is constructed. In the present nanotechnology text mining study, >900,000 references were extracted and tabulated. Table A1-1 contains the ten highest frequency (most cited) references extracted from the nanotechnology database.

TABLE A1-1 – MOST HIGHLY CITED DOCUMENTS (by 64737 retrieved 2005 nanotechnology records)

FIRST AUTHOR	YEAR	SOURCE	VOL	PAGE	# CITES
IIJIMA S	1991	NATURE	V354	P56	1463
SHELDRICK GM	1997				803
KRESGE CT	1992	NATURE	V359	P710	517
HUANG MH	2001	SCIENCE	V292	P1897	453
ALIVISATOS AP	1996	SCIENCE	V271	P933	443
XIA YN	2003	ADV MATER	V15	P353	430
PAN ZW	2001	SCIENCE	V291	P1947	388

Two frequencies are computed for each reference, but only the first is shown in Table A1-1. The frequency shown in the rightmost column is the number of times each reference was cited by the 64737 records in the retrieved database only. This number reflects the importance of a given reference to the specific discipline of nanotechnology. The second frequency number (not shown) is the total number of citations the reference received from all sources in all years after publication, and reflects the importance of a given reference to all the fields of science that cited the reference. This second number is obtained from the citation field or citation window in the SCI. In CAB, only the first frequency is used, since it is topic-specific. Using the first discipline-specific frequency number obviates the need to normalize citation frequencies for different disciplines (due to different levels of activity in different disciplines), as would be the case if total citation frequencies were used to determine the ordering of the references.

CONCEPT IMPLEMENTATION

To identify the total candidate references for the Background section, a table similar in structure to Table A1-1, but containing all the references from the retrieved records, is constructed. A threshold frequency for selection can be determined by arbitrary inspection (e. g., a Background section consisting of 150 key references is arbitrarily selected). The first author has found a dynamic selection process more useful. In this dynamic process, references are selected, analyzed, and grouped based on their order in the citation frequency table until the resulting Background is judged sufficiently complete by the Background developers.

To insure that the influential documents published both long ago and very recently are included, the following total process is used. The reference frequency table is ordered by inverse frequency, as above, and a high value of the selection frequency threshold is selected initially. Documents with citations above this frequency are tagged. Then, the table is re-ordered chronologically. The early historical documents with citation frequencies substantially larger than those of their contemporaries are selected, as are the extremely recent documents with citation frequencies substantially larger than those of their contemporaries. By contemporaries, it is meant documents published in the same time frame, not limited to the same year (see next paragraph for examples of how we implement 'same time frame').

Then, the dynamic selection process defined above is applied to the early historical references, the intermediate time references (those falling under the high frequency threshold), and the extremely recent references (approximately two years or less).

Table A1-2 contains the final references selected for the nanotechnology Background survey. The first reference listed, Young's 1805 paper, had many more citations (twelve) than any reference paper published in the 1800s, up to Faraday's paper in 1857. In turn, Faraday's paper had many more citations (28) than any published previously, or those published until Wulff's paper in 1901. This is a graphic example of how we interpret a paper's having substantially more citations than its contemporaries. We do not constrain ourselves with a numerical threshold, but rather interpret the total citation pattern within a given time frame.

TABLE A1-2 – SEMINAL DOCUMENTS SELECTED FOR INCLUSION IN BACKGROUND (updated for 2005 records)

FIRST AUTHOR	YEAR	SOURCE	VOL	PAGE	# CITES
YOUNG T	1805	PHILOS T R SOC LONDO	V95	P65	12
FARADAY M	1857	PHILOS T ROY SOC LON	V147	P145	28
HERTZ H	1881	J REINE ANGEWANDTE M	V92	P156	27
LAMB H	1882	P LOND MATH SOC	V13	P189	20
WULFF G	1901	Z KRISTALLOGR	V34	P449	30
MAXWELLGARNETT JC	1904	PHILOS T ROY SOC LON	V203	P385	36
EINSTEIN A	1905	ANN PHYS-BERLIN	V17	P549	26
MIE G	1908	ANN PHYS-BERLIN	V25	P377	114
STONEY GG	1909	P R SOC LOND A-CONTA	V82	P172	72
SCHERRER P	1918	GOTTINGER NACHRICHTE	V2	P98	39
FOWLER RH	1928	P R SOC LOND A-CONTA	V119	P173	88
FOCK V	1928	Z PHYS	V47	P446	31
DARWIN CG	1930	P CAMBRIDGE PHILOS S	V27	P86	23
KUBELKA P	1931	Z TECH PHYS	V12	P593	25
FORMHALS A	1934	1975504	US		28
BRUGGEMAN DAG	1935	ANN PHYS-BERLIN	V24	P636	69
WENZEL RN	1936	IND ENG CHEM	V28	P988	69
BRUNAUER S	1938	J AM CHEM SOC	V60	P309	166
AVRAMI M	1939	J CHEM PHYS	V7	P1103	61
AVRAMI M	1940	J CHEM PHYS	V8	P212	43
BRUNAUER S	1940	J AM CHEM SOC	V62	P1723	35
AVRAMI M	1941	J CHEM PHYS	V9	P177	45
CASSIE ABD	1944	T FARADAY SOC	V40	P546	49
STONER EC	1948	PHILOS T ROY SOC A	V240	P599	84
NEEL L	1949	ANN GEOPHYS	V5	P99	64
BARRETT EP	1951	J AM CHEM SOC	V73	P373	162

TURKEVICH J	1951	DISCUSS FARADAY SOC	P55		72
LOWRY OH	1951	J BIOL CHEM	V193	P265	58
HALL EO	1951	P PHYS SOC B	V64	P747	52
WILLIAMSON GK	1953	ACTA METALL	V1	P22	77
FLORY PJ	1953	PRINCIPLES POLYM CHE			67
PETCH NJ	1953	J IRON STEEL I	V174	P25	55
METROPOLIS N	1953	J CHEM PHYS	V21	P1087	52
PARRATT LG	1954	PHYS REV	V95	P359	91
DRESSELHAUS G	1955	PHYS REV	V100	P580	70
LANDAUER R	1957	IBM J RES DEV	V1	P223	71
KISSINGER HE	1957	ANAL CHEM	V29	P1702	64
SAUERBREY G	1959	Z PHYS	V155	P206	118
FANO U	1961	PHYS REV	V124	P1866	68
WAGNER RS	1964	APPL PHYS LETT	V4	P89	177
HOHENBERG P	1964	PHYS REV B	V136	P864	175
BONDI A	1964	J PHYS CHEM-US	V68	P441	99
KOHN W	1965	PHYS REV	V140	P1133	194
SNEDDON IN	1965	INT J ENG SCI	V3	P47	68
STOBER W	1968	J COLLOID INTERF SCI	V26	P62	168
RIETVELD HM	1969	J APPL CRYSTALLOGR	V2	P65	80
TUINSTRA F	1970	J CHEM PHYS	V53	P1126	130
LAEMMLI UK	1970	NATURE	V227	P680	100
JOHNSON KL	1971	P ROY SOC LOND A MAT	V324	P301	86
FUJISHIMA A	1972	NATURE	V238	P37	183
JOHNSON PB	1972	PHYS REV B	V6	P4370	149
SHIRLEY DA	1972	PHYS REV B	V5	P4709	93
FRENS G	1973	NATURE-PHYS SCI	V241	P20	98
KLUG HP	1974	XRAY DIFFRACTION PRO			184
AVIRAM A	1974	CHEM PHYS LETT	V29	P277	102
MATTHEWS JW	1974	J CRYST GROWTH	V27	P118	76
SHANNON RD	1976	ACTA CRYSTALLOGR A	V32	P751	298
MONKHORST HJ	1976	PHYS REV B	V13	P5188	148
BRADFORD MM	1976	ANAL BIOCHEM	V72	P248	91
BUFFAT P	1976	PHYS REV A	V13	P2287	88
ASHCROFT NW	1976	SOLID STATE PHYS			84
SCOFIELD JH	1976	J ELECTRON SPECTROSC	V8	P129	78
CULLITY BD	1978	ELEMENTS XRAY DIFFRA			225
ILER RK	1979	CHEM SILICA			90
WAGNER CD	1979	HDB XRAY PHOTOELECTR			89
CEPERLEY DM	1980	PHYS REV LETT	V45	P566	88
BARD AJ	1980	ELECTROCHEMICAL METH			84
SZE SM	1981	PHYS SEMICONDUCTOR D			232
PERDEW JP	1981	PHYS REV B	V23	P5048	144
GREGG SJ	1982	ADSORPTION SURFACE A			142
ARAKAWA Y	1982	APPL PHYS LETT	V40	P939	123
LEE PC	1982	J PHYS CHEM-US	V86	P3391	88
BOHREN CF	1983	ABSORPTION SCATTERIN			173
BRUS LE	1984	J CHEM PHYS	V80	P4403	102
SING KSW	1985	PURE APPL CHEM	V57	P603	202
KROTO HW	1985	NATURE	V318	P162	172

MOSKOVITS M	1985	REV MOD PHYS	V57	P783	128
ZIEGLER JF	1985	STOPPING RANGE IONS			124
PALIK ED	1985	HDB OPTICAL CONSTANT			118
BINNIG G	1986	PHYS REV LETT	V56	P930	271
BRUS L	1986	J PHYS CHEM-US	V90	P2555	91
YABLONOVITCH E	1987	PHYS REV LETT	V58	P2059	170
TANG CW	1987	APPL PHYS LETT	V51	P913	154
ALLEN MP	1987	COMPUTER SIMULATION			138
PORTER MD	1987	J AM CHEM SOC	V109	P3559	118
JOHN S	1987	PHYS REV LETT	V58	P2486	107
LEE C	1988	PHYS REV B	V37	P785	240
BECKE AD	1988	PHYS REV A	V38	P3098	157
RAETHER H	1988	SURFACE PLASMONS SMO			100
BAIBICH MN	1988	PHYS REV LETT	V61	P2472	96
BAIN CD	1989	J AM CHEM SOC	V111	P321	126
HENGLEIN A	1989	CHEM REV	V89	P1861	114
GLEITER H	1989	PROG MATER SCI	V33	P223	107
BRINKER CJ	1990	SOL GEL SCI PHYS CHE			250
VANDERBILT D	1990	PHYS REV B	V41	P7892	218
CANHAM LT	1990	APPL PHYS LETT	V57	P1046	198
BURROUGHES JH	1990	NATURE	V347	P539	169
SHELDRICK GM	1990	ACTA CRYSTALLOGR A	V46	P467	153
DATTA S	1990	APPL PHYS LETT	V56	P665	122
IIJIMA S	1991	NATURE	V354	P56	1463
OREGAN B	1991	NATURE	V353	P737	326
ISRAELACHVILI JN	1991	INTERMOLECULAR SURFA			268
ULMAN A	1991	INTRO ULTRATHIN ORGA			222
TROULLIER N	1991	PHYS REV B	V43	P1993	158
KRESGE CT	1992	NATURE	V359	P710	517
OLIVER WC	1992	J MATER RES	V7	P1564	387
BECK JS	1992	J AM CHEM SOC	V114	P10834	379
MOULDER JF	1992	HDB XRAY PHOTOELECTR			170
PERDEW JP	1992	PHYS REV B	V46	P6671	146
HAMADA N	1992	PHYS REV LETT	V68	P1579	141
PERDEW JP	1992	PHYS REV B	V45	P13244	135
PAYNE MC	1992	REV MOD PHYS	V64	P1045	101
MINTMIRE JW	1992	PHYS REV LETT	V68	P631	100
MURRAY CB	1993	J AM CHEM SOC	V115	P8706	327
BECKE AD	1993	J CHEM PHYS	V98	P5648	256
IIJIMA S	1993	NATURE	V363	P603	242
USUKI A	1993	J MATER RES	V8	P1179	198
KOJIMA Y	1993	J MATER RES	V8	P1185	158
KRESSE G	1993	PHYS REV B	V47	P558	142
NAZEERUDDIN MK	1993	J AM CHEM SOC	V115	P6382	137
BETHUNE DS	1993	NATURE	V363	P605	122
BRUST M	1994	J CHEM SOC CHEM COMM	P801		243
MARTIN CR	1994	SCIENCE	V266	P1961	239
COLVIN VL	1994	NATURE	V370	P354	123
HOFFMANN MR	1995	CHEM REV	V95	P69	250

KREIBIG U	1995	OPTICAL PROPERTIES M			227
MASUDA H	1995	SCIENCE	V268	P1466	210
LEHN JM	1995	SUPRAMOLECULAR CHEM			204
DEHEER WA	1995	SCIENCE	V270	P1179	172
LINSEBIGLER AL	1995	CHEM REV	V95	P735	164
HAGFELDT A	1995	CHEM REV	V95	P49	160
DATTA S	1995	ELECT TRANSPORT MESO			159
CHOPRA NG	1995	SCIENCE	V269	P966	114
JOANNOPOULOS JD	1995	PHOTONIC CRYSTALS MO			105
YU G	1995	SCIENCE	V270	P1789	104
ALIVISATOS AP	1996	SCIENCE	V271	P933	443
ULMAN A	1996	CHEM REV	V96	P1533	332
PERDEW JP	1996	PHYS REV LETT	V77	P3865	275
THESS A	1996	SCIENCE	V273	P483	234
MIRKIN CA	1996	NATURE	V382	P607	212
GIANNELIS EP	1996	ADV MATER	V8	P29	199
KRESSE G	1996	PHYS REV B	V54	P11169	196
DRESSELHAUS MS	1996	SCI FULLERENES CARBO			181
TREACY MMJ	1996	NATURE	V381	P678	167
ALIVISATOS AP	1996	J PHYS CHEM-US	V100	P13226	163
VANHEUSDEN K	1996	J APPL PHYS	V79	P7983	144
KRESSE G	1996	COMP MATER SCI	V6	P15	141
DAI HJ	1996	NATURE	V384	P147	117
ALIVISATOS AP	1996	NATURE	V382	P609	115
HINES MA	1996	J PHYS CHEM-US	V100	P468	114
AHMADI TS	1996	SCIENCE	V272	P1924	110
YAKOBSON BI	1996	PHYS REV LETT	V76	P2511	108
RENEKER DH	1996	NANOTECHNOLOGY	V7	P216	104
MULVANEY P	1996	LANGMUIR	V12	P788	101
SHELDRICK GM	1997	SHELX-97			803
DECHER G	1997	SCIENCE	V277	P1232	277
NIE SM	1997	SCIENCE	V275	P1102	196
REED MA	1997	SCIENCE	V278	P252	175
WONG EW	1997	SCIENCE	V277	P1971	175
DILLON AC	1997	NATURE	V386	P377	169
OTWINOWSKI Z	1997	METHOD ENZYMOL	V276	P307	164
ELGHANIAN R	1997	SCIENCE	V277	P1078	155
TANS SJ	1997	NATURE	V386	P474	148
HARUTA M	1997	CATAL TODAY	V36	P153	146
DABBOUSI BO	1997	J PHYS CHEM B	V101	P9463	139
RAO AM	1997	SCIENCE	V275	P187	138
CORMA A	1997	CHEM REV	V97	P2373	133
JOURNET C	1997	NATURE	V388	P756	129
BAGNALL DM	1997	APPL PHYS LETT	V70	P2230	122
KNEIPP K	1997	PHYS REV LETT	V78	P1667	121
KAWASUMI M	1997	MACROMOLECULES	V30	P6333	115
HAN WQ	1997	SCIENCE	V277	P1287	112
NAKAMURA S	1997	BLUE LASER DIODE			109
PENG XG	1997	J AM CHEM SOC	V119	P7019	101

SAITO R	1998	PHYS PROPERTIES CARB			334
BRUCHEZ M	1998	SCIENCE	V281	P2013	325
TANS SJ	1998	NATURE	V393	P49	284
CHAN WCW	1998	SCIENCE	V281	P2016	283
ZHAO DY	1998	SCIENCE	V279	P548	283
MORALES AM	1998	SCIENCE	V279	P208	265
LOSS D	1998	PHYS REV A	V57	P120	203
ZHAO DY	1998	J AM CHEM SOC	V120	P6024	195
XIA Y	1998	ANGEW CHEM INT EDIT	V37	P550	192
FRISCH MJ	1998	GAUSSIAN 98 REVISION			178
CARUSO F	1998	SCIENCE	V282	P1111	172
VALDEN M	1998	SCIENCE	V281	P1647	168
REN ZF	1998	SCIENCE	V282	P1105	163
LIU J	1998	SCIENCE	V280	P1253	162
CHEN J	1998	SCIENCE	V282	P95	161
PRINZ GA	1998	SCIENCE	V282	P1660	140
MARTEL R	1998	APPL PHYS LETT	V73	P2447	139
BRAUN E	1998	NATURE	V391	P775	136
WILDOER JWG	1998	NATURE	V391	P59	120
STORHOFF JJ	1998	J AM CHEM SOC	V120	P1959	117
KANE BE	1998	NATURE	V393	P133	108
EBBESEN TW	1998	NATURE	V391	P667	106
ODOM TW	1998	NATURE	V391	P62	104
YANG PD	1998	NATURE	V396	P152	104
FRANK S	1998	SCIENCE	V280	P1744	103
OHNO H	1998	SCIENCE	V281	P951	102
HU JT	1999	ACCOUNTS CHEM RES	V32	P435	240
FAN SS	1999	SCIENCE	V283	P512	167
CHEN J	1999	SCIENCE	V286	P1550	142
AJAYAN PM	1999	CHEM REV	V99	P1787	135
PINER RD	1999	SCIENCE	V283	P661	135
LEBARON PC	1999	APPL CLAY SCI	V15	P11	130
YAO Z	1999	NATURE	V402	P273	123
RYOO R	1999	J PHYS CHEM B	V103	P7743	122
FRIEND RH	1999	NATURE	V397	P121	119
BIMBERG D	1999	QUANTUM DOT HETEROST			114
KATAURA H	1999	SYNTHETIC MET	V103	P2555	113
LIU C	1999	SCIENCE	V286	P1127	107
YING JY	1999	ANGEW CHEM INT EDIT	V38	P56	103
FARRUGIA LJ	1999	J APPL CRYSTALLOGR	V32	P837	100
SUN SH	2000	SCIENCE	V287	P1989	337
ALEXANDRE M	2000	MAT SCI ENG R	V28	P1	258
KONG J	2000	SCIENCE	V287	P622	251
PENG XG	2000	NATURE	V404	P59	203
TEMPLETON AC	2000	ACCOUNTS CHEM RES	V33	P27	148
MURRAY CB	2000	ANNU REV MATER SCI	V30	P545	145
DIETL T	2000	SCIENCE	V287	P1019	143
JOACHIM C	2000	NATURE	V408	P541	141
TATON TA	2000	SCIENCE	V289	P1757	125
FERRARI AC	2000	PHYS REV B	V61	P14095	120

COLLINS PG	2000	SCIENCE	V287	P1801	118
THURNALBRECHT T	2000	SCIENCE	V290	P2126	116
FUJISHIMA A	2000	J PHOTOCH PHOTOBIO C	V1	P1	112
DUAN XF	2000	ADV MATER	V12	P298	111
SHIPWAY AN	2000	CHEMPHYSCHEM	V1	P18	106
MANNA L	2000	J AM CHEM SOC	V122	P12700	105
PARK H	2000	NATURE	V407	P57	101
QIAN D	2000	APPL PHYS LETT	V76	P2868	101
SCHREIBER F	2000	PROG SURF SCI	V65	P151	100
HUANG MH	2001	SCIENCE	V292	P1897	453
PAN ZW	2001	SCIENCE	V291	P1947	388
WOLF SA	2001	SCIENCE	V294	P1488	249
WILK GD	2001	J APPL PHYS	V89	P5243	218
CUI Y	2001	SCIENCE	V293	P1289	193
DUAN XF	2001	NATURE	V409	P66	190
HUANG MH	2001	ADV MATER	V13	P113	162
PUNTES VF	2001	SCIENCE	V291	P2115	162
BACHTOLD A	2001	SCIENCE	V294	P1317	157
CUI Y	2001	SCIENCE	V291	P851	153
JIN RC	2001	SCIENCE	V294	P1901	149
DRESSELHAUS MS	2001	CARBON NANOTUBES SYN			149
CARUSO F	2001	ADV MATER	V13	P11	142
NIEMEYER CM	2001	ANGEW CHEM INT EDIT	V40	P4128	139
GRATZEL M	2001	NATURE	V414	P338	130
HUANG Y	2001	SCIENCE	V294	P1313	127
THOSTENSON ET	2001	COMPOS SCI TECHNOL	V61	P1899	119
CHEN RJ	2001	J AM CHEM SOC	V123	P3838	112
MATYJASZEWSKI K	2001	CHEM REV	V101	P2921	111
VURGAFTMAN I	2001	J APPL PHYS 1	V89	P5815	109
ELSAYED MA	2001	ACCOUNTS CHEM RES	V34	P257	107
HAN MY	2001	NAT BIOTECHNOL	V19	P631	106
SURYANARAYANA C	2001	PROG MATER SCI	V46	P1	102
BAUGHMAN RH	2002	SCIENCE	V297	P787	292
OCONNELL MJ	2002	SCIENCE	V297	P593	174
SUN YG	2002	SCIENCE	V298	P2176	171
HUYNH WU	2002	SCIENCE	V295	P2425	170
BACHILO SM	2002	SCIENCE	V298	P2361	141
DUBERTRET B	2002	SCIENCE	V298	P1759	133
GUDIKSEN MS	2002	NATURE	V415	P617	129
PARK J	2002	NATURE	V417	P722	127
WHITESIDES GM	2002	SCIENCE	V295	P2418	109
AWSCHALOM DD	2002	SEMICONDUCTOR SPINTR			108
HIRSCH A	2002	ANGEW CHEM INT EDIT	V41	P1853	107
DAVIS ME	2002	NATURE	V417	P813	101
PATZKE GR	2002	ANGEW CHEM INT EDIT	V41	P2446	101
XIA YN	2003	ADV MATER	V15	P353	430
RAY SS	2003	PROG POLYM SCI	V28	P1539	138
KELLY KL	2003	J PHYS CHEM B	V107	P668	130
JAVEY A	2003	NATURE	V424	P654	129
DUAN XF	2003	NATURE	V421	P241	114

NITZAN A	2003	SCIENCE	V300	P1384	111
BARNES WL	2003	NATURE	V424	P824	104
DIEBOLD U	2003	SURF SCI REP	V48	P53	100
VAYSSIERES L	2003	ADV MATER	V15	P464	100
DANIEL MC	2004	CHEM REV	V104	P293	235
ZUTIC I	2004	REV MOD PHYS	V76	P323	132
KONG XY	2004	SCIENCE	V303	P1348	84
KITAGAWA S	2004	ANGEW CHEM INT EDIT	V43	P2334	79
MICHALET X	2005	SCIENCE	V307	P538	53
LOVE JC	2005	CHEM REV	V105	P1103	37

These results were examined by the authors of the present document. They judged that all papers in the table were relevant for a Background section, or review paper. Due to space considerations, not all papers listed will be included in the historical narrative shown in the Seminal Nanotechnology Documents section.

There are a number of technical attributes (e.g., technical themes, relation to 2005 nanotechnology documents, level of development, etc) and infrastructure attributes (e.g., author institution, author country, journal, language) that can be assigned to each document above. Temporal trends in these attributes can be tracked, and their evolution evaluated. Such a detailed evaluation was beyond of the scope of the present study. However, one sub-set was examined for demonstration purposes.

Below, in Table A1-3, journals with a significant amount of seminal papers are given. Their outputs are listed for the years 1980 to 2005, which are broken up into five year periods (six years for the most recent one because fewer seminal documents appeared for those years).

TABLE A1-3 – JOURNAL BREAKDOWN FOR CAB

Journal	1980-1984	1985-1989	1990-1994	1995-1999	2000-2005	Total # of Seminal Papers
PHYS REV LETT	1	4	2	3	0	10
J AM CHEM SOC	0	2	3	3	2	13
PHYS REV B	1	1	5	1	1	13
APPL PHYS LETT	1	1	2	2	1	8
J PHYS CHEM*	1	1	0	4	1	8
CHEM REV	0	1	0	6	3	10
NATURE	0	1	7	16	11	37
SCIENCE	0	0	1	30	25	56

* includes Seminal papers published in the *Journal of Physical Chemistry B,* which existed from 1997 onwards

Overall, the seminal document list is dominated by *Science* and *Nature*, but Table A1-3 shows that this supremacy in the noteworthy nanotechnology publications is fairly recent. The two journals have accounted for more than their share of quality papers since 1995, outpacing the other high-ranking journals by more than a factor of two. However, only *Nature* had many seminal documents published in the early 1990s, its seven seminal papers from 1990-1994 being slightly ahead of *Physical Review B* (5) and the *Journal of the American Chemical Society* (3). *Physical Review Letters* was the preeminent journal for 1985-1989, having twice as many seminal papers as the next-leading journal (*Journal of the American Chemical Society*, 2). In percentage terms, this almost matches *Science* and *Nature*'s output in recent years, but when nanotechnology was just emerging (1980-1984) no one journal dominated the publication of quality articles in the field.

Finally, from examination of the early years of Table A1-2, an interesting picture emerges. From 1805 until the mid-1930s, the journals containing the seminal documents appear to be either British or German. American journals containing seminal documents start to appear in the mid-1930s, although it is not clear how many of the authors are American. By the mid-1950s, the majority of the journals appear to be American.

SEMINAL NANOTECHNOLOGY DOCUMENTS

The intellectual heritage of a discipline can be represented by identifying, and relating, the significant documents, people, and events that have had major influences on the development of the discipline. Some influences can be quantified; others are evaluated more subjectively. One of the metrics used as a proxy for influence is the number (and quality) of citations to particular documents and/or events. The technique of Citation-Assisted Background is a useful way to trace the historical development in a discipline. With use of CAB, the previous section identified the key historical documents that served as the building blocks for present-day nanotechnology. These documents are the references extracted from the records retrieved from the SCI/ SSCI database with the full query (Appendix 2), using a systematic rigorous approach to identify references that have had significant influence on the development of nanotechnology.

Most of the references used for this section were identified as highly-cited from the ~65000 documents <u>in the retrieved dataset only.</u> For perspective, there were ~900,000 references accessed by the ~65000 SCI retrievals in 2005. The references described in the present section therefore represent the broader nanotechnology community's views on seminal papers, and go beyond the experiences or biases of any one person or small group. Due to space constraints, only about 284 of the most cited documents dating back to 1805 were analyzed and included in this Seminal Nanotechnology Documents section. Some of these papers, even though referenced in the nanotechnology literature, did not deal directly with nanotechnology. Still, they were part of the intellectual heritage that led to the development of nanotechnology as we know it today.

In the following section, another 401 Abstracts of the most cited nanotechnology papers published from 1991-2003 were retrieved and analyzed. These records, while partially overlapping with the 284 references described in the present section, had two significant differences. They were all nanotechnology documents, and they included citations by documents other than the ~65000 downloaded for 2005 and used in the CAB analysis. Many of these papers were deemed to have significant impact on the development of nanotechnology. In future literature surveys for Background, or for stand-alone reviews, the authors strongly recommend that a systematic approach to defining seminal papers be used, such as the method presented here.

Now the seminal nanotechnology documents will be described. As stated in the Concept Description section, nanotechnology has two components: 1) development and use of techniques to study physical phenomena, and 2) construction of structures in the nanoscale size range or smaller. The first component has been ongoing for many decades, while the second component has come to the forefront within the last two decades. The following intellectual heritage reflects this division in time. The first section traces the nanoscience heritage of nanotechnology from the early 20th century to the middle 1980s. At the latter time, instruments were becoming experimentally available that allowed scanning and probing at the nanoscale level. These instruments offered the promise of being able to manipulate/measure these small structures, and were not limited to observing at the macroscopic level as ensemble averages, as had been done previously. Since about 1985, these advanced instruments were becoming commercially available, and this time period can be viewed as the transition to modern nanotechnology. The second section in the heritage traces the modern development of what can now be termed nanotechnology.

Early Nanoscience Development – pre 1985

The ability to conduct research and development in present-day nanotechnology required the advancement of many technical disciplines. Much of the earlier contributions were due to investigations in the electrical and optical properties of materials. That is the way of science, each new investigation builds on previous knowledge. For example, interpretation of the Scanning Tunneling Microscope (STM) scans requires knowledge of the electronic structure of the material being scanned, and required a century of electromagnetic research to arrive at the present level of understanding.

The earliest paper referenced in the nanotechnology literature was a paper in the Philosophical Transactions of the Royal Society of London (Young, 1805). Some of the intellectual giants of the day were also referenced (Faraday, 1857; Hertz, 1881; Einstein, 1905; Darwin, 1930). The first section describes some of this historical advancement, under the caveats about generational citation mentioned above. For ease of comprehension, the historical papers are categorized into solid state electronic structure, Chemistry/ biochemistry, optics/ spectroscopy, surfaces/ films/ layers, instrumentation and materials. These six categories were generated by visual inspection of the historical records.

Solid State Electronic Structure/Properties

Determination of electronic structure in materials has been of long-term interest, for determining bulk and surface material properties, and later on especially for designing magnetic recording media. An early study focused on explaining the electron emission from metals using the Fowler-Nordheim model for current densities and tunneling currents, although its extension to other materials such as semiconductors is questionable (Fowler and Nordheim, 1928). Later came the effective medium approach, designed to address the inhomogeneous media in which different phases are randomly distributed in the form of grains of an arbitrary shape, size, and orientation (Bruggeman, 1935). One of the first post-WW2 advances in magnetic recording showed that the magnetization reversal of a single-domain nanoparticle can be described by the Stoner-Wohlfarth model (Stoner and Wohlfarth, 1948). This was followed shortly by the theory of thermal remnent magnetization in an ensemble of identical noninteracting single domain uniformly magnetized particles (Neel, 1949). Shortly after, papers on the electronic structures and spin-orbit coupling in solid state zinc-blende structure began to appear (Dresselhaus, G. 1955), as well as spatial variations of current and fields due to localized scatterers in metallic conduction (Landauer, 1957).

A decade later saw origination of the density functional theory (Hohenberg and Kohn, 1964; Kohn and Sham, 1965), which was effective in describing the ground state of finite many electron systems, and was later extended to excitation spectra also. The late 1960s produced the Rietveld method for profile refinement method of nuclear and magnetic structures, which employed directly the profile intensities obtained from step-scanning measurements of the neutron powder diagram (Rietveld, 1969). Another major advance in determining structure and electronic properties of nanocrystals was Raman spectra of graphite (Tuinstra and Koenig, 1970). Raman spectra from single crystals of graphite and other graphitic materials showed one single line for single graphite crystals, and another single line for the other materials. The Raman intensity of this band is inversely proportional to the crystallite size, and allows an estimate of the crystallite size in the surface layer of any carbon sample.

Mossbauer-effect measurements showed that the noncolinear spin arrangement in ultrafine ferromagnetic crystallites differs from the Néel type found in large crystallites, and led to the proposal that the ions in the surface layer are inclined at various angles to the direction of the net moment (Coey, 1971). Shortly thereafter, a molecular electronic device (rectifier), consisting of a single molecule that would demonstrate almost ideal diode characteristics in passing current preferentially in one direction, was proposed (Aviram and Ratner, 1974). Defects in epitaxial multiplayer solid state materials continued to be investigated (Matthews, 1974).

Subsequently, the Monkhorst-Pack method was used for Brillouin-Zone integrations, to analyze the electronic structure of materials (Monkhorst and Pack, 1976). At the same time, determination of effective ionic radii provided a useful capability for computing crystal structures (Shannon, 1976). Demonstration of field emission devices with high emission current density attained in metal tip arrays (Spindt et al, 1976) laid the groundwork for applications as electron emitters in flat panel displays, attracting many subsequent investigations. In that year, one of the most influential books on solid state physics was published (Ashcroft and Mermin, 1976) that remained to be a classic today.

The first important application of the quantum many-body algorithm (now known as the Quantum Diffusion Monte Carlo method, or quantum DMC) to electronic structure calculations used a stochastic method to calculate ground-state of the electronic gas (Ceperley and Alder, 1980). It was then applied to determine the properties of electron gases at intermediate densities. Shortly thereafter, a simple formula for the exchange-correlation energy per electron resulted from self-interaction correction to density-functional approximations for many-electron systems, an important quantity in electronic structure calculations (Perdew and Zunger, 1981). At the same time, a further advance in Raman diagnostics occurred through the one phonon Raman-spectrum in microcrystalline silicon, in which the spatial correlation model was developed to explain the modification of the Raman spectra of crystals by the introduction of disorder (Richter et al, 1981). In parallel, a seminal book on underlying physics and operational characteristics of all major bipolar, unipolar, special microwave, and optoelectronic devices (Sze, 1981) was published.

A norm-conserving form of model pseudo-potentials to treat the electron-ion interaction (Kleinman and Bylander, 1982) advanced ionic core description for density functional theory. An extensive review of surface-enhanced spectroscopy (Moskovits, 1985) was followed by two seminal papers on the electronic structure of semiconductors, emphasizing electron-electron and electron-hole interactions in small semiconductor crystallites, including the size dependence of the lowest excited electronic state, and electronic wave-functions in semiconductor clusters (Brus, 1984, 1986). A correlation-energy formula due to Colle and Salvetti in which the correlation density was expressed in terms of electron density and a Laplacian of the second-order density matrix was restated as a formula involving the density and local kinetic-energy density (Lee et al, 1987). The density-functional enchange-energy theory was further explored to correct for asymptotic behavior (Becke, 1988). Generalized eigenvalue formalism was used to express self-consistent pseudopotentials (Vanderbilt, 1990). In a series of papers, density-functional theory was used to explain the electronic structures by generalized gradient approximaton (Perdew et al, 1992); by analytic representation of the electron-gas correlation energy (Perdew and Wang, 1992); by molecular-dynamics and conjugate gradient for ab initio total energy calculations (Payne et al, 1992); and by generalized gradient approximation to describe the local spin density in atoms, molecules, and solids (Perdew et al, 1996).

Improvement to Kohn's density functional theories with gradient corrections for exchange correlation, using a semi-empirical exchange-correlation functional containing local-spin-density, gradient, and exact-exchange terms, was demonstrated on 56 atomization energies, 42 ionization potentials, 8 proton affinities, and 10 total atomic energies of first- and second-row systems, and performed significantly better than previous functionals with gradient corrections only (Becke, 1993). A book on electron transport in mesoscopic systems was published (Datta, 1995). A connected system of programs for performing semi-empirical, ab initio, and density functional molecular orbital (MO) calculations (Gaussian 98) became available five years later (Frisch et al, 1998). In that year, a highly cited review paper on giant magneto resistance was published as an approach to electronics based on the up or down spin of the carriers rather than on the charge of electrons in semiconductor electronics (Prinz, 1998).

Chemistry/Biochemistry

Nanotechnology was built on the knowledge base in many disciplines, none more important than chemistry and biochemistry. A theory of van der Waal adsorption of gases was developed (Brunauer et al, 1940) and more than two decades later an article was published on the van der Waal forces in particles of varying sizes and diameter (Bondi, 1964). Wettability of porous surfaces was reported (Cassie and Baxter, 1944). In biochemistry, protein measurements were made with the folin phenol reagent (Lowry et al, 1951), and similarly two decades later cleavage of structural proteins was studied during assembly of head of bacteriophage-T4 (Laemmli, 1970). Several years later, a rapid and sensitive method was developed for the quantitation of small quantity of protein using the principles of protein-dye binding (Bradford, 1976). The classic book on the chemistry of silica was published a few years later (Iler, 1979) and the classic book on electrochemistry was published (Bard and Faulkner, 1980). Seven years later, optical ellipsometry, infrared spectroscopy, and electrochemistry were used to characterize normal-alkyl thiol monolayers assembled on gold surface (Porter et al, 1987).

Optics/Spectroscopy

Optical properties of thin films and other nanostructures are important for diagnostic purposes, for luminescent probe applications, and for photonic band gap materials. An effective dielectric constant was proposed for a medium consisting of a dispersion of conducting particles much smaller than the wavelength of light to predict the colors that would be observed (Maxwell Garnett, 1904). Perhaps the initial breakthrough relating the optical extinction of light by an isolated spherical particle to size and frequency was the classical electrodynamics analysis of the extinction cross-section (Mie, 1908). Much later came publications of optical absorption intensities of rare-earth ions (Judd, 1962) and intensities of crystal spectra of rare earth ions, the latter including an expression for the oscillator strength of a transition between different levels (Ofelt, 1962).

Lithographic fabrication of materials with visible stop bands is quite challenging. One class of materials that offers a unique solution to this problem is colloidal crystals, where one relies on the tendency of submicron dielectric spheres to spontaneously self-assemble into ordered arrays. Demonstrated controlled growth of monodisperse silica spheres in micron size range (Stober et al, 1968) allowed the change in optical transmission spectrum to be determined as a function of the thickness of the colloidal crystal. Later, optical constants (including dielectric constants) of noble metals were published (Johnson and Christy, 1972), along with optical properties of solids, the latter emphasizing intrinsic optical properties and photoelectric emission (Wooten, 1972) and x-ray photoemission spectrum of valence bands of gold (Shirley, 1972).

Another optics-based application of potential interest to nanotechnology is photolytic-based catalysis. A critical demonstration of electrochemical photolysis of water at a TiO2 semiconductor electrode (Fujishima and Honda, 1972) consisted of an n-type semiconducting TiO_2 (rutile) electrode exposed to sunlight and connected to a platinum electrode, leading to hydronium-ion and gaseous oxygen formation at the negative electrode. By the late 1970s, several books were published, one on x-ray diffraction (Cullity, 1978), and one on x-ray photoelectron spectroscopy (Wagner et al, 1979). By the mid 1980s, several books on absorption and scattering by nanoparticles were published, one on Absorption and Scattering of Light by Small Particles (Bohren and Huffman, 1983), one on Handbook of Optical Constants of Solids (Palik and Addamiano, 1985), and one on the Stopping and Range of Ions in Solids (Ziegler et al, 1985). Nanostructures have played important roles in improving the lasing characteristics of semiconductor lasers. For example, three-dimensional quantum confinement of electrons with quantum dots was proposed, along with the application of quantum dots to semiconductor lasers, and it predicted significant improvement of temperature sensitivity to the threshold current (Arakawa and Sakaki, 1982).

By then, interest began to focus on photon-electron interactions and on the use of photons for information processing. A paper on the strong localization of photons in certain disordered dielectric superlattices was published (John, 1987), and a paper on the electronic analog of the electroopic modulator (Datta and Das, 1990). At this time, the book on surface plasmons on smooth and rought surfaces and on gratings was published (Raether, 1988); a handbook of x-ray photoelectron spectroscopy (Moulder et al, 1991); and a book on photonic crystals a few years later (Joannopoulos et al, 1995). At the same time, functionalized C-60 fullerenes were used to improve the carrier collection efficiencey in polymer photovoltaic cells (Yu et al, 1995), and the mechanism for the green photoluminescence in ZnO phosphor powder was explained (Vanheusden et al, 1996).

Surfaces, Films and Layers

Measuring the properties of thin films has been a major component of nanotechnology research since its inception, but with far greater scientific insight post 1960. One of the early studies measured the tension of metallic thin films deposited by electrolysis (Stoney, 1909). Three decades later, it was shown that the surface area of a (ceramic) powder can be calculated from the N_2-isotherm (Brunnauer et al, 1938). By the analysis of the adsorption curves, the volume is determined, which corresponds to the quantity of nitrogen necessary for a monomolecular layer. From this value, the specific surface of the sample can be determined. This paper is seminal for introducing methods to determine the presence of an adsorbed molecular monolayer.

A significant feature of nanomaterials is the presence of a high surface to volume ratio (S/V), as noted previously. Study of pure materials for significant times under the high S/V conditions becomes problematical, even under relatively high vacuum conditions. The entrance of even small amounts of air into the vacuum chamber results in almost instant oxidation of the material at the surface. To circumvent this oxidation problem, researchers have used the noble metals extensively, starting with examination of the nucleation and growth processes in the synthesis of colloidal gold (Turkevich et al, 1951).

A thin layer on a substrate will produce oscillations in the reflectivity related to the layer's thickness, and the distance between adjacent fringes gives an indication of layer thickness. An interference pattern is created when more than one layer is present. A major step forward occurred with publication of the Parratt formula for giving the reflectivity relation between the layers, using recursive solution (Parratt, 1954). Measuring the film mass is also critical for thin film analyses, and a variety of methods can be used. One unique approach showed that the frequency shift of a quartz crystal resonator is directly proportional to the added mass (Sauerbrey, 1959), and was the first step in the use of the quartz crystal microbalance to measure very small quantities of surface films. Surface energy and contact of elastic solids was reported (Johnson et al, 1971), as well as defects and dislocations in epitaxial multilayers (Matthews and Blakeslee, 1974). More than a decade later, a book on Adsorption, Surface Area, and Porosity was published (Gregg and Sing, 1982). Further advances on physical adsorption isotherms came through generalization of the Langmuir isotherm, which model assumes monolayer adsorption on a homogeneous surface, in order to extend the description for multilayer adsorption (Sing et al, 1985).

Instrumentation

Probably the single most important instrument for scientific research was the development of the digital computer. Fast computers allowed for the modeling and simulation of large number of molecules. Equation of states calculation by a fast computer was performed (Metropolis et al, 1953). The transition from nanoscience to nanotechnology took a major step forward in the early 1980s, with the invention of the first scanning tunneling microscope (STM) in 1981 (Binnig et al, 1982), followed by the invention of the atomic force microscope (AFM) in 1986. Both probes provide information about the outermost surface, give very accurate height measurements, and are very good for planar surfaces. In the STM, the tunneling currents measured vary exponentially with the tip-surface distance, and in the AFM, the force variations between a cantilevered tip and the surface are influenced by surface height variations. Interestingly, the only one of Binnig's papers to receive significant citations in the present database is the 1986 paper on AFM (Binnig et al, 1986). By the mid 1980s, much higher performance supercomputers had been developed, and the first book on Computer Simulation of Liquids was published (Allen and Tildesley, 1987).

Materials

The value of nanoscale materials is becoming more appreciated with the passage of time. A series of papers on the kinetics of phase transformation driven by nucleation and growth kinetics, containing the Avrami equation, related the transformed fraction to the extended fraction (Avrami, 1939, 1940, 1941). Another important nanotechnology materials area is the wettability of porous surfaces (Cassie, 1944) and the understanding of porosity at the nanoscale level, for eventual filtering and separation applications. A major advance occurred with the development of the BJH model for determination of pore volume and area distributions in porous substances, using computations from nitrogen isotherms (Barrett et al, 1951). Interest was developing to treat polymers as macromolecules, and a volume on the principle of polymer chemistry and quantative characterization of macromolecules was published as part of the Baker lecture series at Cornell University (Flory, 1953). Cleavage strength of polycrystals was also reported (Petch, 1953).

One of the earliest post-war major advances was the use and appropriate interpretation of x-ray diffractometry to examine microstructures.

Diffraction pattern line broadening can be caused by both small grain size and/ or internal strain, and separation of the two effects by a quantitative analysis was shown using a plot according to the Williamson-Hall method (Williamson and Hall, 1953). This was followed by the first and second editions of a classic book on x-ray diffraction procedures for polycrystalline and amorphous materials (Klug and Alexander, 1954, 1974), and further followed by a methodology that allowed phase transition activation energies to be estimated from the temperature of maximum reaction rate and heating rate (Kissinger, 1957). Subsequently came a Vapor-Liquid-Solid mechanism to describe the growth of whiskers without dislocations, in which a drop of liquid at the tip of a whisker controls growth (Wagner and Ellis, 1964). Atoms from the vapor preferentially condense into, or are transported along, the crystal surface to the liquid droplet and then crystallize into the growing whisker tip. A decade later, controlled nucleation for the regulation of particle size was reported (Grens, 1973), and the size effect on the melting temperature of gold particles was published (Buffat, 1976).

More than a decade later, nanocrystalline materials began to receive attention (Gleiter, 1989). One of the most successful and highly cited set of tools consisting of nine computer programs for crystallgraphic analysis was developed (Sheldrick, 1990). Originally the programs were developed in the late 1960s, and then evolved into SHELX-76, SHELX-86, SHELX-90, SHELX-93, and finally into SHELX-97.

The book on intermolecular and surface forces was published (Israelachvili, 1991). Synthisis of mesoporous inorganic solids was reported (Kresge et al, 1992), as well as photocatalysis on TiO2 surfaces (Hoffmann et al, 1995; Linsebigler et al, 1995). At the same time, several papers on plane wave calculations were published, including the use of pseudopotentials for copper, zinc blende, diamond, alpha quartz, rutile, and cerium (Troullier and Martins, 1991); efficient scheme for calculating the Kohn-Sham ground state of metallic systems (Kresse and Furmuller, 1996); and ab initio energy calculations for metals and semiconductors (1996).

Modern Nanotechnology Development – Post 1985

Based simply on the publication counts identified by the keyword search used in this paper, modern nanotechnology development has proceeded along two major technology thrusts: nanotubes and the other nanotechnologies. This reflects the keen interest in the remarkable properties of carbon nanotubes that has led to many publications. Nanotubes can be bifurcated further into development, mainly growth and deposition issues, and into applications, mainly for field emission and functionalization as sensors. The other nanotechnologies split into many different focal areas, including surface quantum dot layers, lasers and optical emissions from nanostructures, film and layer deposition on substrates, nanomaterial magnetics, nanostructure metallurgy, precious metal nanoparticles, and polymer-based nanocomposites. The background and evolution of these developments will now be addressed.

Nanotubes

The basis of nanotube development is the pioneering paper on C-60 – buckminsterfullerene, which identified the unique carbon atomic structures of that class of carbon materials (Kroto et al, 1985). Specific nanotube development started about six years later with a very highly cited paper on the production of helical microtubules of graphitic carbon using an arc-discharge evaporation method (Iijima, 1991). It was shortly followed by synthesis of graphitic nanotubes in gram quantities, using a variant of the standard arc-discharge technique for fullerene synthesis under a helium atmosphere (Ebbesen and Ajayan, 1992); electronic-structure of chiral graphene tubules (Saito et al, 1992); calculation of the electronic structure of a fullerene tubule using a first-principles, self-consistent, all-electron Gaussian-orbital based local-density-functional approach (Mintmire et al, 1992); and electronic transport variation predictions for carbon microtubules (Hamada et al, 1992). In the same year, a general mechanism was proposed in which the graphitic sheets bend in a attempt to eliminate the high energetic dangling bonds at the edge of the growing structure (Ugarte, 1992). With intense electron beam irradiation, there was gradual reorganization of the tubular graphitic structures into quasi-spherical particles composed of concentric graphitic shells, suggesting that planar graphite may not be the most stable allotrope of carbon in systems of limited size. Although theoretical studies predicted that the electronic properties depended on the diameter of the carbon nanotubes and their chirality, experiments were hampered by the lack of large quantity of the material. A variant of the arc-discharge technique under helium atmosphere was developed for the synthesis of gram quantity of graphitic nanotubes (Ebbessen, et al, 1992).

The next year saw the emergence of single shell carbon nanotubes of 1-nm diameter (Iijima and Ichihashi, 1993), and cobalt-catalyzed growth of carbon nanotubes with single-atomic-layer walls (Bethune et al, 1993). Another class of organic nanotubes were designed, synthesized, and characterized based on rationally designed cyclic polypeptides (Ghadiri et al, 1993). When protonated, these compounds crystallize into tubular structures hundreds of nanometers long with internal diameters of 7-8 anstroms. Several papers were focused on the opening and filling of the carbon nanotubes and then capping them. The caps of the carbon nanotubes were edged away by high temperature oxidation, and the hollow carbon nanotubes were filled with inorganic material (Ajayan et al, 1993), and computer simulation showed that it was possible to fill the carbon nanotube by capillary secution (Ajayan and Iijima, 1993). Similarly a chemical method of opening and filling the carbon nanotubes with a variety of metal oxides was demonstrated (Tsang et al, 1994). Then, synthesis of pure boron nitride nanotubes (Chopra et al, 1995), large-scale synthesis of aligned carbon nanotubes (Li et al, 1996), production of single-wall nanotubes by condensation of a laser-vaporized carbon-nickel-cobalt mixture and their self-assembly into ropes (Thess et al, 1996), and a comprehensive book on the science of fullerenes and carbon nanotubes (Dresselhaus et al, 1996) followed shortly thereafter.

Efforts began to electrically and mechanically characterize the carbon nanotubes. In theory, whether the carbon nanotube is metallic or semiconducting depends on the diameter and the helicity. But the experiments faced enormous technical challenge in making the measurements on individual nanotubes. In four-probe measurements of single nanotubes, both metallic and non-metallic behaviors were observed, as well as abrupt jumps in conductivity as the temperature is varied (Ebbesen et al, 1996). The results suggested that differences in geometry of the nanotube played a profound part in determining the electronic behavior. Carbon nanotubes, because of their seamless cylindrical graphitic structure, have been predicted to have high stiffness and axial strength. The Young's moduli of carbon nanotubes were found to be exceptionally high, in the tera pascal range (Treacy et al, 1996). Carbon nanotubes were found to reversibly switch into different morphological patterns when subject to large deformations (Yakobson et al, 1996). Each shape change corresponded to an abrupt release of energy and a singularity in the stress-strain curve. Scanning Tunneling Microscope was used to explore the electrical characteristics of single walled carbon nanotubes (Collins et al, 1997). As the STM tip moved along the length of the nanotube, well-defined positions were found where the transport current changed abruptly from a graphitic-like response to one that is highly nonlinear and asymmetrical, like that of rectification. Similarly Atomic Force Microscopy was used to determine the mechanical properties of multi-walled carbon nanotubes and silicon carbide nanorods (Wong, 1997). It was found that multi-walled carbon nanotubes were twice as stiff as the silicon carbide nanorods. Electrical properties of individual bundles of single walled carbon nanotubes were also measured (Bockrath et al, 1997).

Development toward more useful material quantities included: large-scale production of single-walled carbon nanotubes by the electric-arc technique (Journet et al, 1997); controlled production of aligned nanotube bundles (Terrones et al, 1997); synthesis of individual single-walled carbon nanotubes on patterned silicon wafers (Kong et al, 1998); synthesis of large arrays of well-aligned carbon nanotubes on glass (Ren et al, 1998); conversion of single-wall fullerene nanotubes from nearly endless, highly tangled ropes into short, open-ended pipes that behave as individual macromolecules (Liu et al, 1998); a readily scalable purification process capable of handling single-wall carbon nanotube (SWNT) material in large batches, including progress in scaling up SWNT production by the dual pulsed laser vaporization process, thereby enabling the production of gram per day quantities of highly pure SWNT (Rinzler et al, 1998); encapsulated C-60 in carbon nanotubes (Smith et al, 1998), on atomic structure and electronic properties of single-walled carbon nanotubes (Odom et al, 1998); solution properties of single-walled carbon nanotubes (Chen et al, 1998); electronic structure of atomically resolved carbon nanotubes (Wildoer et al, 1998); paralleled by a book on physical properties of carbon nanotubes (Saito et al, 1998).

The following year saw publication of optical properties of single-wall carbon nanotubes (Kataura et al, 1999), synthesis of nanowires and nanotubes (Hu et al, 1999), and gas-phase catalytic growth of single-walled carbon nanotubes from carbon monoxide (Nikolaev et al, 1999). More recently, catalytic growth of zinc oxide nanowires by vapor transport (Huang et al, 2001) was followed by room temperature UV nanowire nanolasers (Huang et al, 2001).

Synthesis of carbon nanotubes by chemical vapor deposition over patterned catalyst arrays led to the growth of nanotubes from specific sites on surfaces (Dai, 2002). Experimental evidence supported the view that carbon nanotubes were a new macromolecular form of carbon with unique properties associated with molecular species (Niyogi et al, 2002). Subsequently, synthesis of semiconductor nanowire superlattices from group III-V and group IV materials was demonstrated, where the superlattices are created within the nanowires by repeated modulation of the vapour-phase semiconductor reactants during growth of the wires (Gudiksen et al, 2002). At the same time, structure-assigned optical spectra of single-walled carbon nanotubes was demonstrated, where spectrofluorimetric measurements on single-walled carbon nanotubes (SWNT) isolated in aqueous surfactant suspensions have revealed distinct electronic absorption and emission transitions for more than 30 different semiconducting nanotube species. By combining these fluorimetric results with resonance Raman data, each optical transition has been mapped to a specific nanotube structure. Fluorescence was observed directly across the band gap of semiconducting carbon nanotubes (O'Connell et al, 2002). Optical spectroscopy can thereby be used to rapidly determine the detailed composition of bulk SWNT samples, providing distributions in both tube diameter and chiral angle (Bachilo et al, 2002). Later, a comprehensive review described current research activities that concentrate on one-dimensional (1D) nanostructures-wires, rods, belts, and tubes-whose lateral dimensions fall anywhere in the range of 1 to 100 nm, emphasizing 1D nanostructures that have been synthesized in relatively copious quantities using chemical methods (Xia et al, 2003). A method was developed to separate metallic from semiconducting single-walled carbon nanotubes by the use of alternating current dielectrophoresis (Krupke et al, 2003). Single crystal GaN nanotubes were synthesized by an epitaxial casting approach with potential for nanoelectronics, optoelectronics, and biochemical sensing applications (Goldberger et al, 2003).

Nanotube Applications

Seminal applications papers start to appear in the mid-1990s, about four years after the initial nanotube announcement referenced above. A carbon nanotube field emission electron source (Deheer et al, 1995) and an enhancement of field emission of electrons from individually mounted carbon nanotubes when the nanotube tips are opened by laser evaporation or oxidative etching (Rinzler et al, 1995) were described, followed by observations of exceptionally high Young's modulus for individual carbon nanotubes (Treacy et al, 1996) and use of carbon nanotubes as nanoprobes in scanning probe microscopy (Dai et al, 1996). The following year saw hydrogen storage in single-walled nanotubes (Dillon et al, 1997), electrical transport measurements on individual single-wall nanotubes that demonstrate genuine quantum wire behavior (Tans et al, 1997), and synthesis of gallium nitride nanorods through a carbon nanotube-confined reaction (Han et al, 1997). Potential of single-walled carbon nanotubes for storage of hydrogen was reported (Dillon et al, 1997; Liu et al, 1999). The use of carbon nanotubule membranes for elctrochemical energy storage and production in lithium-ion batteries and in fuel-cells was proposed (Che et al, 1998).

Applications in 1998 included a three-terminal switching field-effect transistor consisting of one semiconducting single-wall carbon nanotube connected to two metal electrodes (Tans et al, 1998), single- and multi-wall carbon nanotube field-effect transistors (Martel et al, 1998), and carbon nanotube quantum resistors (Frank et al, 1998). Covalently functionalized nanotubes were used as probe tips in chemistry and biology (Wong et al, 1998). The modified nanotubes wre used as AFM tips to titrate acid and base groups, to image patterned samples based on molecular interactions, and to measure the binding force between single protein-ligand pairs. Further applications included carbon nanotubes as molecular quantum wires (Dekker, 1999), carbon nanotube intramolecular junctions (Yao et al, 1999), a fully sealed, high-brightness carbon-nanotube field-emission display (Choi et al, 1999), and Luttinger-liquid behaviour in carbon nanotubes based on a better approximation to one-dimensional electron transport in conductors (Bockrath et al, 1999). Sheets of single-walled carbon nanotubes as actuators in artificial muscle applications were shown to generate higher stresses than natural muscle and higher strain than high modulus ferroelectrics (Baughman et al, 1999). Self-oriented regular arrays of carbon nanotubes were synthesized by chemical vapor deposition on patterned porous silicon and plain silicon for use as field emission arrays (Fan et al, 1999).

Demonstrations in 2000 included extreme oxygen sensitivity of electronic properties of carbon nanotubes (Collins et al, 2000) and single-wall carbon nanotubes as chemical sensors (Kong et al, 2000). Subsequent seminal applications included: logic circuits with field-effect transistors based on single carbon nanotubes (Bachtold et al, 2001; Derycke et al, 2001); indium phosphide nanowires as building blocks for nanoscale electronic and optoelectronic devices (Duan and lieber, 2001); logic gates and computation from assembled nanowire building blocks (Huang et al, 2001); use of nanowires as building blocks to assemble semiconductor nanodevices (Cui and Lieber, 2001); boron-doped silicon nanowire nanosensors for highly sensitive and selective detection of biological and chemical species (Cui et al, 2001); and noncovalent sidewall functionalization of single-walled carbon nanotubes for protein immobilization for biological and chemical sensing applications (Chen et al, 2001), in parallel with a survey of carbon nanotube applications (Baughman et al, 2002). Ballistic carbon nanotube field effect transistor was demonstrated by palladium contacts to eliminate the barriers for electron transport through the valence band (Javey et al, 2003).

Quantum Dots

While the concept of quantum dots was advanced by Arakawa in 1982, as discussed in the historical section, the earliest quantum dots were fabricated successfully in 1986 by an indirect method, the post-growth lateral patterning of the 2D quantum wells (Reed et al, 1986). A linear response theory was developed for resonant tunneling through a quantum dot of small capacitance (Beenakker, 1991). The theory extended the classical theory of coulomb blockade oscillations to the resonant tunneling regime. Islands of quantum-size dot structures were grown on strained InGaAs on GaAs substrate, and demonstrated photoluminescence at approximately 1.2 eV (Leonard et al, 1993). Quantum levels in InGaAs quantum dots were examined by infrared transmission spectroscopy (Drexler et al, 1994). Photoluminescence was further shown on InAs quantum dots grown by molecular beam epitaxy on GaAs (Marzin et al, 1994). Synthesis of semiconductor nanocrystallites based on pyrolysis of organometallic reagents by injection into a hot coordinating solvent (Murray et al, 1993) followed about a half-decade later. In turn, it was followed by vertically self-organized InAs quantum box islands on GaAs(100), demonstrating that the driving force for such vertically self-organized growth is the interacting strain fields induced by the islands that give rise to a preferred direction for Self organization of CdSe nanocrystallites into 3-D semiconductor quantum dot superlattices was demonstrated (Murray et al, 1995.) In migration (Xie et al, 1995), and InAs/GaAs pyramidal quantum dots, emphasizing strain distribution, optical phonons, and electronic-structure (Grundmann et al, 1995).

The next year saw the growth of quantum dot superlattices in multilayer array of coherently strained islands in elecronic devices (Tersoff et al, 1996). In the same year, research was focused on properties of semiconductor fragments consisting of hundreds to thousands of atoms with bulk bonding geometry (Alivisatos, 1996), size-dependent properties and physical chemistry of semiconductor nanocrystals (Alivisatos, 1996), as well as shell filling and spin effects in a few electron quantum dot (Tarucha et al, 1996). It was followed by: quantum dot bioconjugates for ultrasensitive nonisotopic detection (Chan and Nie, 1998); a universal set of one- and two-quantum-bit gates for quantum computation using the spin states of coupled single-electron quantum dots (Loss and DiVincenzo, 1998); Kondo effect in a single-electron transistor (Goldhaber-Gordon et al, 1998); a tunable Kondo effect in quantum dots, where a dot can be switched from a Kondo system to a non-Kondo system as the number of electrons on the dot is changed from odd to even, and the Kondo temperature can be tuned by means of a gate voltage as a single-particle energy state nears the Fermi energy (Cronenwett et al, 1998); and semiconductor nanocrystals as fluorescent biological labels (Bruchez et al, 1998). The role of oxygen in the electronic states and photoluminescence in porous silicon quantum dots was reported (Wolkin, 1999). It was shown that depending on the size, the photoluminescence can be tuned from the near infrared to ultraviolet.

In 1999, a seminal book on the principles and phenomena of quantum dot heterostructures (Bimberg, 1999) was published, followed by demonstration that control of the growth kinetics of the II-VI semiconductor cadmium selenide can be used to vary the shapes of the resulting particles from a nearly spherical morphology to a rod-like one (Peng et al, 2000), and then by triggered single photons from a quantum dot (Santori et al, 2001). A later demonstration showed in vivo imaging of quantum dots encapsulated in phospholipid micelles. Specifically, when conjugated to DNA, the nanocrystal-micelles acted as in vitro fluorescent probes to hybridize to specific complementary sequences (Dubertret et al, 2002). Still later, immunofluorescent labeling of cancer marker Her2 and other cellular targets with semiconductor quantum dots (QD) was demonstrated, indicating that QD-based probes can be very effective in cellular imaging and offer substantial advantages over organic dyes in multiplex target detection (Wu et al, 2003). Water soluble cadmium selenide-zinc sulfide quantum dots were used as fluorescent labels for multiphoton microscopy to enable multicolor imaging in biological tissues (Larson et al, 2003).

In a comprehensive paper, the electronic structure of quantum dots was extensively reviewed (Reimann et al, 2002). The electronic structure was analyzed in terms of simple single particle models, density-functional theory, and exact diagnonalization methods. The spontaneous magnetization due to Hund's rule, spin-desnsity wave states, and electron localization were descbribed. Another paper reviewed the electron transport on two lateral quantum dots coupled in series (van der Wiel et al, 2003). Charge stability diagram was given in terms of the electrochemical potentials of both dots.

A review of current approaches to the synthesis, solubilization, and functionalization of qdots and their applications to cell and animal biology emphasized recent examples of their experimental use, including the observation of diffusion of individual glycine receptors in living neurons and the identification of lymph nodes in live animals by near-infrared emission during surgery. The new generations of qdots have far-reaching potential for the study of intracellular processes at the single-molecule level, high-resolution cellular imaging, long-term in vivo observation of cell trafficking, tumor targeting, and diagnostics (Michalet at al, 2005).

Optics/Spectroscopy

Significant papers on the emission, transmission, reflection, and absorption in the optical spectrum for the purposes of diagnosis, detection, display, and communication start with organic electroluminescent diodes (Tang and Vanslyke, 1987) and inhibited spontaneous emission in solid-state physics and electronics, where strong diffraction effects can inhibit the propagation of electromagnetic waves of certain frequencies in systems that exhibit periodic dielectric properties (Yablonovitch, 1987). Light-emitting-diodes based on conjugated polymers, with electroluminescence generated from polymers where single and double bonds alternate in the main chain (Burroughs et al, 1990), were then described, followed by conversion of light to electricity by cis-x2bis(2,2'-bipyridyl-4,4'-dicarboxylate) ruthenium(ii) charge-transfer sensitizers (x = Cl-, Br-, I-, CN-, and SCN-) on nanocrystalline TiO2 electrodes (Nazeeruddin et al, 1993).

Absorption spectra in the ultraviolet to visible wavelength were given for 10nm diameter colloidal particles of 52 metallic elements in the periodic table, calculated from the optical constants of the metals by means of Mie theory (Creighton et al, 1991). A few years later, optical properties of manganese-doped nanocrystals of ZnS semiconductor were reported (Bhargava et al, 1994). Light-emitting-diodes made from cadmium selenide nanocrystals and a semiconducting polymer were shown subsequently (Colvin et al, 1994), followed by a review of interfacial electron transfer reactions in colloidal semiconductor solutions, and thin films and their application for solar light energy conversion and photocatalytic water purification (Hagfeldt and Gratzel, 1995), as well as a book on optical properties of metal clusters (Kreibig and Vollmer, 1995).

Optical detection and spectroscopy of single molecules and single nanoparticles were achieved at room temperature with the use of surface enhanced Raman scattering (Nie et al, 1997). Later came structural and luminescence properties of porous silicon (Cullis et al, 1997), followed by diameter-selective Raman scattering from vibrational modes in carbon nanotubes (Rao et al, 1997) and semiconductor nanocrystals as fluorescent biological labels (Bruchez et al, 1998). Several years later, the optical properties of metals nanoparticles were described, with a wide range of sizes, shapes, and dielectric environment (Kelly et al, 2003). Included was a description of the qualitative features of dipole and quadrupole plasmon resonances for spherical particles, a discussion of analytical and numerical methods for calculating extinction and scattering cross-sections, local fields, and other optical properties of nonspherical particles, and survey of applications to problems of interest involving triangular silver particles and related shapes.

Surfaces, Films and Layers

At the same time that positioning of single atoms with a scanning tunneling microscope (Eigler and Schweizer, 1990) was demonstrated, construction of first principles pseudopotentials with possible application to first row and transition metal systems (Vanderbilt, 1990) was an important electronic structures landmark, as was demonstration of dye-sensitized colloidal titanium dioxide thin films for efficient and cheap solar cells (Oregan and Gratzel, 1991), and a text on ultrathin organic films (Ulman, 1991). Self-assembly was emerging as a new strategy in chemical synthesis for generating nonbiological structures in the 1 to 100nm range (whitesides et al, 1991). At the same time, atomic force micropscope was used to directly measure the force between a planar surface and an individual colloid particle (Ducker et al, 1991). The following year saw ordered mesoporous molecular sieves synthesized by a liquid crystal template mechanism (Kresge et al, 1992), as well as a new family of mesoporous molecular sieves prepared with liquid-crystal templates (Beck et al, 1992), and polyhedral and cylindrical structures of tungsten disulfide (Tenne et al, 1992). A method for confining electrons to artificial structures was demonstrated (Crommie et al, 1993). Surface state electrons on a copper (111) surface were confined to closed structures called corrals defined by barriers built from iron adatoms. The barriers were assembled by individually positioning iron adatoms with the tip of an STM at 4 degree Kelvin.

Surface plasmon spectronscopy was used to monitor electrochemical changes on the surface of nanosized particles (Mulvaney, 1996). A review of the formation and structure of self-assembled monolayers covered organized molecular assemblies, penetration-controlled reactions, Langmuir-Blodgett monolayers, surface-confined monolayers, long-chain surfactants, phase probe molecules, aqueous permanganate interaction, transform infrared-spectroscopy, chemically adsorbed monolayers, and ray photoelectron-spectroscopy (Ulman, 1996), and was followed by nanoassemblies of layered polymeric composites (Decher, 1997).

A demonstration of direct-write "dip-pen" nanolithography to deliver collections of molecules in a positive printing mode, where molecules are delivered from an AFM tip to a solid substrate of interest via capillary transport (Piner et al, 1999) was a substantive advance in nanolithography, and was followed by monolayer protected cluster molecules (Templeton et al, 2000), and synthesis of semiconducting oxides by evaporation of commercial metal oxide powders at high temperatures (Pan et al, 2001). More recently, self-assembled monolayers of thiolates on metals were examined as a form of nanotechnology (Love et al, 2005).

Magnetics

While a substantial number of articles are published in nanotechnology magnetics, relatively few are cited highly, compared to some of the other sub-fields. Whether this is due to the more concentrated focus of the discipline, or the more applied nature, or some other factors, is not clear.

In 1988, a huge magnetoresistance was discovered in (001)Fe/(001)Cr superlattices prepared by molecular beam epitaxy, and ascribed this giant magnetoresistance to spin-dependent transmission of the conduction electrons between Fe layers through Cr layers (Baibich et al, 1988). Also that year, new Fe-based soft magnetic-alloys composed of ultrafine grain-structure (Yoshizawa et al, 1988) were described. Giant magnetoresistance was demonstrated with the measurement of currents perpendicular to the plane and current in the plane of Ag/Co magnetic multilayers (Pratt et al, 1991). Arrays of ferromagnetic nickel and cobalt nanowires were fabricated by electrochemical deposition of the metals into templates with nanometer size pores (Whitney et al, 1993). The preferred magnetization direction was perpendicular to the film plane. Clusters of metal ions that can change gradually from simple paramagnet to bulk magnet were investigated (Gatteschi et al, 1994). Measurements were made at low temperature on single crystal superparamagnetic manganese clusters to demonstrate the existence of quantum mechanical tunnelling of the bulk magnetization (Thomas et al, 1996).

Later, self-oriented regular arrays of carbon nanotubes and their field emission properties (Fan et al, 1999) were shown, followed by synthesis of monodisperse iron-platinum nanoparticles and ferromagnetic iron-platinum nanocrystal superlattices (Sun et al, 2000), and more recently by demonstrating a simple approach for controlling the colloidal synthesis of anisotropic cadmium selenide semiconductor nanorods can be extended to the size-controlled preparation of magnetic cobalt nanorods as well as spherically shaped nanocrystals (Puntes et al, 2001).

Materials

Synthesis of semiconductor materials were discussed to focus on the size effects on the optical and photophysical properties (Wang et al, 1991). In a review paper, various approaches to nanophase materials with stringent requirements of size, shape, and dimensionality were discussed (Ozin, 1992). An improved technique to determine hardness and elastic modulus using load and displacement sensing indentation experiments (Oliver and Pharr, 1992) was soon followed by demonstration of mechanical-properties of nylon 6-clay hybrid, emphasizing tensile, flexural, impact, and heat distortion tests (Kojima et al, 1993). Ultrafine grained metallic materials with grain sizes as small as 20nm were investigated, and shown that the intercrystalline boundaries were the main element of the structure (Valiev et al, 1993). A few years later, nanobeam mechanics, including elasticity, strength, and toughness of nanorods and nanotubes (Wong et al, 1997) were described, and followed by the synthesis of semiconductor nanowires combining laser ablation cluster formation and vapor-liquid-solid growth (Morales and Lieber, 1998).

Nanowires, Powders, and Catalysts

A review of small-particle research, emphasizing physicochemical properties of extremely small colloidal metal and semiconductor particles (Henglein, 1989) was followed by silicon quantum wire array fabrication by electrochemical and chemical dissolution of wafers (Canham, 1990), as well as a classic book on the physics and chemistry of sol-gel processing (Brinker and Scherer, 1990).

A membrane-based synthetic approach to nanomaterials (Martin, 1994) was followed by synthesis of thiol derivatized gold nanoparticles in a two phase liquid-liquid system (Brust et al, 1994). Later, fabrication of a highly ordered metal nanohole array (platinum and gold) by a two-step replication of the honeycomb structure of anodic porous alumina (Masuda and Fukuda, 1995) was followed shortly by a DNA-based method for rationally assembling gold nanoparticles into macroscopic materials (Mirkin et al, 1996). The ability of gold to catalyze certain reactions had been called into question in older literature. Recently it was discovered that gold catalysts can affect the oxidation of carbon monoxide at or below ambient temperature. In a lengthy review paper, the potentials of gold catalysts were discussedfor oxidation of hybrocarbons, for methanol synthesis by hydrogenation of cargon monoxide or dioxide, for the reduction of nitric oxide by hydrogen, propene, or carbon monoxide (Bond and Thompson, 1999). The remarkable catalytic behavior shown by gold was dependent on the ability to form very small nanoparticles. For oxidation of carabon monoxide at low temperature, catalysts comprising small (<5nm) gold particles supported preferably on an oxide of the first transition metals were needed.

A study on general synthesis of compound semiconductor nanowires provided a rational and predictable intellectual framework as well as corresponding methodologies for the synthesis of a broad range of nanowire materials with controlled chemical compositions, physical dimensions, and electronic and optical properties (Duan et al, 2000). Room temperature ultraviolet lasing in semiconductor nanowire arrays was demonstrated (Huang et al, 2001). Self-organized <0001> oriented zinc oxide nanowires were grown on sapphire substrate with a simple vapor transport and condensation process (Huang, et al, 2001). These widebandgap semiconductor nanowires formed a natural laser cavity with diameter from 20 to 150nm and lengths up to 10 microns. Under optical excitation, surface emitting laser action was observed at 385nm, with linewidth <0.3nm. Ultralong belt-like nanostructures called nanobelts were successfully synthesized for semiconducting oxides of zinc, tin, indium, cadmium, and gallium by simply evaporating the desired commercial metal oxide powders at high temperature (Pan et al, 2001).

Two years later, a comprehensive review of state of research was published that concentrated on one-dimensional (1D) nanostructures such as nanowires, nanorods, nanobelts, nanotubess (Xia et al, 2003). Attention was focused only on 1D nanostructures that have been synthesized in large quantity. The paper presented the unique electrical and mechanical properties of different types of 1D nanostructures. In the same year, a novel approach to the fabrication of arrayed nanorods and nanowires of ZnO in thin film and coatings was demonstrated (Vayssieres et al, 2003). Electrically driven lasing from individual nanowires was demonstrated (Duan et al, 2003). Optical and electrical measurements were made on single crystal cadmium sulphide nanowires, and showed that these structures could function as Fabry-Perot optical cavities with mode spacing inversely related to the nanowire length.

A review of gold nanoparticles covered a variety of structures, properties and applications, including biology, catalysis, and nanotechnology (Daniel and Astruc, 2004). At the same time, the fundamental physics of spintronics, or spin electronics, which involves the study of active control and manipulation of spin degrees of freedom in solid-state systems, was described. Experimental work was reviewed with the emphasis on projected applications, in which external electric and magnetic fields and illumination by light could be used to control spin and charge dynamics to create new functionalities not feasible or ineffective with conventional electronics (Zutic et al, 2004).

Polymers/ Nanocomposites

In a review paper, polymer microstructures were considered as tethered chains or macromolecular chains that reattached themselves by their ends (Halperin et al, 1992). Synthesis of nylon 6-clay hybrid (Usuki et al, 1993) showed that montmorillomite cation exchanged for 12-aminolauric acid was swollen by epsilon-caprolactam to form a new intercalated compound. Design and synthesis of polymer nanocomposites with layered silicates (Gianellis, 1996) provoked much interest, and was followed in a couple of years by triblock copolymer syntheses of mesoporous silica with periodic 50 to 300 angstrom pores (Zhao et al, 1998), and nonionic triblock and star diblock copolymer and oligomeric surfactant syntheses of highly ordered, hydrothermally stable, mesoporous silica structures (Zhao et al, 1998). The possibility of using ionically conducting polymer membranes (polymer electrolytes) for application in lithium batteries was explored (Croce et al, 1998). The nanocomposite polymer electrolyte were the common complexes of lithium salt with a high-molecular weight polymer such as polyethylene oxide. Subsequently, a lengthy review paper was published on the syntheses, properties and (future) applications of polymer-layered silicate nanocomposites (Alexandre and Dubois, 2000). The whole range of polymer matrices were covered, including thermoplastics, thermosets, and elastomers. Two types of structures were discussed, intercalated nanocomosites where the polymer chains were sandwiched between silicate layers, and exfoliated nanomposites where the the silicate layers were dispersed in the polymer matrix.

Two years later, semiconductor nanorods together with polymers were demonstrated to be excellent hybrid solar cells (Huynh et al, 2002). The photovoltaic device consisted of 7nm by 60nm CdSe nanorods and the conjugated polymer poly-3 (hexyltheiphene) with quantum efficiency over 54% and monochromatic power efficiency of 6.9% at 0.1 milliwatt per square centimeter. In the same year, the use of functionalized carbon nanotubes in the fabrication of polymeric carbon nanocomposites was demonstrated (Sun et al, 2002).

1.2. Seminal Nanoscience/ Nanotechnology Documents Determined using Nanotechnology Papers with Most Citations

AUTHORS OF MOST CITED NANOSCIENCE/ NANOTECHNOLOGY PAPERS

In the previous section, the most cited first authors were obtained from their presence in the references of the 2005 retrieved records. These referenced papers may or may not have been nanoscience/ nanotechnology-focused. To identify all the authors most associated with the highly cited nanoscience/ nanotechnology-focused papers, the 401 nanoscience/ nanotechnology-related documents cited most highly (as listed in the SCI/ SSCI) from 1991 to 2003 were retrieved, and the author frequency was extracted. The papers were chosen by selecting all the articles between 1991 (the first year that Abstracts were included in SCI records) and 2001 that had 400 citations or more and the 30 most cited articles from 2002 and 2003. This method of author extraction includes all the paper authors, not limited to first author. Table A1-4 shows the results. The central authors in nanoscience/ nanotechnology are clearly evident from this result. The only name in common between Table A1-4 and the list of most cited first authors from the retrieved 2005 articles (Table 10) is Alivasatos, offering further evidence that the central authors in nanoscience/ nanotechnology tend not to be first authors when they have become established.

TABLE A1-4 – AUTHORS OF (401) MOST CITED PAPERS SINCE 1991

AUTHOR	#PAPERS	INSTITUTION	COUNTRY
Smalley, RE	15	RICE UNIV	USA
Lieber, CM	13	HARVARD UNIV	USA
Mirkin, CA	11	NORTHWESTERN UNIV	USA
Alivisatos, AP	10	UNIV CALIF BERKELEY	USA
Dai, HJ	10	STANFORD UNIV	USA
Whitesides, GM	10	HARVARD UNIV	USA
Rinzler, AG	8	UNIV FLORIDA	USA
Colbert, DT	7	NGEN	USA
Dekker, C	7	DELFT UNIV TECHNOL	NETHERLANDS
Thess, A	6	M-PHASYS GMBH	GERMANY
Ebbesen, TW	5	UNIV STRASBOURG 1	FRANCE
Gratzel, M	5	ECOLE POLYTECH FED LAUSANNE	SWITZERLAND
Nikolaev, P	5	ERC INC / JOHNSON SPACE CENTER	USA

Yang, PD	5	UNIV CALIF BERKELEY	USA

Note that Hongjie Dai worked as postdoctoral fellow in Lieber's group at Harvard University and in Smalley's group at Rice University and that Rinzler, Colbert, Thess, and Nikolaev were part of the Smalley group before holding their current positions. Yang is a former member of Lieber's research group as well, so not only is there some overlap in the authors of the most cited papers, but their institution does not necessarily correspond to where they published one of the seminal works of 1991 to 2003. Ten of the institutions of the authors of the seminal nanotechnology papers are in the USA, and the remaining four are in Central Europe.

TABLE A1-5 – TOP 18 JOURNALS OF (401) MOST CITED PAPERS

JOURNAL	#PAPERS	IMPACT FACTOR	THEME
SCIENCE	113	30.93	SCIENCE
NATURE	71	29.27	SCIENCE
PHYSICAL REVIEW LETTERS	23	7.50	PHYS
APPLIED PHYSICS LETTERS	15	4.13	PHYS
CHEMICAL REVIEWS	13	20.87	CHEM
ADVANCED MATERIALS	12	9.11	MATLS
JOURNAL OF THE AMERICAN CHEMICAL SOCIETY	12	7.42	CHEM
ACCOUNTS OF CHEMICAL RESEARCH	9	13.14	CHEM
JOURNAL OF PHYSICAL CHEMISTRY*	8	4.03*	CHEM
ANGEWANDTE CHEMIE-INTERNATIONAL EDITION IN ENGLISH	7	9.60	CHEM
JOURNAL OF APPLIED PHYSICS	7	2.50	PHYS
PHYSICAL REVIEW B	6	3.19	PHYS
REVIEWS OF MODERN PHYSICS	6	30.25	PHYS
CELL	5	29.43	BIO
PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	5	10.23	SCIENCE
CHEMICAL PHYSICS LETTERS	4	2.44	CHEM
LANGMUIR	4	3.71	CHEM
PHYSICS REPORTS-REVIEW SECTION OF PHYSICS LETTERS	4	10.46	PHYSICS

*Note: The *Journal of Physical Chemistry* refers to both papers published in the *Journal of Physical Chemistry* (which existed from 1896-1996) and the *Journal of Physical Chemistry B* (which along with the *Journal of Physical Chemistry A* existed from 1997 onwards). The Impact Factor cited refers to the Impact Factor for the *Journal of Physical Chemistry B*.

Table A1-5 lists the journals that contain the most highly cited nanoscience/ nanotechnology papers. It is not a surprise that the most cited papers of the last fifteen years come from highly cited journals, the eighteen journals having a median Impact Factor of 9.36. While these journals do not have the highest Impact Factors possible, they do rank near the top. *Science*, *Reviews of Modern Physics*, and *Nature* are journals with the sixth, eighth, and eleventh highest Impact Factors, respectively, in the SCI. Furthermore, these three journals have the highest Impact Factors for multi-disciplinary or physical science journals, having only medical or biological sciences journals ahead of them. The pivotal nanotechnology articles appeared primarily in journals of science, physics, chemistry, and materials science. The journals *Science* and *Nature* clearly stand out as the publication venues of choice for the leading nanotechnology papers.

TABLE A1-6 – TOP 18 COUNTRIES OF (401) MOST CITED PAPERS

COUNTRY	#REC
USA	126
GERMANY	31
FRANCE	19
JAPAN	19
NETHERLANDS	17
ENGLAND	15
SWITZERLAND	10
ITALY	7
AUSTRALIA	6
CANADA	5
ISRAEL	5
PEOPLES R CHINA	5
RUSSIA	5
SWEDEN	4
BELGIUM	3
SOUTH KOREA	2
SPAIN	2
TAIWAN	2

As shown in Table A1-6, the US outpaced the rest of the world in terms of authorship of the most cited papers between 1991 and 2003. The US had more than four times as many records as its closest competitor, Germany, and more publications than the next eight countries combined. This table re-emphasizes the mismatch between China's high publication productivity and low impact (citations), and a similar problem exists for Korea as well.

China's and South Korea's most cited papers were published more or less evenly throughout the studied time period (1991-2003). South Korea's most cited papers appeared at each end, one each in 1991 and 2002. China had papers published during the heart of the 1990s, one each in 1994, 1996, and 1997, and two in 1999. This might suggest that more high quality research is coming out of China in recent years.

As far as co-authorship is concerned, there is no clear trend in China's and South Korea's most cited papers. Two of China's five most cited papers feature only Chinese authors, and one of South Korea's two most cited papers is authored exclusively by domestic researchers. The two nations collaborate with authors from countries that are prolific in nanotechnology, but are not necessarily latching on to the top world powers. South Korea's joint article has authors from the US, Japan, and France, while China counts co-authorships with the US, England, and Belgium and Russia.

TABLE A1-7 – TOP 25 INSTITUTIONS OF (401) MOST CITED PAPERS

INSTITUTION	COUNTRY	#PAPERS
HARVARD UNIV	USA	27
UNIV CALIF BERKELEY	USA	23
RICE UNIV	USA	17
UNIV CALIF SANTA BARBARA	USA	16
IBM CORP	USA	12
NORTHWESTERN UNIV	USA	12
DELFT UNIV TECHNOL	NETHERLANDS	11
MIT	USA	10
UNIV ILLINOIS	USA	9
STANFORD UNIV	USA	9
MICHIGAN STATE UNIV	USA	7
GEORGIA INST TECHNOL	USA	6
PURDUE UNIV	USA	6
CALTECH	USA	5
CORNELL UNIV	USA	5
PENN STATE UNIV	USA	5
CNRS	FRANCE	4
UNIV PENN	USA	4
UNIV CAMBRIDGE	UK	4
UNIV WISCONSIN	USA	4
UNIV TOKYO	JAPAN	4
UNIV TEXAS	USA	4
UNIV KENTUCKY	USA	4
SWISS FED INST TECHNOL	SWITZERLAND	4

USN	USA	4

As shown in Table A1-7, twenty-two of the institutions are universities, and all but four of the top twenty-five research institutions of the authors of the most cited nanotechnology articles from 1991 to 2003 were in the US. This is contrasted with Table 4, where only four of the thirty most prolific institutions are in the US. In other words, publications and citations are not necessarily proportional.

1.3. Relation of seminal nanotechnology document production to total nanotechnology document production.

In the previous section, the absolute value of seminal nanotechnology documents produced by specific people, institutions, and countries was determined. There is also substantial value in understanding the efficiency of seminal nanotechnology document production; i.e., the ratio of seminal nanotechnology documents produced to overall nanotechnology documents produced. The present short section addresses some methods for arriving at this ratio.

In the first part of this section, citations (and publications) for nanotechnology documents published in two specific years are examined. The purpose is to obtain some time trend data as well as better statistics than one year's data could provide. All nanotechnology documents for 1998 and 2002 were retrieved and analyzed. These years were selected to be as close to the present as possible, in order to insure currency of findings, yet sufficiently vintaged to insure accumulation of adequate citations.

In the second part of this section, all the nanotechnology documents produced by USA institutions were retrieved and examined. The USA was selected for this demonstration because of its diversity of effort in nanotechnology research. When doing the analysis of the 256 clusters, it became apparent that the USA research was being conducted in a large number of institutions relative to both the Asian and European countries. The question arose as to whether high impact documents were being produced uniformly as well, or whether the production of seminal nanotechnology documents was concentrated in a core of institutions.

To address this question, all nanotechnology documents produced in the USA (each document had at least one author with a USA address) from 1991-2002 were retrieved and analyzed. The USA institutions were extracted, and their fraction of total seminal documents was compared to their fraction of total published documents.

1.3.1. Normalized Country Production of Seminal Nanotechnology Papers

The main nanotechnology query in this report was used to retrieve documents from the SCI/ SSCI for 1998 and 2002. The distribution of numbers of publications among institutions and countries was generated using the Analyze function of the SCI search engine. Then, the publications for each year were ordered according to Times Cited. The most highly cited publications were extracted, and the country and institution distributions for those documents were generated. The country and institution publication distributions were then compared to the citation distributions. This allowed identification of countries and institutions whose citation fractions were greater than their publication fractions (and thus were producing highly cited papers more efficiently than their publication statistics would predict), as well as institutions whose citation fractions were less than their publication fractions.

A central issue is how one defines most highly cited. Are these seminal papers the top 10, top 100, top 1%? Because of the discrete choice imposed by the Analyze function at present, results for the top 100, 250, and 500 documents were examined parametrically. While some re-ordering occurred, the countries and institutions producing the seminal documents were plainly evident at the top of the list. Therefore, the results using the 500 most cited documents (about 1% of the total documents retrieved for 2002, and about 1.5% of the total documents retrieved for 1998) are presented.

TABLE A1-8 – COUNTRY DISTRIBUTIONS – OVERALL RECORDS/ 500 MOST CITED RECORDS - 1998

COUNTRY RANK BY TOTAL PUBLICATIONS		COUNTRY RANK BY MOST CITED RECORDS (121 CITES MIN)	
USA	25.99%	USA	58.80%
JAPAN	15.72%	GERMANY	12.20%
GERMANY	13.72%	JAPAN	9.60%
FRANCE	7.73%	FRANCE	8.00%
ENGLAND	6.93%	ENGLAND	7.80%
PEOPLES R CHINA	6.10%	SWITZERLAND	4.20%
RUSSIA	4.87%	NETHERLANDS	3.20%
ITALY	3.89%	CANADA	2.40%
SPAIN	3.02%	ISRAEL	2.40%
SOUTH KOREA	2.96%	ITALY	2.20%
CANADA	2.81%	SWEDEN	1.80%
SWITZERLAND	2.44%	SPAIN	1.60%
INDIA	2.31%	AUSTRALIA	1.40%
SWEDEN	2.13%	PEOPLES R CHINA	1.40%
NETHERLANDS	1.88%	AUSTRIA	1.20%
POLAND	1.68%	INDIA	1.00%
TAIWAN	1.63%	RUSSIA	1.00%

AUSTRALIA	1.52%	DENMARK	0.80%
BELGIUM	1.32%	IRELAND	0.80%
ISRAEL	1.27%	BELGIUM	0.60%
BRAZIL	1.20%	BRAZIL	0.40%
DENMARK	0.94%	FINLAND	0.40%
AUSTRIA	0.89%	HONG KONG	0.40%
UKRAINE	0.78%	HUNGARY	0.40%
SCOTLAND	0.76%	SCOTLAND	0.40%
MEXICO	0.71%	SOUTH KOREA	0.40%
CZECH REPUBLIC	0.69%	CROATIA	0.20%
FINLAND	0.67%	CZECH REPUBLIC	0.20%
HONG KONG	0.66%	NORTH IRELAND	0.20%
HUNGARY	0.65%	NORWAY	0.20%
SINGAPORE	0.65%	POLAND	0.20%

Table A1-8 contains the country distributions for 1998. The left column of data is ranked according to a country's total nanotechnology publications in 1998. For example, in 1998, the USA produced 25.99% of the total nanotechnology publications. The right column of data is ranked according to a country's representation on most highly cited papers. For example, the USA was represented on 58.8% of the 500 most highly cited nanotechnology papers published in 1998.

Thus, the USA is both the most prolific nanotechnology publishing country and most represented country on highly cited nanotechnology papers for 1998. Its ratio of percent representation on most highly cited nanotechnology papers to percent of total nanotechnology publications (ratio=58.80/25.99) is 2.26. A ratio greater than one means that a country has higher representation on most cited papers than would be expected from its publications alone, and a ratio less than one means that a country has lower representation. A ratio of 2.26 for the USA means that the USA representation on most highly cited records is 2.26 times what would be expected based on nanotechnology publications alone.

None of the other producers has ratios approaching that of the USA (for 1998 publications), and only some of the smaller hi-tech countries (Switzerland, Netherlands, Israel) have ratios that only remotely approach that of the USA. Countries that have exhibited rapid growth in SCI/ SSCI nanotechnology paper production in recent years (e.g., China, South Korea) have ratios an order of magnitude less than that of the USA (for 1998).

Table A1-9 contains the same type and structure of data as Table A1-8, but for 2002. The USA remains dominant in nanotechnology publications and representation on most highly cited nanotechnology papers, with a ratio of 2.42. A few of the smaller Central/ Northern European countries (Switzerland, Finland, Denmark) have ratios on the order of two, and form the second ratio tier after the USA. Norway, the third member of the small Scandanavian countries, has about 1/3 the publications of Finland/ Denmark, and has no representation on the 500 most cited papers list, in line with its relatively poor citation performance shown in our Finland country assessment study (Kostoff et al, 2005).

A number of countries retain the same ratio as in 1998 (within 10%), including the USA, Germany, Japan, England, Switzerland, Italy, and Spain. China's ratio doubled to about .5, placing it on parity with Japan, Italy, and Spain for this metric. In a recent study by the first author (Kostoff et al, 2006, 2007), it was shown that China's growth of papers in high Impact Factor journals was faster than its rate of overall publication growth, and that conclusion may be reflecting itself in the present numbers. South Korea's ratio jumped even more dramatically from 1998. Russia's, Taiwan's, and Poland's ratios remain low, and India's ratio decreased substantially to join this latter group.

TABLE A1-9 – COUNTRY DISTRIBUTIONS – OVERALL RECORDS/ 500 MOST CITED RECORDS - 2002

COUNTRY RANK BY TOTAL PUBLICATIONS		COUNTRY RANK BY MOST CITED (80 CITES MIN)	
USA	24.02%	USA	58.20%
JAPAN	15.09%	GERMANY	11.40%
PEOPLES R CHINA	11.62%	JAPAN	8.40%
GERMANY	11.55%	ENGLAND	6.20%
FRANCE	7.43%	PEOPLES R CHINA	5.80%
ENGLAND	5.86%	FRANCE	5.40%
RUSSIA	4.83%	SOUTH KOREA	3.80%
SOUTH KOREA	4.45%	SWITZERLAND	3.40%
ITALY	3.92%	CANADA	2.80%
SPAIN	3.09%	NETHERLANDS	2.20%
INDIA	2.89%	ITALY	2.00%
CANADA	2.40%	SPAIN	2.00%
TAIWAN	2.18%	SWEDEN	2.00%
SWEDEN	2.05%	FINLAND	1.40%
POLAND	1.92%	BELGIUM	1.20%
BRAZIL	1.91%	BRAZIL	1.20%

SWITZERLAND	1.80%	DENMARK	1.20%
NETHERLANDS	1.77%	RUSSIA	1.20%
AUSTRALIA	1.54%	AUSTRALIA	1.00%
BELGIUM	1.26%	AUSTRIA	1.00%
ISRAEL	1.25%	ISRAEL	1.00%
SINGAPORE	1.22%	SCOTLAND	0.80%
AUSTRIA	1.02%	SINGAPORE	0.80%
UKRAINE	0.99%	TAIWAN	0.60%
MEXICO	0.81%	INDIA	0.40%
SCOTLAND	0.78%	IRELAND	0.40%
CZECH REPUBLIC	0.78%	PORTUGAL	0.40%
FINLAND	0.73%	ARGENTINA	0.20%
DENMARK	0.69%	CZECH REPUBLIC	0.20%
PORTUGAL	0.62%	GREECE	0.20%
HUNGARY	0.59%	HUNGARY	0.20%
GREECE	0.56%	LITHUANIA	0.20%
TURKEY	0.51%	MEXICO	0.20%
ARGENTINA	0.46%	POLAND	0.20%
ROMANIA	0.45%	SLOVENIA	0.20%
BULGARIA	0.31%	TURKEY	0.20%

1.3.2. Normalized Institution Production of Seminal Nanotechnology Papers

Table A1-10 contains the institution distribution for 1998. The data structure has been changed slightly from the previous two figures, with publication and citation information being cross-plotted. For example, the most prolific publication-producing institution, the Russian Academy of Science, produced 2.55% of the total nanotechnology publications for 1998, but was represented on only .80% of the 500 most highly cited papers published in 1998. Conversely, the institution with the largest representation on the 500 most highly cited papers published in 1998, Harvard University, was represented on 4.00% of the 500 most highly cited papers, but published only .38% of the total nanotechnology papers in 1998.

TABLE A1-10 – INSTITUTION DISTRIBUTIONS – OVERALL RECORDS/ 500 MOST CITED RECORDS - 1998

INSTITUTION RANK BY TOTAL PUBLICATION	CIT%	PUB%	INSTITUTION RANK BY MOST CITED RECORDS	CIT%	PUB%
RUSSIAN ACAD SCI	0.80%	2.55%	HARVARD UNIV	4.00%	0.38%
CHINESE ACAD SCI	0.20%	1.75%	UNIV CALIF SANTA BARBARA	3.80%	0.72%
UNIV TOKYO	0.80%	1.52%	MIT	3.20%	0.58%
CNRS	1.60%	1.32%	UNIV CALIF BERKELEY	2.60%	0.84%
OSAKA UNIV	0.40%	1.14%	PENN STATE UNIV	2.20%	0.52%
TOHOKU UNIV	1.20%	1.06%	RICE UNIV	2.20%	0.19%

UNIV CAMBRIDGE	1.20%	0.89%	IBM CORP	2.00%	0.56%
UNIV ILLINOIS	1.00%	0.86%	UNIV OXFORD	2.00%	0.68%
UNIV CALIF BERKELEY	2.60%	0.84%	CNRS	1.60%	1.32%
KYOTO UNIV	ABSENT	0.84%	UNIV N CAROLINA	1.60%	0.17%
CNR	0.60%	0.83%	CORNELL UNIV	1.40%	0.43%
TOKYO INST TECHNOL	1.40%	0.83%	PRINCETON UNIV	1.40%	0.33%
CSIC	0.40%	0.79%	STANFORD UNIV	1.40%	0.44%
ACAD SINICA	0.40%	0.73%	TOKYO INST TECHNOL	1.40%	0.83%
UNIV CALIF SANTA BARBARA	3.80%	0.72%	UNIV CALIF SAN DIEGO	1.40%	0.28%
UNIV OXFORD		0.68%	UNIV MINNESOTA	1.40%	
POLISH ACAD SCI		0.64%	DELFT UNIV TECHNOL	1.20%	
UNIV TEXAS		0.59%	NORTHWESTERN UNIV	1.20%	
MIT		0.58%	SANDIA NATL LABS	1.20%	
IBM CORP		0.56%	TOHOKU UNIV	1.20%	
HOKKAIDO UNIV		0.54%	UNIV CAMBRIDGE	1.20%	
USN		0.54%	UNIV TEXAS	1.20%	
UNIV PARIS 06		0.52%	WEIZMANN INST SCI	1.20%	
PENN STATE UNIV		0.52%	BROOKHAVEN NATL LAB	1.00%	
NAGOYA UNIV		0.50%	CASE WESTERN RESERVE UNIV	1.00%	
UNIV WISCONSIN		0.50%	ECOLE POLYTECH FED LAUSANNE	1.00%	
NANJING UNIV		0.50%	GEORGIA INST TECHNOL	1.00%	
OAK RIDGE NATL LAB		0.49%	MAX PLANCK INST KOLLOID & GRENZFLACHENFORSCH	1.00%	
CHALMERS UNIV TECHNOL		0.48%	RUTGERS STATE UNIV	1.00%	
UNIV WURZBURG		0.48%	SCRIPPS RES INST	1.00%	

With a couple of exceptions (CNRS, Tokyo Institute of Technology), the institutions with high numbers of highly cited papers (right side of Table A1-10) have ratios of three or greater. Most of these institutions are from the USA. On the other hand, institutions with large numbers of publications (left side of Table A1-10) span the gamut from high ratios (UCB, UCSB) to intermediate ratios hovering slightly above unity (CNRS, Tohoku University, University of Illinois) to low ratios (Russian Academy of Science, Chinese Academy of Science, Kyoto University, Osaka University).

Table A1-11 contains the same type and structure of data as Table A1-10, except for 2002. Because institutions are very detailed stratifications of country data, the volatility with time of individual institution data can be substantially greater than that of country data. For example, Georgia Institute of Technology and University of Washington increased their standings in representation on 500 most cited papers substantially, from

1998 to 2002. The Chinese Academy of Science increased its representation on 500 most cited papers by an order of magnitude, and increased its ratio by more than a factor of four. Tsing Hua University had .28% of publications in 1998, and was not represented on 500 most cited papers. In 2002, Tsing Hua University was in the top ten in publications, and had a favorable ratio of 1.4. Seoul National University increased its ratio by 2.6 from 1998 to 2002, and Korea Advanced Institute for Science and Technology was not represented on the 500 most cited in 1998, but had a ratio of 1.7 in 2002. UCSB dropped noticeably in its representation on the 500 most cited papers, while Kyoto University increased noticeably. University of North Carolina dropped noticeably in its representation on the 500 most cited papers, but still had a respectable ratio of about 4. To compensate for the institution volatility displayed here, the data for a number of years need to be tracked.

TABLE A1-11 – INSTITUTION DISTRIBUTIONS – OVERALL RECORDS/ 500 MOST CITED RECORDS – 2002

INSTITUTION RANK BY TOTAL PUBLICATION	CIT%	PUB%	INSTITUTION RANK BY MOST CITED RECORDS	CIT%	PUB%
CHINESE ACAD SCI	1.80%	3.30%	UNIV CALIF BERKELEY	5.00%	0.71%
RUSSIAN ACAD SCI	0.60%	2.36%	HARVARD UNIV	3.40%	0.40%
CNRS	1.40%	1.46%	IBM CORP	2.40%	0.34%
UNIV TOKYO	1.80%	1.40%	MIT	2.40%	0.53%
TOHOKU UNIV	0.20%	1.28%	GEORGIA INST TECHNOL	2.20%	0.34%
OSAKA UNIV	0.80%	1.09%	STANFORD UNIV	2.20%	0.39%
TOKYO INST TECHNOL	0.60%	1.02%	UNIV TEXAS	2.20%	0.68%
CSIC	1.00%	0.94%	UNIV WASHINGTON	2.20%	0.33%
NATL INST ADV IND SCI & TECHNOL	0.60%	0.94%	NORTHWESTERN UNIV	2.00%	0.46%
TSING HUA UNIV	1.20%	0.86%	CHINESE ACAD SCI	1.80%	3.30%
CNR	0.20%	0.78%	UNIV TOKYO	1.80%	1.40%
UNIV ILLINOIS	1.40%	0.77%	UNIV CAMBRIDGE	1.60%	0.74%
UNIV CAMBRIDGE	1.60%	0.74%	UNIV HAMBURG	1.60%	0.33%
KYOTO UNIV	0.60%	0.72%	CNRS	1.40%	1.46%
POLISH ACAD SCI	0.20%	0.71%	NASA	1.40%	0.28%
UNIV CALIF BERKELEY	5.00%	0.71%	RICE UNIV	1.40%	0.18%
NATL UNIV SINGAPORE	0.80%	0.69%	SEOUL NATL UNIV	1.40%	0.59%
UNIV TEXAS	2.20%	0.68%	UNIV BASEL	1.40%	0.19%
NATL INST MAT SCI		0.65%	UNIV CALIF SAN DIEGO	1.40%	
NANJING UNIV		0.64%	UNIV ILLINOIS	1.40%	
MOSCOW MV LOMONOSOV STATE UNIV		0.63%	TSING HUA UNIV	1.20%	
HOKKAIDO UNIV		0.59%	UNIV CALIF LOS ANGELES	1.20%	
SEOUL NATL UNIV		0.59%	UNIV MINNESOTA	1.20%	
PEKING UNIV		0.58%	UNIV PENN	1.20%	

UNIV OXFORD	0.58%	USN	1.20%
UNIV SCI & TECHNOL CHINA	0.57%	CSIC	1.00%
MIT	0.53%	LOS ALAMOS NATL LAB	1.00%
ACAD SINICA	0.51%	LUND UNIV	1.00%
PENN STATE UNIV	0.51%	OKLAHOMA STATE UNIV	1.00%
JAPAN SCI & TECHNOL CORP	0.50%	UNIV CALIF SANTA BARBARA	1.00%

1.3.3. Production Efficiency of Seminal Nanotechnology Papers by USA Institutions

The purpose of this section is to identify the citation impact of different segments of the very diverse USA nanotechnology research community, and relate the citation impact to the overall level of publications. All the nanotechnology papers produced by USA institutions from 1991-2002 (nearly 100000 papers) were retrieved, and the institutions and their metrics were evaluated by the SCI search engine Analyze function. Use of this capability constrains the institutions to the first 500. The institutions were first ordered by numbers of publications in that time interval, and then by numbers of citations. The most cited papers were defined as the 500 papers receiving the most citations. This represented about ½ percent of total publications, and is a more stringent requirement than that of the previous sections (where the 500 most cited papers were on the order of 1 to 1.5% of total publications).

There were three groups of papers resulting from the analysis. The first group consists of 66 institutions that were listed as authoring one or more highly cited papers, but were sufficiently small nanotechnology producers to not be listed in the first 500 most publication prolific institutions (it should be noted that not all the 500 institutions identified were USA. Due to extensive co-authorship with USA institutions, some non-USA institutions were listed as well. These foreign institutions were eliminated from the analysis.). Table A1-12 shows the handful of institutions in this group that produced more than one highly cited paper. The column headed #REC contains the number of papers in the 500 most cited on which the institution is represented. For example, Lorentzian, Inc., a small Connecticut company that published a series of high impact papers in the early-mid 90s on density functional theory and ab initio molecular orbital studies, is represented on six of the 500 most cited nanotechnology papers published in the 1991-2002 time frame, but is not among the 500 most prolific producers of nanotechnology papers in this time frame. Most of the other organizations listed are biomedical organizations, and reflect the reality that biomedicine in general attracts more citations than other disciplines due to the large number of researchers (especially in the USA) in biomedicine.

TABLE A1-12 – LOW NANOTECHNOLOGY PUBLICATION INSTITUTIONS WITH MORE THAN ONE HIGHLY CITED PAPER

INSTITUTION	#REC	%TOT
LORENTZIAN INC	6	1.20%
COLD SPRING HARBOR LAB	4	0.80%
HOWARD HUGHES MED INST	3	0.60%
NYU MED CTR	3	0.60%
REGENERON PHARMACEUT INC	3	0.60%
WESLEYAN UNIV	2	0.40%
WHITEHEAD INST BIOMED RES	2	0.40%
WORCESTER FDN BIOMED RES	2	0.40%

The second group consists of 155 institutions that were listed as producing substantial numbers of papers, but did not produce any highly cited papers. Due to space limitations, tables will not be presented for this group. There are no obvious patterns that distinguish this group of institutions.

The third group consists of 147 institutions that were listed in both the top 500 publication category and the top 500 citation category. Table A1-13 shows selected relatively prolific producers with their fractions of most cited papers. The first column on the left is the institution. The next column (#PUBS) is the number of nanotechnology papers produced by the institution in the 1991-2002 time frame. For example, Harvard produced 1559 nanotechnology publications in this period. The next column (#CIT) is the number of nanotechnology papers produced in this time frame that were represented on the list of 500 most highly cited. For example, Harvard was represented on 48 of the 500 most highly cited papers, almost 10%. The third column (% TOTAL PUBS) is number of nanotechnology publications for the institution expressed as a percent of the total nanotechnology publications, and the final column is number of highly cited papers for the institution expressed as a percent of total highly cited papers

TABLE A1-13 – SUBSTANTIAL NANOTECHNOLOGY PUBLICATION INSTITUTIONS WITH SOME HIGHLY CITED PAPERS

	%	%TOTAL

INSTITUTION	#PUB	#CIT	TOTAL PUBS	CITES
HARVARD UNIV	1559	48	1.62%	9.60%
UNIV CALIF BERKELEY	2744	35	2.85%	7.00%
RICE UNIV	588	24	0.61%	4.80%
UNIV CALIF SANTA BARBARA	2219	32	2.31%	6.40%
AT&T BELL LABS	2186	27	2.28%	5.40%
IBM CORP	2288	31	2.38%	6.20%
UNIV CALIF SAN FRANCISCO	378	7	0.39%	1.40%
YALE UNIV	612	12	0.64%	2.40%
WASHINGTON UNIV	432	7	0.45%	1.40%
UNIV KENTUCKY	447	7	0.46%	1.40%
SCRIPPS RES INST	261	7	0.27%	1.40%
BROOKHAVEN NATL LAB	941	7	0.98%	1.40%
CALTECH	1318	11	1.37%	2.20%
CORNELL UNIV	1689	14	1.75%	2.80%
MIT	2292	23	2.38%	4.60%
NORTHWESTERN UNIV	1570	11	1.63%	2.20%
PENN STATE UNIV	1739	10	1.81%	2.00%
PRINCETON UNIV	1024	9	1.06%	1.80%
STANFORD UNIV	1625	17	1.69%	3.40%
UNIV WASHINGTON	1013	8	1.05%	1.60%
UNIV ILLINOIS	3172	14	3.30%	2.80%
UNIV TEXAS	2265	11	2.35%	2.20%
UNIV MINNESOTA	1719	8	1.79%	1.60%
UNIV WISCONSIN	1621	6	1.68%	1.20%
UNIV FLORIDA	1262	5	1.31%	1.00%
OAK RIDGE NATL LAB	1558	2	1.62%	0.40%
PACIFIC NW LAB	611	1	0.64%	0.20%
SANDIA NATL LABS	1450	4	1.51%	0.80%
NASA	866	1	0.90%	0.20%
ARIZONA STATE UNIV	1439	2	1.50%	0.40%
UNIV MARYLAND	1142	1	1.18%	0.20%
UNIV ARIZONA	939	1	0.98%	0.20%
UNIV DELAWARE	724	1	0.75%	0.20%
UNIV NEW MEXICO	648	1	0.67%	0.20%
UNIV CALIF IRVINE	611	1	0.63%	0.20%
RENSSELAER POLYTECH INST	605	1	0.63%	0.20%

There are four main sub-groups of institutions shown in Table A1-13. The first sub-group, ranging from Harvard University to Scripps Research Institute, has high ratios (>3) of citation to publication fractions, and numbers of publications ranging from medium to high. The second sub-group, ranging from Brookhaven National Lab to University of Washington, has a positive ratio of citation to publication fractions, with substantial numbers of publications. The third sub-group, ranging from University of

Illinois to University of Florida, has a slightly negative ratio of citation to publication fractions, with very large numbers of publications. The fourth sub-group, ranging from Oak Ridge National Labs to Rensselear Polytechnical Institute, has relatively small ratios of citation to publication fractions, and medium to large numbers of publications.

The first sub-group contains three institutions from the University of California system and Scripps Research Institute, while the second sub-group contains the excellent California institutions Caltech and Stanford. The fourth sub-group contains the University of California Irvine.

There are also four DOE National Laboratories listed in Table A1-13. While BNL has a reasonable ratio, ORNL/PNNL/SNL have rather low ratios, and LLNL had no highly cited papers. It should be remembered that citations are only one metric of a research effort's full value.

SUMMARY AND CONCLUSIONS

In summary, modern day nanotechnology achievements are based on the confluence of 1) research results and discoveries from diverse disciplines such as Solid State Electronic Structure, Optics/ Spectroscopy, Surfaces/ Films/ Layers, Instrumentation, Materials, and Magnetics, and 2) technology developments including Lasers, Computers, and High Vacuum, dating back to the early twentieth century, and more recently the development of surface probe microscopes such as STMs and AFMs. Citation-Assisted Background, supplemented by high quality human judgment, helps document these discoveries, displays the sequencing among these achievements, and describes the spatial temporal evolution in the development of the disciplines. For nanotechnology, Science and Nature have become the journals of choice for the most highly cited papers, with Science becoming the clear leader in the past decade.

In this Appendix, we described the geneology of the seminal papers that accelerated nanotechnology research and development. The CAB technique proved to be very comprehensive in identifying what the authors perceived to be the seminal papers in nanotechnology, and allowed a technical narrative to be constructed linking these technical achievements and breakthroughs over time. Since the data obtained were temporal, CAB allowed interesting time-dependent effects to be observed, such as the changes in fraction of highly-cited papers being published in Nature/ Science.

Limitations of the source databases prevented greater use of the full power of CAB. The SCI/ SSCI version available to the authors provided only first author name, source, year, and volume/ issue for journal paper references downloaded en masse. For those references that were contained in the SCI as full records, the full record could have been downloaded manually. For references not accessed by the SCI, the data would have to be re-constructed manually from other sources to be part of the analytical database.

Once complete historical records had been obtained, Reference Mining, the retrospective analog of Citation Mining [Kostoff et al, 2001], could be performed on the historical database to obtain a wide variety of bibliometric and technical taxonomy results. For example, the full author fields could be clustered to identify key researchers such as Smalley and Lieber who were instrumental in nanotechnology development but may not have been first authors on many papers. Additionally, if sponsor information were obtained (laboriously) for each record, then a Hindsight-type of retrospective analysis [Sherwin and Isenson, 1967] could be performed for nanotechnology using the complete text and numerical data contained within the full record. Such analysis would provide some quantitative and qualitative indicators of the environment associated with these advances.

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APPENDIX 2 – NANOTECHNOLOGY QUERY

The following sets of keywords are used in queries to retrieve the data in the literature (* denotes the wild-card character used in most search engines), and the union of these sets constitutes the operational definition of nanotechnology/ nanoscience used by the authors.

SET 1 - TOPIC

NANOPARTICLE* OR NANOTUB* OR NANOSTRUCTURE* OR NANOCOMPOSITE* OR NANO-COMPOSITE* OR NANOWIRE* OR NANOCRYSTAL* OR NANOFIBER* OR NANOFIBRE* OR NANOSPHERE* OR NANOROD* OR NANOTECHNOLOG* OR NANOCLUSTER* OR NANOCAPSULE* OR NANOMATERIAL* OR NANOFABRICAT* OR NANOPOR* OR NANOPARTICULATE* OR NANOPHASE OR NANOPOWDER* OR NANOLITHOGRAPHY OR NANO-PARTICLE* OR NANODEVICE* OR NANODOT* OR NANOINDENT* OR NANO-INDENT* OR NANOLAYER* OR NANOSCIENCE OR NANOSIZE* OR NANO-SIZE* OR NANOSCALE* OR NANO-SCALE* OR NANOROBOT*

SET 2 - TOPIC

((NM OR NANOMETER* OR NANOMETRE*) SAME (SURFACE* OR FILM* OR GRAIN* OR POWDER* OR SILICON OR DEPOSITION OR LAYER* OR DEVICE* OR CLUSTER* OR CRYSTAL* OR MATERIAL* OR SUBSTRATE* OR STRUCTURE* OR ROUGHNESS OR MONOLAYER* OR RESOLUTION OR PARTICLE* OR ATOMIC FORCE MICROSCOP* OR TRANSMISSION ELECTRON MICROSCOP* OR SCANNING TUNNELING MICROSCOP*))

SET 3 - TOPIC

(AFM OR ATOMIC FORCE MICROSCOP* OR SCANNING ELECTRON MICROSCOP* OR SEM OR SCANNING TUNNELING MICROSCOP* OR STM OR SELF-ASSEMBL* OR SELF-ORGANIZ* OR TRANSMISSION ELECTRON MICROSCOP* OR TEM) SAME (SURFACE* OR FILM* OR LAYER* OR SUBSTRATE* OR ROUGHNESS OR MONOLAYER* OR MOLECUL* OR STRUCTURE* OR RESOLUTION OR ETCH* OR GROW* OR SILICON OR SI OR

DEPOSIT* OR PARTICLE* OR FORMATION OR TIP OR ATOM* OR GOLD OR AU OR POLYMER* OR COPOLYMER* OR GAAS OR INAS OR SUPERLATTICE* OR ADSORPTION OR ADSORB* OR ISLAND* OR SIZE OR POWDER* OR RESOLUTION OR QUANTUM OR MULTILAYER* OR ARRAY* OR NANO*)

SET 4 - TOPIC

(NSOM OR CHEMICAL VAPOR DEPOSITION OR CVD OR CHEMICAL VAPOUR DEPOSITION OR X-RAY PHOTOELECTRON SPECTROSCOPY OR DIFFERENTIAL SCANNING CALORIMETRY OR X-RAY DIFFRACTION OR XRD OR SURFACE PLASMON RESONANCE OR "NEAR" FIELD SCANNING OPTICAL MICROSCOP*) SAME (SURFACE* OR FILM* OR LAYER* OR SUBSTRATE* OR ROUGHNESS OR MONOLAYER* OR MOLECUL* OR STRUCTURE* OR RESOLUTION OR ETCH* OR GROW* OR SILICON OR SI OR DEPOSIT* OR PARTICLE* OR FORMATION OR TIP OR ATOM* OR GOLD OR AU OR POLYMER* OR COPOLYMER* OR GAAS OR INAS OR SUPERLATTICE* OR ADSORPTION OR ADSORB* OR ISLAND* OR SIZE OR POWDER OR RESOLUTION OR QUANTUM OR MULTILAYER* OR ARRAY* OR NANO*)

SET 5 - TOPIC

NANOMECHANICAL OR NANOELECTRONIC* OR NANOHARDNESS OR NANORIBBON* OR NANOBELT* OR NANOGRAIN* OR NANOCABLE* OR NANOCHANNEL* OR NANOSHEET* OR NANODIAMOND* OR NANOMAGNET* OR NANODISK* OR NANOSHELL* OR NANOCONTACT* OR NANOREACTOR* OR NANOIMPRINT* OR NANOHOLE* OR NANOWHISKER* OR NANOCHEMISTRY OR NANOGRAPHITE OR NANOELECTRODE* OR NANOGRANULAR OR NANOFOAM* OR NANOMETER-SIZE* OR NANOCOLLOID* OR NANORING* OR NANOPHOTONIC* OR NANOSENSOR* OR NANOELECTROSPRAY* OR NANOBRIDGE* OR NANOMETER-SCALE* OR NANOBIO* OR BIONANO* OR HIPCO

SET 6 - TOPIC

MOLECUL* MOTOR* OR MOLECUL* RULER* OR MOLECUL* DEVICE* OR MOLECULAR ENGINEERING OR MOLECULAR ELECTRONIC* OR COULOMB STAIRCASE* OR QUANTUM DOT* OR QUANTUM WELL* OR QUANTUM WIRE* OR COULOMB BLOCKADE* OR MOLECULAR WIRE*

SET 7 - JOURNALS

(BULK "AND" GRADED NANOMETALS OR CURRENT NANOSCIENCE OR FROM NANOPOWDERS TO FUNCTIONAL MATERIALS OR FULLERENES NANOTUBES "AND" CARBON NANOSTRUCTURES OR FULLERENES NANOTUBES "AND" CARBON NANOSTRUCTURES OR FUNCTIONAL MOLECULAR NANOSTRUCTURES OR IEEE TRANSACTIONS ON NANOBIOSCIENCE OR IEEE TRANSACTIONS ON NANOTECHNOLOGY OR INORGANIC POLYMERIC NANOCOMPOSITES "AND" MEMBRANES OR JOURNAL OF COMPUTATIONAL "AND" THEORETICAL NANOSCIENCE OR JOURNAL OF NANOPARTICLE RESEARCH OR JOURNAL OF NANOSCIENCE "AND" NANOTECHNOLOGY OR MICROSYSTEM TECHNOLOGIES MICRO "AND" NANOSYSTEMS INFORMATION STORAGE "AND" PROCESSING SYSTEMS OR NANO LETTERS OR NANOPOROUS MATERIALS IV OR NANOTECHNOLOGY OR ON THE CONVERGENCE OF BIO INFORMATION ENVIRONMENTAL ENERGY SPACE "AND" NANO TECHNOLOGIES PTS 1 "AND" 2 OR PHYSICA E LOW DIMENSIONAL SYSTEMS NANOSTRUCTURES OR PRECISION ENGINEERING JOURNAL OF THE INTERNATIONAL SOCIETIES FOR PRECISION ENGINEERING "AND" NANOTECHNOLOGY OR SYNTHESIS "AND" REACTIVITY IN INORGANIC METAL ORGANIC "AND" NANO METAL CHEMISTRY)

SET 8 – ADDRESS

NANO* NOT NANOPHOTON*

The first six sets of the query are generated using an iterative relevance feedback technique [Kostoff et al, 1997] applied to the phrases in the Abstract fields of the SCI/ SSCI records. The seventh set is applied to the journal Titles field, and represents journals that contain ‘nano*’ in the title. The eighth set is applied to the author address field, and represents organizations that contain nano* in their address but not nanophoton*. The retrievals from each query set have been validated for relevance and precision. The full query (the union of all eight sets) is used to retrieve relevant documents from selected source databases.

APPENDIX 3. DOCUMENT CLUSTERING ALGORITHM DESCRIPTION

Specifically, CLUTO implements various algorithms for clustering low- and high-dimensional datasets and for analyzing the characteristics of the various clusters. CLUTO implements three different classes of clustering algorithms that can operate either directly in the object's feature space or in the object's similarity space. The clustering algorithms provided by CLUTO are based on the partitional, agglomerative, and graph-partitioning paradigms. CLUTO's partitional and agglomerative algorithms are able to find clusters that are primarily globular, whereas its graph-partitioning and some of its agglomerative algorithms are capable of finding transitive clusters.

In this study, documents were clustered using the partitional clustering algorithms provided by CLUTO. Partitional clustering algorithms find the clusters by partitioning the entire document collection into a predetermined number of disjoint sets, each corresponding to a single cluster. This partitioning is achieved by treating the clustering process as an optimization procedure that tries to create high quality clusters according to a particular function that reflects the underlying definition of the “goodness” of the clusters. This function is referred to as the *clustering criterion function.* CLUTO implements seven such criterion functions that measure various aspects of intra-cluster similarity, inter-cluster dissimilarity, and their combinations, and have been shown to produce high-quality clusters in low- and high-dimensional datasets.

CLUTO uses two different methods for computing the partitioning clustering solution. The first method computes a *k*-way clustering solution via a sequence of repeated bisections, whereas the second method computes the solution directly (in a fashion similar to traditional *K*-means-based algorithms). These methods are often referred to as *repeated bisecting* and *direct k*-way clustering, respectively. CLUTO computes a direct *k*-way clustering as follows. Initially, a set of *k* objects is selected from the datasets to act as the *seeds* of the *k* clusters. Then, the similarity of each object to these *k* seeds is computed, and the object is assigned to the cluster corresponding to its most similar seed. This forms the initial *k*-way clustering. This clustering is then repeatedly refined so that it optimizes a desired clustering criterion function. This optimization is performed using a randomized incremental optimization algorithm that is greedy in nature, has low computational requirements, and produces high-quality solutions (Zhao and Karypis, 2004). A *k*-way partitioning via repeated bisections is obtained by recursively applying the above algorithm to compute 2-way clustering (*i.e*., bisections). Initially, the objects are partitioned into two clusters, then one of these clusters is selected and is further bisected, and so on. This process continues *k* - 1 times, leading to *k* clusters. Each of these bisections is performed so that the resulting two-way clustering solution optimizes a particular criterion function.

The actual documents were represented using the widely-used vector-space model in which the various terms present in the documents were used to define a high-dimensional space and each document was considered to be a vector in that space. However, unlike the traditional vector-space representation, which relies entirely on single terms, all consecutive two- and three-word combinations were taken into account, resulting in a representation that is capable of capturing the phrases commonly occurring in the documents. In addition, Porter's stemming algorithm was used to pre-process the various terms of each document prior to obtaining their vector-space representation. The weight of each dimension was computed using the TF-IDF model in which terms that occur many times within a document are given higher weight (TF) and terms that occur across many documents were given lower weight (IDF). The similarity between two documents was measured using the cosine of their corresponding document vectors.

APPENDIX 4. MULTIPLE AUTHORS WITH THE SAME NAME

AUTHOR-INSTITUTION CO-OCCURRENCE MATRIX

Essentially, an author-institution co-occurrence matrix is generated for the most prolific authors and institutions. If it is assumed that each institution contains one author with a given full name in a specific technology, then the leading authors may be identified uniquely. Unfortunately, the software is not configured to allow mapping by authors deconvolved using this approach.

An author-institution co-occurrence matrix of the top 327 authors and the top 348 institutions was generated to assign the authors to a particular institution. This assumes that 1) at a given institution there is only one person with a given name publishing in the field of nanotechnology/ nanoscience and 2) that the author's institution appears on all of his/her records. Because the records correspond to one year, author mobility is not an issue, so the first assumption should be valid on that account. For the authors with less common names, the number of papers published at the given institution matches the total number of papers published by that author. Thus the second assumption should hold.

The author-insitution pairings occurring with the highest frequency were extracted from the co-occurrence matrix, and a list of the 29 most prolific authors was generated (Table A4-1).

TABLE A4-1 – MOST PROLIFIC NANOTECHNOLOGY RESEARCH AUTHORS LISTED WITH THEIR INSTITUTION (2005)

AUTHOR	#PAPERS	INSTITUTION	COUNTRY
Qian, YT	86	UNIV SCI & TECHNOL CHINA	PEOPLES R CHINA
Li, Y	54	CHINESE ACAD SCI	PEOPLES R CHINA
Jiang, L	53	CHINESE ACAD SCI	PEOPLES R CHINA
Chu, PK	52	CITY UNIV HONG KONG	PEOPLES R CHINA
Cingolani, R	52	UNIV LECCE	ITALY
Zhang, LD	52	CHINESE ACAD SCI	PEOPLES R CHINA
Wang, ZG	51	CHINESE ACAD SCI	PEOPLES R CHINA
Zhang, Y	45	CHINESE ACAD SCI	PEOPLES R CHINA
Du, YW	44	NANJING UNIV	PEOPLES R CHINA
Hopkinson, M	44	UNIV SHEFFIELD	ENGLAND
Shi, JL	44	CHINESE ACAD SCI	PEOPLES R CHINA
Gao, L	43	CHINESE ACAD SCI	PEOPLES R CHINA
Liu, Y	43	CHINESE ACAD SCI	PEOPLES R CHINA
Knoll, W	42	MAX PLANCK INST POLYMER RES	GERMANY
Zhu, DB	42	CHINESE ACAD SCI	PEOPLES R CHINA
Chang, SJ	41	NATL CHENG KUNG UNIV	TAIWAN
Mullen, K	41	MAX PLANCK INST POLYMER RES	GERMANY
Bando, Y	40	NATL INST MAT SCI	JAPAN
Bhushan, B	40	OHIO STATE UNIV	USA
Lee, ST	40	CITY UNIV HONG KONG	PEOPLES R CHINA
Reinhoudt, DN	40	UNIV TWENTE	NETHERLANDS
Schubert, US	40	EINDHOVEN UNIV TECHNOL	NETHERLANDS
Yu, DP	40	PEKING UNIV	PEOPLES R CHINA
Arakawa, Y	39	UNIV TOKYO	JAPAN
Kim, TW	39	HANYANG UNIV	SOUTH KOREA
Li, YD	39	TSING HUA UNIV	PEOPLES R CHINA
Zhang, J	39	CHINESE ACAD SCI	PEOPLES R CHINA
Liu, WM	38	CHINESE ACAD SCI	PEOPLES R CHINA
Pearton, SJ	38	UNIV FLORIDA	USA

Only four names from the top 30 remained in the list of the 29 most prolific authors, and the author with the most papers, YT Qian, was not included in the original list of 30.

The top four authors, eight of the top nine, and seventeen total were from China. Two of the top authors were each from Germany, Japan, the Netherlands, and the US; and one each was from England, Italy, Taiwan, and South Korea. The majority of the most prolific authors were from universities (52%), and the rest of the top authors were from research institutions. This suggests a relatively balanced split between basic and applied science, and may be indicative of a balanced nanoscience/

nanotechnology split as well. Work is continuing on a more comprehensive name disambiguation approach.

APPENDIX 5. NANOTECHNOLOGY INSTRUMENTATION

In the updated nanotechnology study, all of the technical structural analyses of the total nanotechnology database, including the phrase correlation mapping, the factor analysis, and the document clustering taxonomy, show instrumentation playing a central role in nanoscience and nanotechnology research. The objectives of this Appendix are to examine the nanotechnology instrumentation literature in depth, and show how suites of instruments are used in concert, especially in relation to measurements on common materials, properties, phenomena, and nanostructures.

There are four main sections in this Appendix. The first lists the key nanotechnology instruments, and emphasizes those used most frequently. The second presents key findings of co-occurrence matrices, showing the relation of the major nanotechnology instruments to materials, properties, phenomena, and nanostructures. The third presents correlation mapping of the nanotechnology instruments to each other, especially how they relate to common materials, properties, phenomena, and nanostructures. Included in this section is a factor matrix analysis, which presents a more quantitative description of the relationships shown on the maps. The fourth presents a hierarchical taxonomy (generated by document clustering) of all the retrieved nanotechnology records related to instrumentation, with metrics provided at every taxonomy node.

APPROACH

The following approach describes how the main nanotechnology instruments were identified, along with the main categories of items that they measure. The ~65000 total nanotechnology records retrieved for 2005 were subject to a phrase frequency analysis, and hundreds of thousands of phrases were generated. All single word, adjacent double word, and adjacent triple word phrases were extracted and corrected to eliminate phrases containing trivial words at the beginning or end, and their occurrence frequencies were recorded. Approximately 60000 phrases were then inspected visually, starting from the highest frequency. Every instrument-related phrase was extracted. Then, the root phrase for each instrument (e.g., microscop*, spectroscop*) was inserted into the phrase search engine, and all variants of the instrument terminology were retrieved, including the lowest frequency variants Approximately 240 phrases resulted. Additionally, phrases related to materials, properties, phenomena, and nanostructures were extracted during the visual inspection process.

The 401 most cited nanotechnology papers published since 1991 were also retrieved. A short analysis was done of this retrieved database as well.

RESULTS

<u>Nanotechnology Instrument Types</u>

Overview

Historically, various scientific instruments were used for measurement and characterization of chemicals and materials. Nanotechnology uses many of the same instruments that are in the chemistry and material science laboratories. X-ray diffraction (XRD) is a technique in crystallography to study the nature of the crystal lattice by studying the pattern produced by the diffraction of X-rays through the crystal lattice. The technique is widely used in chemistry and biochemistry to determine the structures of a variety of molecules including inorganic compounds, DNA, and proteins. In the case of nanotechnology research, XRD is more suitable for the study of nanocrystals of various types. Transmission Electron Microscopy (TEM) is an imaging technique where an electron beam is focused on a specimen. Details of the sample are detected using a photographic film or fluorescent screen or other imaging sensors. Modern research TEMs with aberration corrections can have resolution as small as 0.08nm – 0.1nm. TEMs are heavily used in material science and metallurgy laboratories, as well as in biological science to study cells and microorganisms. However, for effective use of TEM the specimen must be very thin (in the microns) and be able to withstand the required high vacuum. Scanning Electron Microscope (SEM) is capable of producing high resolution images at spot size of 1nm to 5nm. Because the images have a characteristic three-dimension appearance, SEMs are useful for the study of material surfaces and structures.

Electron microscopes are used for various purposes in the study of materials. Topography, surface features, and textures are important to understanding the materials properties such as hardness and reflectivity. Morphology is used to study the shape and size of the particles making up the object or material, and the relationship between these structures and material properties such as ductility, strength, and reactivity. Electron microscopes are also used to determine the composition of the elements and compounds in terms of the relative amounts and the relationship between the composition and the material properties such as melting points, hardness, and reactivity. Crystallographic information is important to understanding how the atoms are arranged in the material and the relationship between these arrangements and the material properties such as conductivity, electrical properties, and optical properties.

More recent development in instruments for nanotechnology research includes the Scanning Tunneling Microscope (STM) based on the tunneling current between the probe tip and the surface atom. STMs are mostly used to study surfaces, and can obtain images of conductive surfaces at an atomic scale down to 0.2nm. Variants of STM can also be used to manipulate individual atoms, trigger chemical reactions, or produce ions by removing electrons from atoms. Atomic Force Microscope (AFM) is a high resolution scanning probe microscope based on forces between the probe tip and the surface atom. A laser beam is deflected as it is pointed at the cantilever tip, which scans the sample surface. AFMs have demonstrated resolution of fractions of an Angstrom, or <0.1nm. AFM is one of the foremost instruments for imaging, measuring, and manipulating matters at the molecular and atomic scale. Because of the closeness to the surface, both STM and AFM require sample surfaces that are extremely smooth and flat, usually in ultra-high vacuum.

Specific Types

In this study, variant terminologies of each instrument (e.g., Scanning Electron Microscope or SEM) were combined. The resultant list of instrumentation types is shown in Table A5-1. The first column in Table A5-1, #REC TOTAL, is the number of records in the total 2005 nanotechnology database that contain the instrument (or one of its proxy variants). The second column, #REC TOT%, is the ratio of the entry in the first column to the sum of the entries in the first column. The third column, #REC CITED, is the number of records in the 401 most cited nanotechnology records database that contains the instrument (or one of its proxy variants). The fourth column, #REC CIT%, is the ratio of the entry in the third column to the sum of the entries in the third column.

The purpose of incorporating results from both databases is to identify the instruments that have strong relative representation in highly cited papers. While many instrument types are listed, the top seven dominate the first tier. They are a combination of x-ray diffraction, variants of electron microscopy, atomic force microscopy, and spectroscopy variants.

In Table A5-1, scanning tunneling microscopy was ranked number 16 in terms of # Records, whereas in the most cited papers STM moved up significantly. Conventional microscopes and spectroscopes have been around for decades in the study of chemistry and materials, and it is no surprise that these instruments would be used in the study of nanomaterials and nanotechnology. As discussed previously, the invention of the STM was a significant advance enabling the study of surfaces at the molecular scale and thus was important to nanotechnology research. The fact that more highly cited papers mentioned the use of STM confirms the importance of this scientific instrument.

Instruments that have much higher representation in the most cited documents database than their representation in the total nanotechnology database include: optical microscopy, scanning tunneling microscopy, UV/visible spectroscopy, mass spectrometry, electron energy loss spectroscopy, photoluminescence spectroscopy, optical spectroscopy, probe microscopy, crystallography. These results could be interpreted two different ways: the instruments listed could be the most promising for yielding important results, or these instruments generated important results in the past, but have become superceded by improved techniques.

If the contents of Table A5-1 are used as the category headings of an instrumentation taxonomy, and the full 240 instrumentation phrases as the contents of an instrumentation taxonomy, then a flat taxonomy (one level only) can be constructed (Table A5-2). The contents of these two tables serve as starting points for many of the analyses in this paper.

TABLE A5-1. LIST OF INSTRUMENTATION
(after combining instrument variants)

#REC TOTAL	#REC TOT%	#REC CITED	#REC CIT%	Instrumentation (Cleaned)
9134	23.29	22	14.01	X-ray diffraction
5881	15.00	18	11.46	transmission electron microscopy
4059	10.35	10	6.37	scanning electron microscopy
3286	8.38	15	9.55	atomic force microscopy
2712	6.92	15	9.55	electron microscopy
2428	6.19	7	4.46	X-ray photoelectron spectroscopy
2077	5.30	6	3.82	infrared spectroscopy
979	2.50	2	1.27	Raman spectroscopy
791	2.02	1	0.64	differential scanning calorimetry
727	1.85		0.00	NMR spectroscopy
615	1.57	1	0.64	cyclic voltammetry
612	1.56		0.00	microscopy
590	1.50	2	1.27	energy-dispersive x-ray spectroscopy
552	1.41		0.00	calorimetry
513	1.31	6	3.82	optical microscopy
491	1.25	10	6.37	scanning tunneling microscopy
384	0.98	3	1.91	electron diffraction
323	0.82		0.00	Spectroscopy
276	0.70	5	3.18	UV-visible spectroscopy
273	0.70	7	4.46	mass spectrometry
246	0.63		0.00	impedance spectroscopy
243	0.62	1	0.64	Auger electron spectroscopy
240	0.61		0.00	ellipsometry
216	0.55	3	1.91	small-angle X-ray scattering
211	0.54		0.00	dynamic light scattering
131	0.33		0.00	Mossbauer spectroscopy
104	0.27	3	1.91	electron energy loss spectroscopy
103	0.26		0.00	quartz crystal microbalance
101	0.26	1	0.64	fluorescence microscopy
92	0.23	2	1.27	photoluminescence spectroscopy
78	0.20		0.00	vibrating sample magnetometer
77	0.20		0.00	fluorescence spectroscopy
76	0.19		0.00	confocal microscopy
68	0.17		0.00	spectrometry
53	0.14	4	2.55	probe microscopy
47	0.12		0.00	X-ray absorption spectroscopy

46	0.12	1	0.64	chronoamperometry
44	0.11	4	2.55	optical spectroscopy
42	0.11		0.00	X-ray reflectivity
41	0.10	2	1.27	Force Microscopy
40	0.10		0.00	Electron Spectroscopy
40	0.10		0.00	Rutherford backscattering spectrometry
38	0.10		0.00	flow cytometry
36	0.09	6	3.82	crystallography
36	0.09		0.00	Spectrophotometry
33	0.08		0.00	absorption spectroscopy
31	0.08		0.00	optical absorption spectroscopy

TABLE A5-2. ONE LEVEL TAXONOMY OF INSTRUMENTS

- X-Ray Diffraction (Powder, Single-Crystal, Wide-Angle, High-Resolution, Surface, Small-Angle, Low-Angle, High-Temperature, Time-Resolved, Grazing-Incidence, Energy-Dispersive, In-Plane, High-Energy, Temperature-Dependent, Glancing-Angle, Thin-Film)
- Transmission Electron Microscopy (High-Resolution, Scanning, Cross-Sectional, Cryo, Environmental)
- Scanning Electron Microscopy (Field Emission, Emission, High-Resolution, Cryo)
- Atomic Force Microscopy (Conducting, Frequency Modulation, Tapping Mode, Non-Contact, Probe, Conductive Probe, Scanning Electrochemical)
- Photoelectron Spectroscopy/Spectrometry (X-Ray, Ultraviolet, Angle-Resolved X-Ray, High-Resolution X-Ray)
- Infrared Spectroscopy (Fourier Transform, Reflection-Absorption, Diffuse-Reflectance Infrared Fourier Transform Spectroscopy, Attenuated Total Reflectance Fourier Transform)
- Raman Spectroscopy/Spectrometry (Micro, Laser, Resonance, Fourier Transform)
- Calorimetry (Differential Scanning, Titration, Micro, Cone, Isothermal Titration, Nano, Modulated Differential Scanning)
- Nuclear Magnetic Resonance Spectroscopy (H-1, Magic Angle Spinning, C-13, Solid-State, P-31, Multinuclear, Si-29, Al-27)
- Voltammetry (Cyclic, Square Wave)
- Energy-Dispersive X-Ray Spectroscopy/Spectrometry
- Optical Microscopy (Near-Field, Polarized, Scanning, Near-Field Scanning, Light, Scattering-Type Scanning Near-Field)
- Scanning Tunneling Microscopy (Low-Temperature, Cross-Sectional, Spin-Polarized)
- Electron Diffraction (Selected-Area, Reflection High-Energy, Convergent Beam, Low-Energy, Transmission, Photo)
- UV-Visible Spectroscopy/Spectometry
- Mass Spectrometry (Secondary Ion, Time-of-Flight Secondary Ion, Time-of-Flight, Ionization, Plasma, Matrix-Assisted Laser Desorption/Ionization, Quadrupole, Electrospray, Electrospray Ionization, Nanoelectrospray Tandem, Temperature Programmed Desorption)

- Impedance Spectroscopy (Electrochemical, AC, Complex)
- Auger Electron Spectroscopy
- Ellipsometry (Spectroscopic, Angle Spectroscopic, Infrared Spectroscopic, Variable Incident Angle Spectroscopic, Imaging)
- X-Ray Scattering (Small-Angle, Wide-Angle, Synchotron, Synchotron Small-Angle, Grazing-Incidence Small-Angle)
- Dynamic Light Scattering
- Mossbauer Spectroscopy/Spectrometry (Fe-57, Electron)
- Electron Energy-Loss Spectroscopy (High-Resolution)
- Quartz Crystal Microbalance
- Fluorescence Microscopy (Confocal, Epi)
- Photoluminescence Spectroscopy
- Vibrating Sample Magnetometer
- Fluorescence Spectroscopy (X-Ray, Surface Plasmon Enhanced)
- Confocal Microscopy (Scanning)
- Probe Microscopy (Scanning, Kelvin)
- Absorption Spectroscopy (X-Ray, Optical, Infrared, Reflection, Atomic, UV-Visible, Transient, Near-Edge X-Ray Absorption Fine Structure Spectroscopy, Extended X-Ray Absorption Fine Structure Spectroscopy)
- Chronoamperometry
- Optical Spectroscopy
- X-Ray Reflectivity
- Rutherford Backscattering Spectroscopy/Spectrometry
- Flow Cytometry
- Spectrophotometry (UV-Visible)
- Deep Level Transient Spectroscopy
- Inductively-Coupled Plasma-Atomic Emission Spectrometry

Instrument-Measured Quantity Co-occurrence Matrices

A central nanotechnology research question revolves around the selection of instrumentation to measure desired quantities. This section identifies instruments commonly associated with different materials, properties, phenomena, and nanostructures. Following sections expand to groups of instruments commonly used to measure these quantities.

The TechOasis (Search, 2006) software was used to construct co-occurrence matrices of the most used nanotechnology instruments with quantities they measure. The co-occurrence frequencies (matrix elements) represent the number of records in which a specific instrument co-occurs with a specific term.

Eight of the most widely used nanotechnology instruments (according to Table A5-1) were matrixed with: a) the materials-related terms strongly associated with each instrument; b) the materials properties-related terms strongly associated with each instrument; c) the nanoscale phenomena-related terms strongly associated with each instrument; d) the nanostructure-related terms strongly associated with each instrument. These results are now presented.

Instrument-Materials Co-Occurrence Matrix

Table A5-3a contains eight of the most widely used nanotechnology instruments (according to Table A5-1) and the materials-related terms strongly associated with each instrument. While many terms are listed for each instrument, a few are dominant, and are highlighted in the table. *TiO2, Ti, Si, SiO2, and polymers tend to stand out as the most pervasive material types* related to the most heavily used instruments. With the exception of polymers, many of the material systems are used in electronic applications.

TABLE A5-3a. INSTRUMENTS-MATERIALS CO-OCCURRENCE MATRIX

- **X-ray Diffraction** (powders, 194; TiO2, 179; Fe, 137; Ni, 136; composites, 131; Si, 129; Cu, 121; Ti, 106; clay 97; ZnO, 96; SiO2, 87; alloys, 86; polymer, 84; silicon, 84; glass, 84)
- **Transmission Electron Microscopy** (composites, 117; Si, 110; powders, 101; TiO2, 100; polymer, 81; Ni, 79; composite, 73; clay, 72; SiO2, 70; alloy, 68; Fe, 67; Cu, 66; silicon, 60; Pt, 51; Ag, 47)
- **Scanning Electron Microscopy** (composites, 116; powders, 91; polymer, 80; TiO2, 67; Si, 65; composite, 61; Ni, 54; alloy, 52; SiO2, 47; Fe, 47; silicon, 47; glass, 47; alloys, 46; Ti, 45; polymers, 44)
- **Atomic Force Microscopy** (polymers, 71; silicon, 58; glass, 56; polymer, 55; protein, 50; proteins, 47; Si, 46; TiO2, 34; gold, 33; SiO2, 30; composites, 25; graphite, 24; Ti, 23; copper, 23; GaAs, 23)
- **X-ray Photoelectron Spectroscopy** (TiO2, 79; Si, 71; SiO2, 50; Ti, 48; copper, 47; silicon, 45; gold, 42; polymer, 39; Cu, 39; Ni, 39; Pt, 38; polymers, 32; Ag, 32; Al2O3, 32; nickel, 29)
- **Infrared Spectroscopy** (polymer, 85; composites, 62; polymers, 59; TiO2, 43; SiO2, 37; Si, 33; powders, 29; silicon, 28; copolymers, 27; composite, 22; aniline, 22; copper, 19; titanium, 19; chitosan, 19; MCM-41, 19)
- **Raman Spectroscopy** (Si, 24; diamond, 24; silicon, 23; graphite, 20; amorphous carbon, 17; composites, 16; TiO2, 14; gold, 14; anatase,

14; polymer, 13; glass, 12; Ni, 11; silver, 11; Ag, 10; SiO2, 9; metal, 9)

- **Differential Scanning Calorimetry** (polymers, 57; polymer, 45; copolymers, 32; composites, 26; copolymer, 19; block copolymers, 17; PEO, 14; powders, 11; clay, 11; Ni, 10; alloys, 10; PP, 10; alloy, 9; MMT, 9)

Instruments-Properties Co-Occurrence Matrix

Table A5-3b contains eight of the most used nanotechnology instruments and the material properties-related terms strongly associated with each instrument. While a number of terms are listed for each instrument, a few are dominant, and are highlighted in the table. *Morphology/ surface morphology, thickness/diameter/particle size, surface roughness/surface area, mechanical properties/optical properties/thermal properties, crystal structure/crystallinity tend to stand out as the most pervasive material properties* related to the most heavily used instruments. Morphology at the surfaces is an important property of material systems and is of great interest to chemists and material scientists.

TABLE A5-3b. INSTRUMENTS-PROPERTIES CO-OCCURRENCE MATRIX

- **X-ray Diffraction** (morphology, 582; crystal structure, 522; crystallinity, 278; thickness, 272; particle size, 252; diameter, 250; magnetic properties, 228; crystal structures, 199; mechanical properties, 198; grain size, 176; optical properties, 174; surface morphology, 157; surface area, 130; hardness, 121; lattice parameters, 112)
- **Transmission Electron Microscopy** (morphology, 590; diameter, 335; particle size, 242; thickness, 210; mechanical properties, 159; morphologies, 118; crystallinity, 106; magnetic properties, 105; optical properties, 98; grain size, 93; size distribution, 82; crystal structure, 80; hardness, 79; chemical composition, 67; surface area, 65)
- **Scanning Electron Microscopy** (morphology, 536; thickness, 195; mechanical properties, 180; diameter, 172; surface morphology, 160; morphologies, 112; particle size, 99; crystallinity, 98; hardness, 85; chemical composition, 83; grain size, 82; porosity, 67; surface area, 63; crystal structure, 59; tensile strength, 57)

- **Atomic Force Microscopy** (morphology, 327; surface morphology, 215; thickness, 188; surface roughness, 185; roughness, 111; mechanical properties, 105; diameter, 88; optical properties, 82; hardness, 70; surface topography, 60; topography, 59; film thickness, 54; surface properties, 51; grain size, 48; crystallinity, 47; substrate temperature, 47)
- **X-ray Photoelectron Spectroscopy** (morphology, 142; thickness, 114; chemical composition, 99; surface morphology, 74; surface properties, 66; surface roughness, 50; diameter, 48; optical properties, 47; particle size, 40; surface composition, 40; hardness, 38; electronic structure, 38; mechanical properties, 36; film thickness, 36; corrosion resistance, 33)
- **Infrared Spectroscopy** (morphology, 163; crystallinitiy, 70; particle size, 55; mechanical properties, 52; thickness, 50; diameter, 48; surface area, 45; optical properties, 37; conductivity, 33; crystal structure, 33; FTIR spectra, 33; surface morphology, 31; chemical composition, 27; surface properties, 27; tensile strength, 27)
- **Raman Spectroscopy** (Raman spectra, 70; morphology, 52; thickness, 35; optical properties, 32; diameter, 31; surface morphology, 27; surface roughness, 23; crystallinity, 21; mechanical properties, 20; hardness, 20; structural properties, 19; grain size, 16; Raman spectrum, 15)
- **Differential Scanning Calorimetry** (crystallinity, 66; morphology, 65; thermal properties, 57; mechanical properties, 38; molecular weight, 23; glass transition temperature, 20; thermal behavior, 20; particle size, 19; activation energy, 18; glass transition temperature T-g, 18; enthalpy, 17; crystal structure, 16; crystallization behavior, 16; crystallization rate, 15)

Instruments-Phenomena Co-occurrence Matrix

Table A5-3c contains eight of the most used nanotechnology instruments and the nanoscale phenomena strongly associated with each instrument. While a number of terms are listed for each instrument, a few are dominant, and are highlighted in the table. *Deposition, oxidation, crystallization, catalytic activity, nucleation, adsorption, polymerization, adhesion, decomposition/ degradation tend to stand out as the most pervasive nanoscale phenomena* related to the most heavily used instruments. These phenomena are an indication of the chemical processes going on and are closely reflected in the material properties.

TABLE A5-3c. INSTRUMENTS-PHENOMENA CO-OCCURRENCE MATRIX

- **X-ray Diffraction** (crystallization, 209; catalytic activity, 174; oxidation, 155; deposition, 136; decomposition, 127; adsorption, 99; nucleation, 87; field emission, 80; intercalation, 75; photocatalytic activity, 74; photoluminescence, 73; thermal decomposition, 72; degradation, 71; hydrolysis, 70; precipitation, 64)
- **Transmission Electron Microscopy** (oxidation, 102; deposition, 93; crystallization, 86; nucleation, 86; decomposition, 78; catalytic activity, 73; aggregation, 70; field emission, 69; precipitation, 60; hydrolysis, 56; polymerization, 54; degradation, 53; thermal decomposition, 49; diffusion, 46; adsorption, 44; intercalation, 44)
- **Scanning Electron Microscopy** (deposition, 85; field emission, 82; oxidation, 71; adhesion, 63; crystallization, 59; degradation, 50; adsorption, 50; field-emission, 44; decomposition, 43; nucleation, 42; diffusion, 38; corrosion, 37; polymerization, 35; catalytic activity, 34; precipitation, 32; surface modification, 32)
- **Atomic Force Microscopy** (deposition, 120; adhesion, 94; adsorption, 83; nucleation, 51; crystallization, 46; irradiation, 37; aggregation, 36; surface modification, 32; degradation, 30; self-assembly, 29; field emission, 27; oxidation, 27; immobilization, 26; epitaxial growth, 24)
- **X-ray Photoelectron Spectroscopy** (deposition, 108; adsorption, 98; oxidation, 87; surface modification, 59; catalytic activity, 51; adhesion, 50; decomposition, 46; grafting, 32; photocatalytic activity, 31; degradation, 30; diffusion, 27; desorption, 23; thermal decomposition, 23; irradiation, 22; field emission, 21; immobilization, 21)
- **Infrared Spectroscopy** (adsorption, 67; polymerization, 47; catalytic activity, 46; oxidation, 41; decomposition, 38; grafting, 37; deposition, 36; crystallization, 35; hydrolysis, 31; degradation, 28; aggregation, 27; thermal decomposition, 24; precipitation, 24; photocatalytic activity, 23; field emission, 21; condensation, 21)
- **Raman Spectroscopy** (deposition, 45; photoluminescence, 25; oxidation, 19; crystallization, 17; field emission, 16; adhesion, 12; nucleation, 12; field-emission, 12; adsorption, 11; decomposition, 10; fluorescence, 8; graphitization, 8; precipitation, 7; diffusion, 7; irradiation, 7; photoluminescence PL, 7)

- **Differential Scanning Calorimetry** (crystallization, 58; polymerization, 23; phase separation, 15; degradation, 13; phase transitions, 13; decomposition, 12; precipitation, 10; intercalation, 10; hydrogen bonding, 10; phase transition, 10; thermal decomposition, 9; grafting, 9; crystallization process, 9; crosslinking, 9; aggregation, 8)

Instruments-Nanostructures Co-Occurrence Matrix

Table A5-3d contains eight of the most used nanotechnology instruments and the material properties-related terms strongly associated with each instrument. While a number of terms are listed for each instrument, a few are dominant, and are highlighted in the table. *Thin films, nanocomposites, nanowires, nanotubes, monolayers/self-assembled monolayers tend to stand out as the most pervasive nanostructures* related to the most heavily used instruments.

TABLE A5-3d. INSTRUMENTS-NANOSTRUCTURES CO-OCCURRENCE MATRIX

- **X-ray Diffraction** (thin films, 213; nanocomposites, 167; nanowires, 85; nanocrystals, 62; nanorods, 57; nanotubes, 52; thin film, 48; nanocomposite, 44; nanostructures, 36; carbon nanotubes, 35; nanostructure, 28; nanofibers, 21; monolayer, 20; CNTs, 19; nanocrystallites, 19)
- **Transmission Electron Microscopy** (nanocomposites, 195; nanowires, 131; nanotubes, 102; thin films, 84; nanorods, 84; carbon nanotubes, 75; nanocrystals, 70; CNTs, 61; nanocomposite, 60; nanostructure, 54; MWNTs, 47; silver nanoparticles, 37; nanostructure, 34; SWNTs, 34; carbon nanotubes CNTs, 32)
- **Scanning Electron Microscopy** (thin films, 73; nanowires, 68; nanocomposites, 55; nanotubes, 51; nanorods, 41; CNTs, 32; nanostructures, 31; carbon nanotubes, 27; thin film, 25; MWNTs, 19; nanocomposite, 17; carbon nanotubes CNTs, 16; nanostructure, 15; nanocrystals, 14; SWNTs, 14; nanofibers, 14)
- **Atomic Force Microscopy** (thin films, 141; monolayer, 47; nanostructures, 39; monolayers, 37; thin film, 28; nanotubes, 21; nanostructure, 20; self-assembled monolayers SAMs, 19; SAMS, 17; QDs, 17; nanowires, 16; nanocomposites, 16; quantum dots, 16; carbon nanotubes, 15; SWNTs, 14)

- **X-ray Photoelectron Spectroscopy** (thin films, 78; monolayer, 29; self-assembled monolayers SAMs, 29; SAMS, 24; monolayers, 22; thin film, 15; CNTs, 15; carbon nanotubes, 13; SAM, 13; nanostructures, 12; nanotubes, 11; nanowires, 10; Au nanoparticles, 10; nanostructure, 9; nanocrystals, 9; Pt nanoparticles, 9)
- **Infrared Spectroscopy** (nanocomposites, 57; thin films, 50; monolayer, 25; nanotubes, 17; MWNTs, 15; nanocomposite, 13; monolayers, 11; carbon nanotubes, 11; nanocrystals, 11; SWNTs, 11; tiO2 nanoparticles, 11; thin film, 10; Au nanoparticles, 9; self-assembled monolayers SAMs, 8; nanofibers, 8; magnetic nanoparticles, 8)
- **Raman Spectroscopy** (nanotubes, 40; SWNTs, 32; thin films, 30; carbon nanotubes, 28; CNTs, 26; nanostructures, 16; carbon nanotubes CNTs, 14; single-walled carbon nanotubes SWNTs, 13; nanocrystals, 12; MWNTs, 9; nanowires, 9; nanorods, 9; SWCNTS, 9; SWNT, 9; single-walled carbon nanotubes, 7)
- **Differential Scanning Calorimetry** (nanocomposites, 45; nanocomposite, 14; thin films, 5; nanocrystals, 4; nanostructures, 3; nanofibers, 3; nanocomposite films, 3; silica nanoparticles, 3; self-assembled structures, 3; nanotubes, 2; thin film, 2; nanoclusters, 2; Au nanoparticles, 2; fe3O4 nanoparticles, 2; nano-particles, 2; nanospheres, 2; nanodevices, 2)

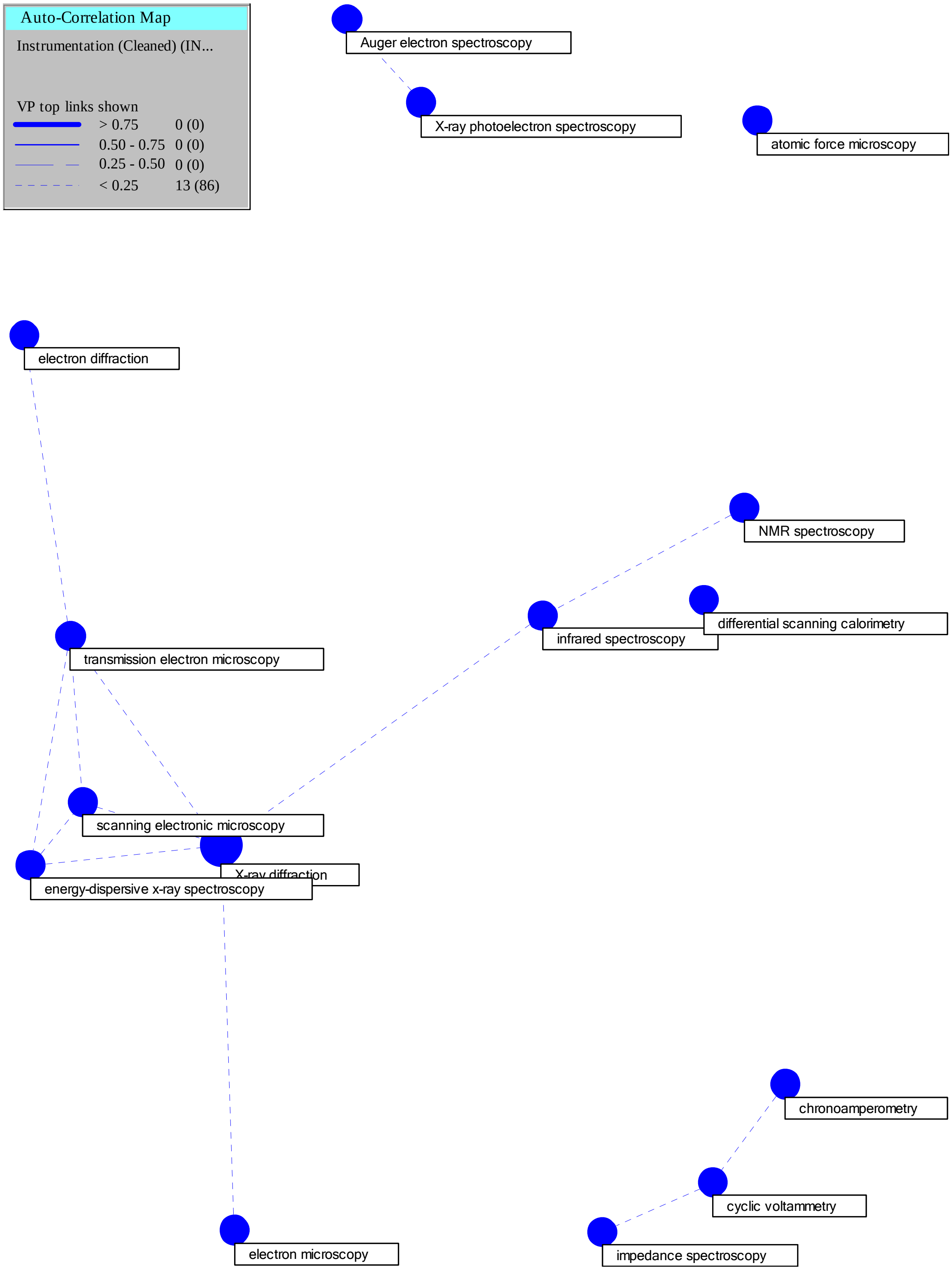
Correlation Maps

Many nanotechnology studies involve the use of multiple instruments. In order to understand the relationships among the instruments, two approaches are used. The first, presented in this section, is correlation mapping. Here, instruments are grouped by their direct correlation with each other (essentially co-occurrence within the same Abstract) or by correlation with a third quantity (e.g., similar materials examined). Factor analysis, and the associated factor matrix, are used to further quantify the relationships shown on the map. In the interests of space, only one factor matrix is presented. The second, presented in the next section, is hierarchical taxonomy through document clustering.

Figure A5-1 is an auto-correlation map of the linkages among the most widely used instruments. The map identifies linkages through common occurrence of the instruments in the same Abstracts. The map was constructed iteratively. The most frequently appearing forty instruments were plotted initially. All instruments not included in a network were eliminated, and the map re-plotted. A few of the very weakly connected instruments went under the threshold and were decoupled from the network in the subsequent map, but are included in Figure A5-1.

The figure contains one large network, and two disconnected groups. At the core of the main network is XRD, and the two main sub-networks focus on electron microscopy and spectroscopy. X-ray diffraction is mostly used to study lattices in crystalline materials. A well equipped chemistry or material science research laboratory usually has an array of instruments for making different measurements. The clustering in this autocorrelation map probably reflects the diversity of instruments in the laboratory of the authors. The group on the lower right involves electrical measurements, and mostly likely is from solid state materials research laboratories with an interest in the electrical properties of the materials. The spectroscopy group at the top reflects research activities with an interest in the electronic properties of the materials.

FIGURE A5-1 – INSTRUMENT AUTO-CORRELATION MAP



To obtain a more quantitative estimate of the relationships shown on the iterated auto-correlation map, a factor analysis of the instrument phrases was performed. Table A5-4 is a six factor matrix of the instrument phrases. Each factor represents a group of instruments sufficiently correlated to form an instrument 'theme' or focus. The shaded sectors represent the key (high factor loading) phrases that determine each factor's 'theme', or instrument suite in the present case.

Factor 1 corresponds to the TEM-centric sub-network located in the left center region of Figure 1. Factor 2 corresponds to the XPS-centric network located in the upper center. Factor 3 corresponds to the infrared spectroscopy-centric sub-network located in the center right. Factor 4 corresponds to the cyclic voltammetry-centric network located at the lower right. The elements of Factors 5 and 6 do not appear on Figure A5-1. They were on the pre-iterated original map, but were not connected sufficiently strongly to survive the iterative process.

What determines connectivity of the instrument groups? To answer that question, instruments were mapped that were related to each other by their common relation to a third item. Following Figure A5-1a (an autocorrelation map of instruments in the 401 most cited nanotechnology papers), cross-correlation maps of instruments to materials, material properties, phenomena, and nanostructures are shown, to help identify why instrument suites provide complementary data.

TABLE A5-4 – FACTOR MATRIX OF NANOTECHNOLOGY INSTRUMENTS

FACTOR	1	2	3	4	5	6
transmission electron microscopy	-0.642	0.034	0.078	0.02	0.187	0.014
X-ray diffraction	-0.471	-0.009	0.383	0.023	-0.07	-0.066
electron diffraction	-0.463	0.032	-0.174	0.047	0.18	-0.024
energy-dispersive x-ray spectroscopy	-0.458	-0.01	0.012	-0.054	-0.208	0.093
scanning electronic microscopy	-0.364	0.022	0.292	-0.097	-0.3	0.141
electron energy loss spectroscopy	-0.294	-0.003	-0.194	0.031	0.102	-0.033
atomic force microscopy	0.03	0.486	-0.009	-0.214	0.124	0.137
X-ray photoelectron spectroscopy	-0.125	0.477	0.122	-0.282	-0.161	-0.102
ellipsometry	0.092	0.415	0.026	-0.19	0.034	-0.038
Auger electron spectroscopy	-0.064	0.314	-0.029	-0.098	-0.218	-0.014
infrared spectroscopy	-0.109	0.125	0.59	-0.055	0.022	-0.049
differential scanning calorimetry	0.063	-0.128	0.527	0.049	0.026	0.127
NMR spectroscopy	0.126	-0.063	0.52	0.033	0.189	-0.029
cyclic voltammetry	-0.025	-0.288	-0.015	-0.704	0.027	0.002
impedance spectroscopy	0.001	-0.213	0.021	-0.503	-0.071	0.048
chronoamperometry	-0.033	-0.278	-0.018	-0.484	0.003	0.004
dynamic light scattering	-0.028	0.014	0.088	0.022	0.491	0.063
fluorescence spectroscopy	0.037	0.067	0.079	-0.062	0.479	0.058
UV-visible spectroscopy	-0.091	0.122	0.057	-0.266	0.351	-0.095
confocal microscopy	-0.035	0.034	-0.088	0.003	0.04	0.646
flow cytometry	-0.014	0.009	-0.072	0.006	-0.014	0.613
optical microscopy	-0.001	0.083	0.155	0.011	-0.111	0.267
fluorescence microscopy	0.061	0.167	-0.011	-0.034	0.09	0.243
small-angle X-ray scattering	-0.017	-0.039	0.115	0.042	0.22	0.174
Rutherford backscattering spectrometry	-0.013	0.099	0.01	-0.036	-0.139	0.04
probe microscopy	0.027	0.09	-0.022	-0.022	0.035	0.015
X-ray reflectivity	0.008	0.1	-0.005	-0.004	0.02	0.008
quartz crystal microbalance	0.069	0.135	-0.049	-0.199	0.086	0.005
vibrating sample magnetometer	-0.119	-0.091	0.027	0.051	0.013	-0.007
optical spectroscopy	-0.024	0.009	-0.007	-0.003	0.052	-0.014
scanning tunneling microscopy	0.035	0.07	-0.097	-0.072	-0.048	-0.06
optical absorption spectroscopy	-0.035	0.07	-0.018	0.003	0.015	-0.079
Raman spectroscopy	-	0.237	-	-	0	-0.08

	0.184		0.014	0.038		
mass spectrometry	0.043	0.167	0.118	-0.05	-0.125	-0.081
Mossbauer spectroscopy	-0.163	-0.082	-0.014	0.05	0.056	-0.084
photoluminescence spectroscopy	-0.084	0.063	-0.032	-0.013	0.231	-0.087
X-ray absorption spectroscopy	-0.009	0.042	-0.029	0.004	0.032	-0.091

Figure A5-1a is an auto-correlation map of the instruments listed in the 401 most cited papers. In contrast to the auto-correlation map of instruments in the total nanotechnology database, the main poles of the network in Figure 1A are small-angle x-ray scattering, photoluminescence spectroscopy, UV/visible spectroscopy, infrared spectroscopy, x-ray photoelectron spectroscopy, in addition to transmission electron microscopy.

FIGURE A5-1a – AUTO-CORR MAP – INSTR-MOST CITED

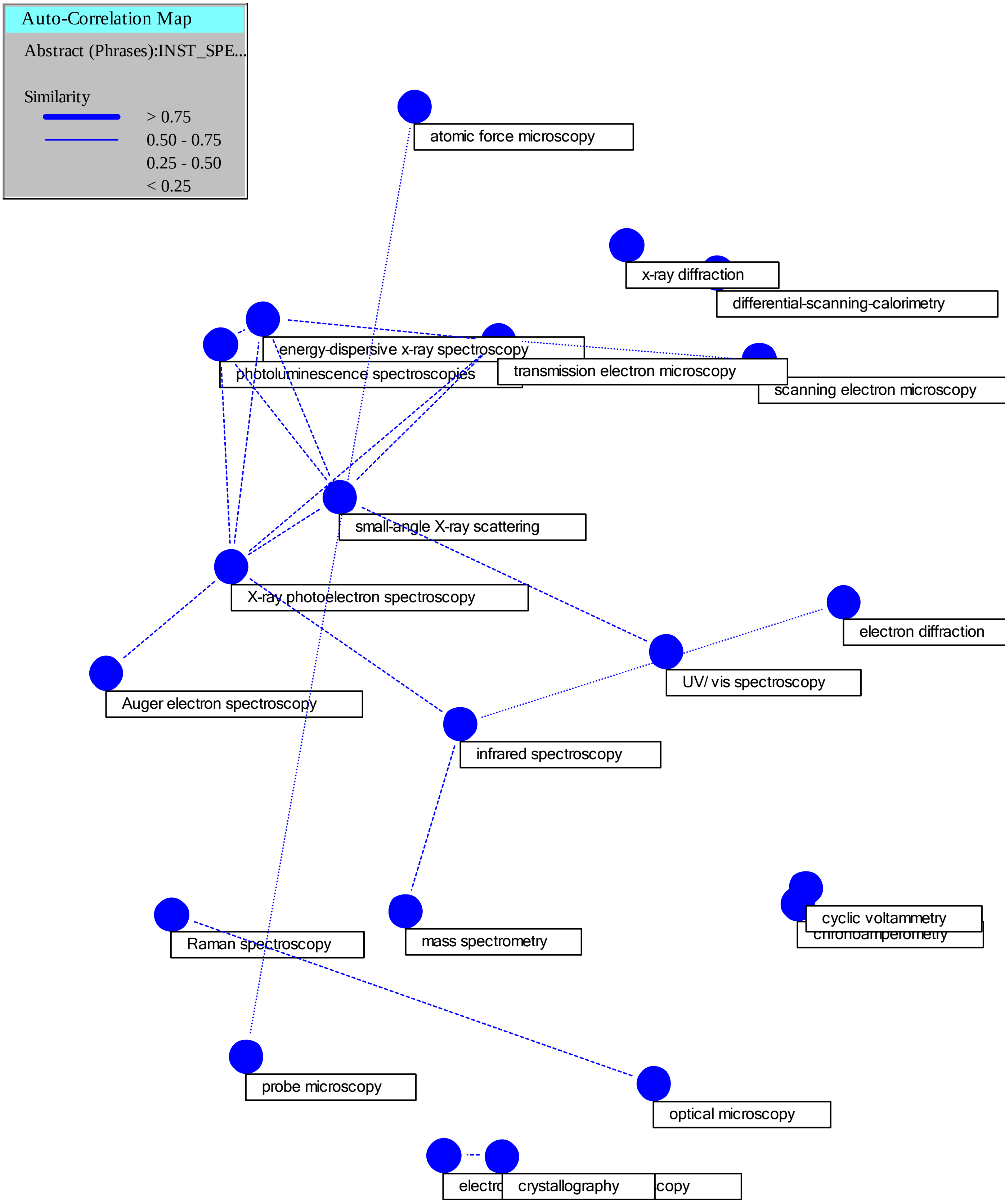


Figure A5-2 is a cross-correlation map of the linkages among the most widely used instruments by their common use of materials. The map was constructed iteratively. The most frequently appearing forty instruments were plotted initially. All instruments not included in a network were eliminated, and the map re-plotted. A few of the very weakly connected instruments went under the threshold, but are included in the map.

The figure contains one large network with a multiplicity of instrument types (upper left), and one small disconnected group based on calorimetry-NMR (center). While XRD is a key element of the network, more central are the electron microscopy variants. It came as no surprise that electron microscopes are the more versatile scientific instrument, especially since many of the material systems under study are for electronic applications, such as Si, SiO2, Ti, and others. Many solid state materials laboratories have these instruments for measuring and characterizing the morphology, composition, and electronic properties of the materials.

The TechOasis software shows that the main calorimetry-NMR group materials connectors are Polymers and Copolymers (in other words, these are the key materials that members of the calorimetry-NMR network share). In the larger networked group: electron microscopy-infrared spectroscopy are connected by Polymers and Composites; XRD-SEM are connected by Composites, Powders, TiO2; XRD-EDX are connected by Iron and Nickel; XPS-SEM are connected by TiO2 and Silicon; and XPS-XRD are connected by TiO2. These results display not only the complementary nature of instrument suites, but the unique roles instruments play as well.

FIGURE A5-2 – INSTRUMENT-MATERIALS CROSS-CORRELATION MAP

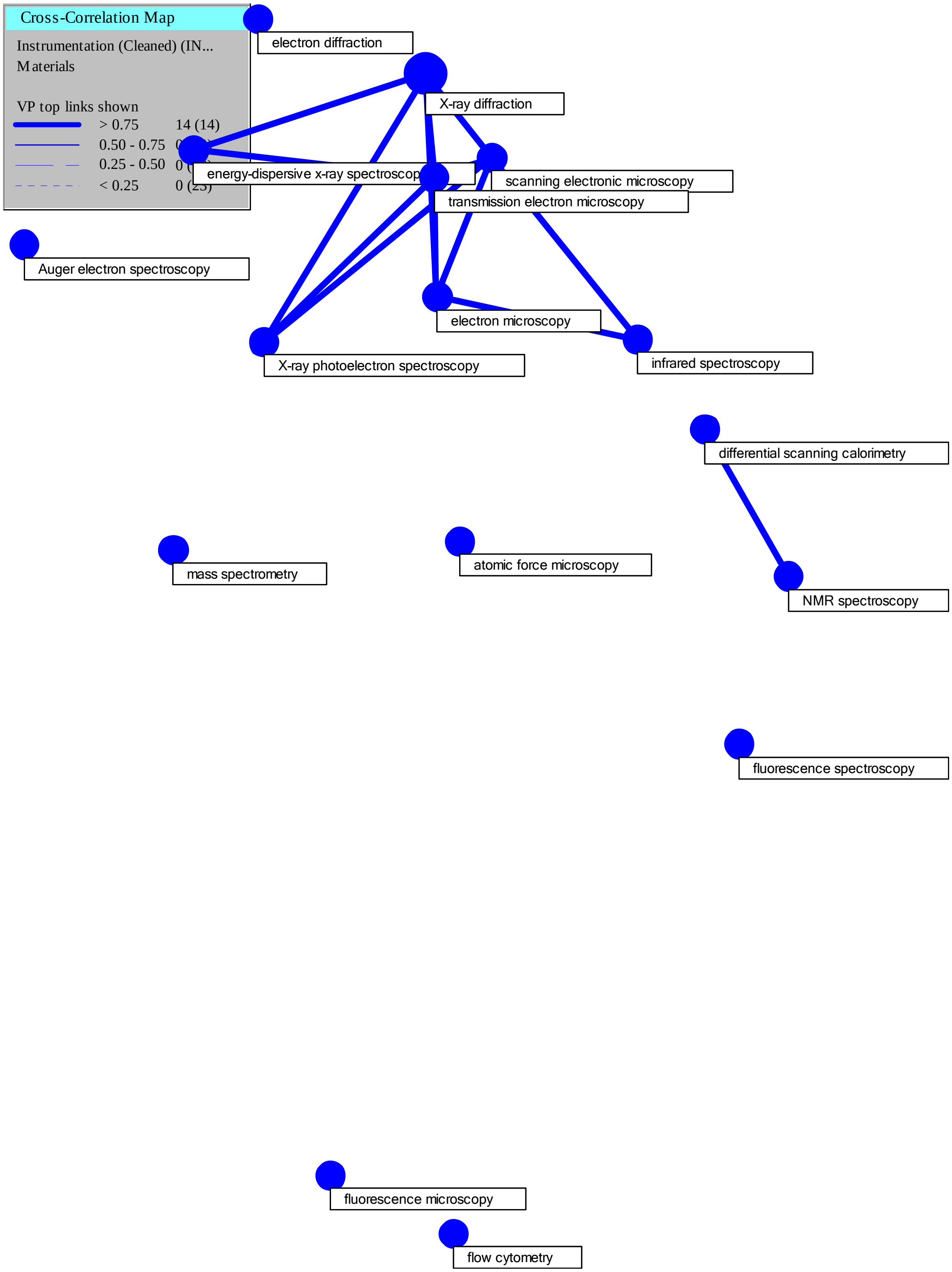


Figure A5-3 is a cross-correlation map (constructed iteratively) of the linkages among the most widely used instruments by the common properties they measure.

The figure contains one large network. The core is strongly centered about electron microscopy, with some spectroscopy at the periphery. In this network: EDX-SEM are connected by Morphology, Diameter, and Mechanical properties. In fact, most of the links are connected by Morphology and Diameter, as well as Thickness and/ or Mechanical Properties.

FIGURE A5-3 – INSTRUMENT-PROPERTIES CROSS-CORRELATION MAP

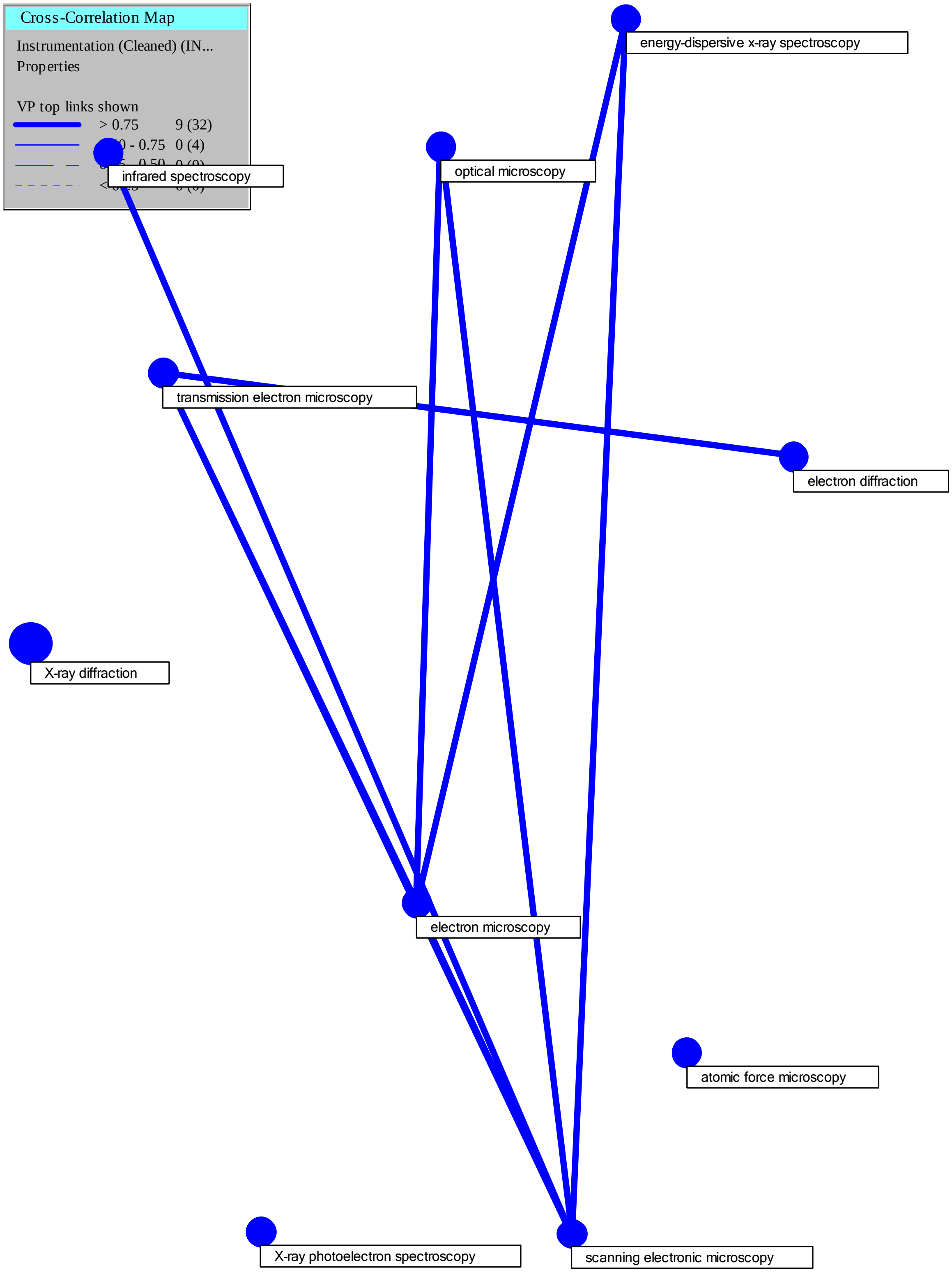


Figure A5-4 is a cross-correlation map (constructed iteratively) of the linkages among the most widely used instruments by the common phenomena they measure.

The figure contains one large network, centered strongly about scanning electron microscopy, with variants of spectroscopy at the periphery. SEM links to XPS through Deposition and Oxidation; SEM links to IS through Oxidation; SEM links to EDX through Deposition, Oxidation, and Crystallization; SEM links to EM through Field Emission, Deposition and Oxidation; TEM links to XRD through Crystallization, Oxidation, Decomposition, and Deposition; and IS links to XRD through Catalysis, Decomposition, and Oxidation.

FIGURE A5-4 – INSTRUMENT-PHENOMENA CROSS-CORRELATION MAP

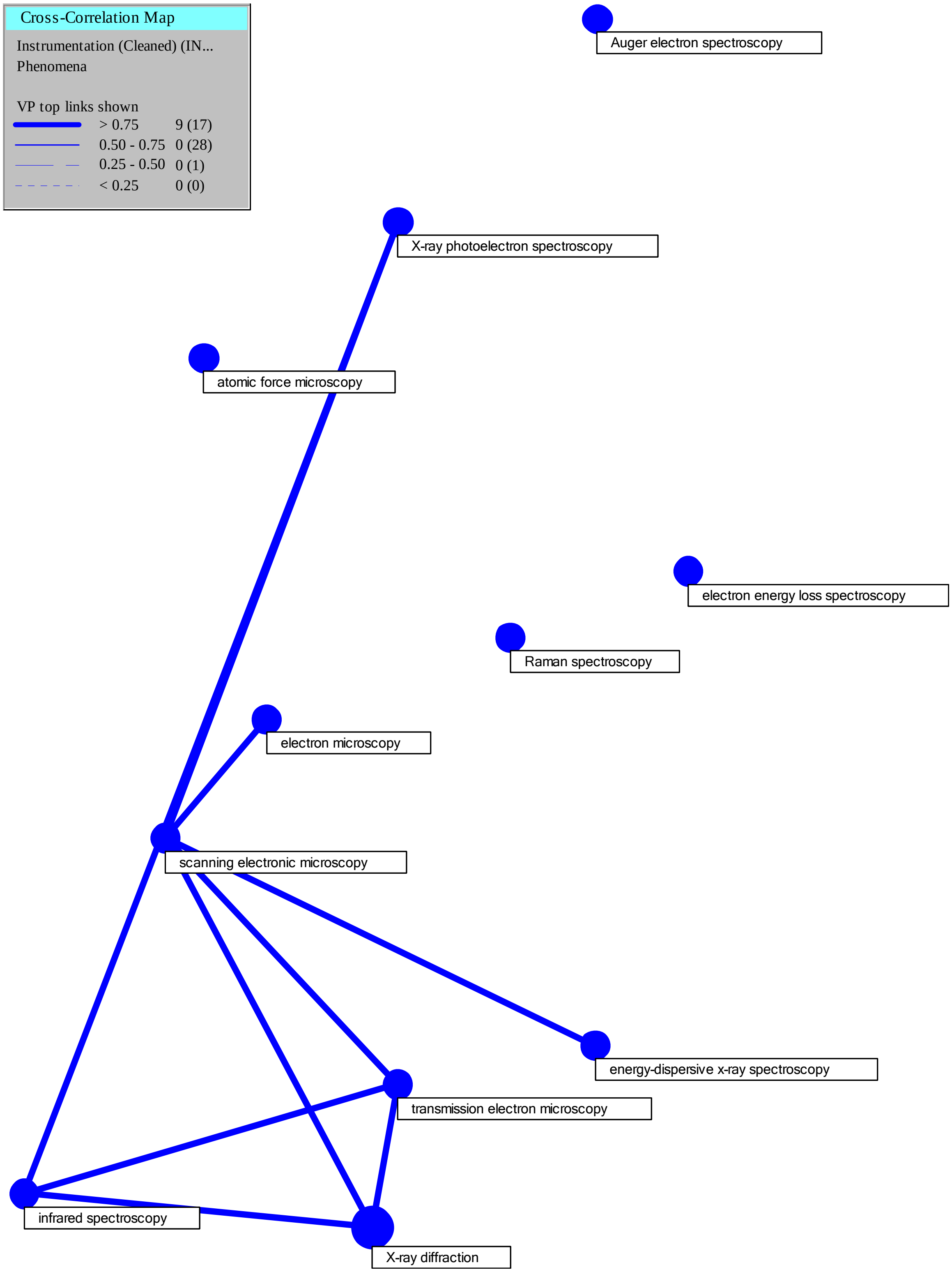
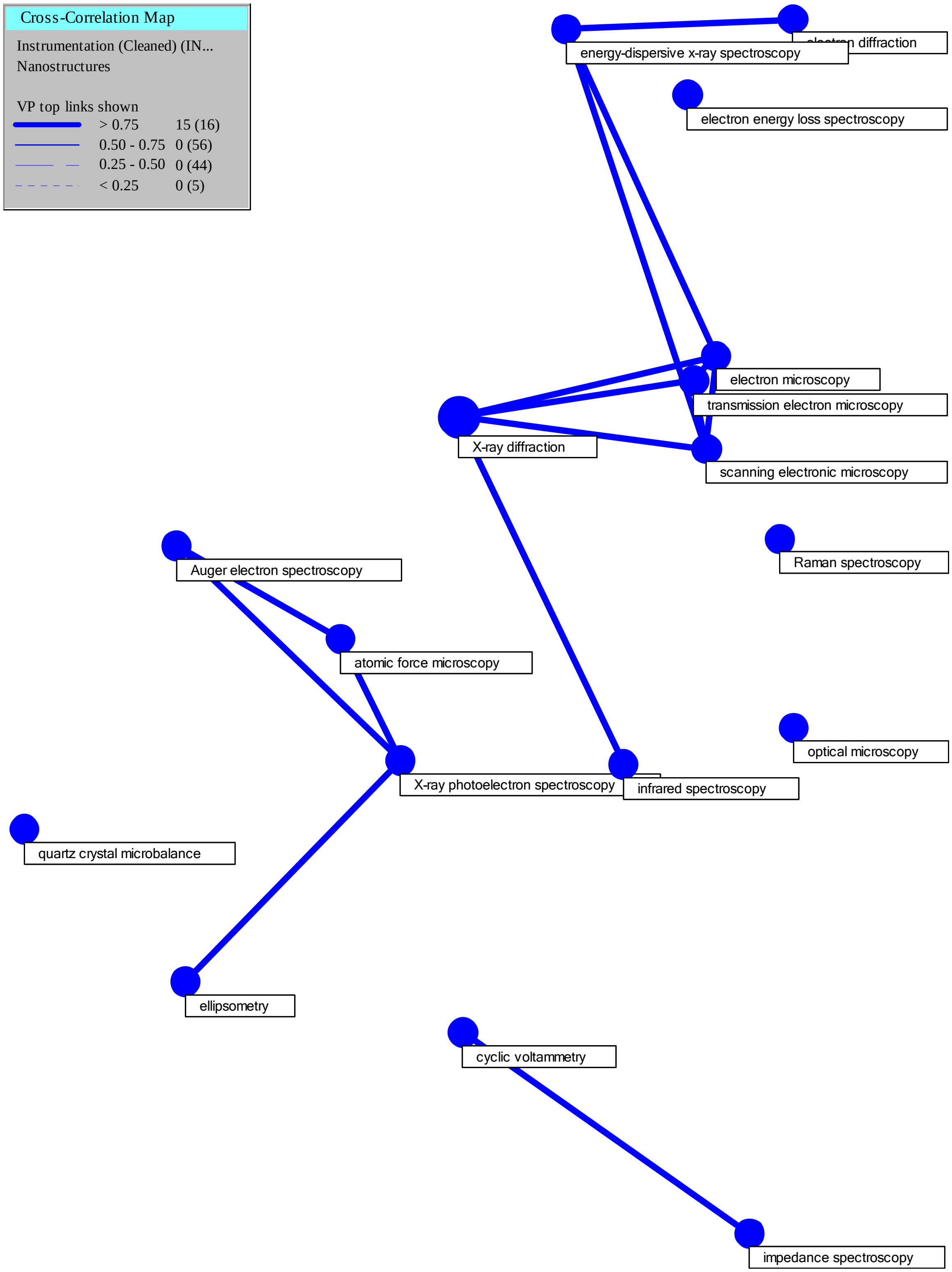


Figure A5-5 is a cross-correlation map (constructed iteratively) of the linkages among the most widely used instruments by the common nanostructures they measure.

The figure contains one large network (upper center), one intermediate network (left center), and one small network (lower center). The large network contains a dual core, one pole of which is electron microscopy and the other pole is XRD. Both sub-networks have spectroscopy on the periphery.

In the small network, cyclic voltammetry is linked to IS through Carbon Nanotubes, Thin Films, SAMs, and Monolayers. In the intermediate network, ellipsometry is linked to XPS through Thin Films, SAMs, and Monolayers; in fact, Thin Films and Monolayers with or without SAMs are the pervasive connectors in this network. In the large network: XRD is linked to IS through Nanocomposites and Thin Films; XRD is linked to SEM through Thin Films, Nanocomposites, Nanowires, and Nanorods; XRD is linked to EM through Thin Films, Nanowires, Nanocomposites; and EDX is linked to EM through Nanowires, Thin Films, and Nanotubes.

FIGURE A5-5 – INSTRUMENT-NANOSTRUCTURES CROSS-CORRELATION MAP



Hierarchical Instrumentation Taxonomy

Taxonomy Construction Approach

This section portrays the relationships among the instruments, and among the instruments and associated quantities, through use of a hierarchical taxonomy. The taxonomy was generated through the use of document clustering with a software package named CLUTO (described in the main body of the report, and in more detail in Appendix 3). In the variant of CLUTO used for the present analysis, metrics can be obtained for each node of the taxonomy (e.g., prolific authors, key journals, prolific institutions, prolific countries). The node metrics are an extremely important capability, since metrics at a sub-technology level can be very different from those at the overall aggregate technology level.

The taxonomy was constructed as follows. Most of the 240 instrument-related terms (obtained through the visual inspection process described initially) were entered into CLUTO, and provided the basis for the taxonomy structure. A few stand-alone single generic terms (such as microscopy, spectroscopy, etc,) were dropped, as their generic nature distorted the clustering process. However, multi-word phrases containing those generic terms were retained. Only those records from the total ~65000 nanotechnology record retrieval that contained any of the 240 terms were included in the clustering. Approximately 27000+ records were clustered into 64 elemental cluster categories (the most detailed), and then the hierarchical levels were constructed. These records should be viewed as the instrumentation-related records.

Even though only about 240 instrument phrases were used for the clustering, all the phrases in the database (minus the trivial word phrases) were included in the output. ***This feature of splitting the input from the output phrases was recently added to the CLUTO algorithm, and allows targeted structuring of the clusters while retaining all phrase relationships.***

Taxonomy Analysis Approach

Table A5-5 contains the first four levels of the hierarchical taxonomy. The shaded blocks are those in which China had higher paper production than the USA, even though in the overall nanotechnology study (~65000 records), the USA out-produced China in terms of published research papers by about

25%. If 100% represents parity between China and the USA in terms of paper production, the lightest shaded regions represent 100-125% production of China relative to the USA, the intermediate shaded regions represent 125-150% relative paper production, and the darkest shaded regions represent >150% relative paper production.

In the following analysis, the overall ‘zeroth’ level (all 27000+ records treated as one category) will be summarized, then the first level (first column on Table A5-5, two categories) will be described briefly, and then the fourth level (fourth column on Table A5-5, sixteen categories) will be described in detail. The contents of the second and third levels are readily understood from the first and fourth level contents.

TABLE A5-5. NANOTECHNOLOGY INSTRUMENTATION TAXONOMY

<table>
<tr><td rowspan="8">AFM,
NMR,
Calorimetry
(8423)</td><td rowspan="4">NMR, RS,
Calorimetry
(4684)</td><td rowspan="2">NMR, Complexes,
Compounds
(1546)</td><td>NMR Spectroscopy
(306)</td></tr>
<tr><td>NMR, Complexes, Compounds
(1240)</td></tr>
<tr><td rowspan="2">RS,
Calorimetry
(3138)</td><td>DSC
(1138)</td></tr>
<tr><td>Raman Scattering, RS, AFM
(2000)</td></tr>
<tr><td rowspan="4">AFM
(3739)</td><td rowspan="2">AFM, Films, Tip,
Imaging
(2003)</td><td>AFM, Film, Tip, Imaging
(1055)</td></tr>
<tr><td>AFM, Film, Substrate, Deposit
(948)</td></tr>
<tr><td rowspan="2">AFM, Films,
Deposition,
Growth, Substrate
(1736)</td><td>AFM, Film, Deposit, Substrate, Growth
(1511)</td></tr>
<tr><td>AFM, Magnetic
(226)</td></tr>
<tr><td rowspan="8">EM, XRD
(19090)</td><td rowspan="4">EM
(4492)</td><td rowspan="2">TEM
(2545)</td><td>HRTEM
(296)</td></tr>
<tr><td>TEM
(2249)</td></tr>
<tr><td rowspan="2">SEM, Films,
Composites,
Particles, Cells
(1947)</td><td>SEM, Film, Particle, Cell
(1652)</td></tr>
<tr><td>SEM, IS
(295)</td></tr>
<tr><td rowspan="4">XRD, Films
(14598)</td><td rowspan="2">SEM, XRD,
Films, Coatings,
Composites
(3634)</td><td>SEM, XRD
(1451)</td></tr>
<tr><td>SEM, Film, Coating, Deposit, XRD
(2183)</td></tr>
<tr><td rowspan="2">XRD, TEM, Thin
Films
(10964)</td><td>TEM, Film, Particle, Nanoparticle, STM
(5986)</td></tr>
<tr><td>Film, XRD, XPS
(4978)</td></tr>
</table>

Abbreviations:
AFM-Atomic Force Microscopy
NMR-Nuclear Magnetic Resonance
EM-Electron Microscopy
XRD-X-Ray Diffraction
RS-Raman Spectroscopy
TEM-Transmission Electron Microscopy
HRTEM-High Resolution Transmission Electron Microscopy
SEM-Scanning Electron Microscopy
DSC-Differential Scanning Calorimetry
IS-Infrared Spectroscopy
STM-Scanning Tunneling Microscopy

XPS-X-Ray Photoelectron Spectroscopy

For each of the sixteen fourth level categories, the following format will be used in the detailed analysis. The category number (following the order shown in Table A5-5, starting from the top) will be followed by the number of records (in parenthesis), and then followed by the category theme, summary of category metrics, and nominally two titles (and summary themes) from each of the 64 elemental clusters that fall within the category.

Taxonomy Results

The ‘zeroth’ level (not shown in Table A5-5) contains 27513 records, the full nanotechnology instrumentation database. All these records contain Abstracts, and the associated metrics apply to these Abstract-containing records only. As expected, the main theme of the total instrumentation database is the use of electron microscopy (and to a smaller extent spectroscopy and X-ray diffraction) to determine the structure of films on surfaces. More detailed themes will be presented in the level four analysis.

The weighted phrases generated by CLUTO and used to determine the ‘zeroth’ level category theme follow.

By examining the names of the authors of the papers at this zeroth level, it is found that all the prolific authors have Asian names. However, due to the high frequencies of the same monosyllable names, there is likelihood that the same name may belong to more than one author. Disambiguation of Asian names is under study, and will be reported in a later paper. At this overall level, the names will not be discussed further.

The following five physics and physical chemistry journals stand out as containing the most nanotechnology instrumentation papers: Journal of Physical Chemistry B 720; Applied Physics Letters 673; Langmuir 595; Journal of Applied Physics 519; Thin Solid Films 510. This is consistent with previous findings that these journals contain the most nanotechnology papers in general, but is a bit surprising because many of the instruments described here are the mainstay of well equipped chemistry and material science laboratories.

The most prolific countries in nanotechnology instrumentation are the following: Peoples R China 6473; USA 5194; Japan 2993; Germany 2250;

France 1654; South Korea 1560. For the total nanotechnology database of ~65000 records, the USA produced about 25% more documents than China, but in the present instrumentation-only database, ***China is out-producing the USA by about 25%!*** The other leading instrumentation countries are the same as in the total database. Since instruments are generally used to measure and characterize materials and structures, the use of instruments tends to lead to application oriented research. Thus, the fact that China produces more papers in the use of nanotechnology instrumentation seems to reflect the applied nature of their research.

As expected from the country results, the most prolific institutions are heavily Chinese: Chinese Acad Sci 1491; Tsing Hua Univ 365; Zhejiang Univ 326; Russian Acad Sci 322; CNRS 321; Univ Sci & Technol China 293. Of the four Chinese institutions, the most dominant by far is the Chinese Academy of Sciences (CAS), with three universities far behind. The other two prolific institutions are European research institutes. Only two USA institutions are listed among the most prolific thirty (UCB and University of Illinois), and each has about 160 publications listed.

The 27513 records are split into two categories by the algorithm, to form the first hierarchical level. One category constitutes about 30% of the total instrumentation database (8423 records), and focuses on atomic force microscopy and associated measurements on films and other surface properties. There are three leading journals associated with this category: Langmuir 296, Applied Physics Letters 241, Journal of Physical Chemistry B 239. Of the most prolific institutions (Chinese Acad Sci 374, Russian Acad Sci 147, CNRS 106), the CAS is the most dominant by far. The leading country producers of this category are as follows: USA 1954, Peoples R China 1346, Japan 928, Germany 825, France 576, South Korea 443. In this category, the USA outproduces China by about 45%.

The other first level category constitutes 70% of the total instrumentation database (19090 records), and focuses on electron microscopy variants (and to a smaller extent x-ray diffraction) to characterize mainly films and surfaces, and to a lesser degree particles and nanoparticles. Three journals stand out in this category: Journal of Physical Chemistry B 481, Applied Physics Letters 432, Thin Solid Films 347. The most prolific institutions (Chinese Acad Sci 1117, Tsing Hua Univ 299, Univ Sci & Technol China 262, Zhejiang Univ 258, CNRS 215) are dominated by Chinese institutions, especially the CAS. The leading country producers in this category are:

Peoples R China 5127; USA 3240; Japan 2065; Germany 1425; South Korea 1117; France 1078. In this large category, ***China outproduces the USA by almost 60%!***

Now the sixteen level four categories will be assessed. These categories correspond to the right-most column on Table A5-5, starting from the top.

Category 1 (NMR Spectroscopy, 306 records) focuses on use of NMR spectroscopy for structural measurements in complexes and compounds, with emphasis on ligands and reactions. The key performers (Pillinger, M 8; Goncalves, IS 8; Kollipara, MR 6; Braga, SS 6; Antipin, MY 6; Stoddart, JF 5; Govindaswamy, P 5) appear to have unique non-Oriental names. Two journals stand out for this thematic area (Journal of Organometallic Chemistry 17; European Journal of Inorganic Chemistry 16), both in chemistry. The USA leads among prolific countries (USA 57; Germany 45; Peoples R China 34), and the two dominant institutional leaders (Russian Acad Sci 18; Univ Aveiro 10) are Russian and Spanish, respectively.

Since this category is also an elemental cluster, a few additional titles will be presented to illustrate the theme:

- Conformational change of H+-ATPase beta monomer revealed on segmental isotope labeling NMR spectroscopy
- The identification of some new antimony(III) compounds containing fluoroxyl ligands by F-19 solution-state NMR spectroscopy: crystal and molecular structure of Ar ' Ar " Sb-2 (Ar '=2,6-(CF3)(2)C6H3; Ar "=2,4-(CF3)(2)C6H3)
- Tethered or adsorbed supported lipid bilayers in nanotubes characterized by deuterium magic angle spinning NMR spectroscopy
- High-temperature, high-pressure hydrothermal synthesis, crystal structure, and solid-state NMR spectroscopy of Cs-2(UO2)(Si2O6) and variable-temperature powder X-ray diffraction study of the hydrate phase Cs-2(UO2)(Si2O6)(.)0.5H(2)O

Category 2 (NMR, Complexes, Compounds, 1240 records) focuses on NMR for structural analysis of complexes and compounds, especially crystals and ligands. The key performers (Zhang, Y 9, Richmond, MG 9, Liu, Y 9, Callaghan, PT 9, Zhang, L 8, Yin, HD 8, Song, HB 7, Li, Y 7, Chen, T 7) include a stronger representation of Asian names, and they are sufficiently common that we cannot state they are unique. The key journals (Journal of the American Chemical Society 43, Polymer 35, Macromolecules 35, Journal of Physical Chemistry B 32, Journal of Polymer Science Part A-Polymer Chemistry 31, Synthesis and Reactivity in Inorganic Metal-Organic and Nano-Metal Chemistry 30) are chemistry-dominated, and except for JACS, form a continuum in terms of frequency. Five countries stand out (Peoples R China 289, USA 224, Japan 107, Germany 105, France 104), with China and USA dominant. Chinese institutions are dominant (Chinese Acad Sci 68, Russian Acad Sci 22, CNRS 17, Univ Paris 06 16, Zhejiang Univ 15, Nankai Univ 15, Jilin Univ 14, Fudan Univ 13, CSIC 13), with CAS by far the dominant institution.

This category contains two elemental clusters, and their themes/ representative titles are shown.

(NMR and XRD for structural analysis of compounds and complexes, especially films)

- A study of ordered structure in acid-modified tapioca starch by C-13 CP/MAS solid-state NMR
- Self-organization of amphiphilic copolymers into nanoparticles: Study by H-1 NMR longitudinal relaxation time

(NMR spectra, especially for structural analysis of films and crystals)

- A Te-125 and Na-23 NMR investigation of the structure and crystallisation of sodium tellurite glasses
- Quadrupole effects in Cu-63 NMR spectroscopy of copper nanocrystals

Category 3 (DSC, 1138 records) focuses on DSC, especially for thermal properties of crystals, polymers, and copolymers. The key performers (Privalko, VP 8, Privalko, EG 8, Kim, JH 8, Wilkie, CA 7, Navrotsky, A 7, Kulik, T 7, Hsiao, BS 6) appear to have unique names. Three key journals dominate (Polymer 68, Journal of Applied Polymer Science 56, Macromolecules 42), and they have a strong polymer emphasis. China, USA are the dominant prolific countries (Peoples R China 229, USA 177, Japan 109, Germany 72, India 65, France 64, South Korea 60). Prolific institutions tend to be Chinese and Former Soviet Union (Chinese Acad Sci 50, Russian Acad Sci 20, Zhejiang Univ 19, Natl Acad Sci Ukraine 14, Natl Univ Singapore 13, Tokyo Inst Technol 12, Shanghai Jiao Tong Univ 12, Moscow MV Lomonosov State Univ 12).

This category contains three elemental clusters, and themes/ representative titles of each will be presented.

(DSC, especially for crystals, melts, polymers)

- Cure kinetic study of carbon nanofibers/epoxy composites by isothermal DSC
- Melting and thermal history of poly(hydroxybutyrate-co-hydroxyvalerate) using step-scan DSC

(DSC, especially for films, copolymers)

- Polyester and polyamide 6 fibres thermally and hydrothermally treated - Characterization through DSC
- Side-chain crystallization behavior of graft copolymers consisting of amorphous main chain and crystalline side chains: Poly(methyl methacrylate)-graft-poly (ethylene glycol) and poly(methyl acrylate)-graft-poly (ethylene glycol)

(Calorimetry, mainly DSC, emphasizing polymers and copolymers)

- Effect of the composition ratio of copolymerized poly(carbonate) glycol on the microphase-separated structures and mechanical properties of polyurethane elastomers
- Study of crystallization processes in ethylene-styrene copolymers by conventional DSC and temperature-modulated calorimetry: Linear polyethylene and low styrene content copolymers

Category 4 (Raman Scattering, RS, AFM, 2000 records) focuses on Raman scattering/ RS, supported by AFM, for film and substrate analysis. Key authors are a mix of Eastern and Western (Zhang, Y 12, Lefrant, S 9, Van Duyne, RP 8, Liu, YC 8, Dresselhaus, MS 8, Yamamoto, K 7, Xu, J 7, Wang, L 7, Tian, ZQ 7, Lee, H 7, Kim, K 7, Fang, Y 7), but some of the Asian names are sufficiently common to represent multiple authors. Five journals dominate (Journal of Physical Chemistry B 97, Applied Physics Letters 96, Journal of Applied Physics 82, Physical Review B 75 Langmuir 71), representing a combination of physics and chemistry. Five countries dominate the production (USA 527, Japan 272, Peoples R China 245, Germany 225, France 152), with the USA being most dominant. The most prolific performers are the large institutions (Chinese Acad Sci 71, Russian Acad Sci 39, CNRS 27, Tokyo Inst Technol 24, CNR 24, Natl Inst Adv Ind Sci & Technol 22), with CAS being the most dominant.

This category contains nine elemental clusters, and themes/ titles of each will be presented.

(Raman scattering, especially surface-enhanced)

- Surface- and resonance-enhanced micro-raman spectroscopy of xanthene dyes: From the ensemble to single molecules
- Surface enhanced Raman scattering arising from multipolar plasmon excitation

(Surface-enhanced Raman scattering, especially for silver and gold films)

- Unique gold nanoparticle aggregates as a highly active surface-enhanced Raman scattering substrate
- The study of deposited silver particulate films by simple method for efficient SERS
- Surface-enhanced Raman scattering of pi-conjugated "push-pull" molecules - Part I. p-Nitroaniline adsorbed on silver nanoparticles

(RS, especially for films and carbon nanotubes)

- Surface enhanced Raman spectroscopy for adsorption studies on semiconductor nanostructured films
- Strain determination in electrochemically doped single-walled carbon nanotubes via Raman spectroscopy

(Absorption spectroscopy, especially x-ray absorption, focused on gold nanoparticles and films)

- Detection of differences in oligonucleotide-influenced aggregation of colloidal gold nanoparticles using absorption spectroscopy
- Pure surface plasmon resonance enhancement of the first hyperpolarizability of gold core-silver shell nanoparticles

(Ellipsometry, especially spectroscopic ellipsometry, focused on thin film optical measurements)

- Optical study of cobalt nanocrystals implanted into silica matrix by spectroscopic ellipsometry
- In situ optical analysis of low temperature MOCVD GaN nucleation layer formation via multiple wavelength ellipsometry

(Crystallography, especially x-ray crystallography, for structural analyses of complexes, crystals, and ligands)

- Synthesis and structural characterisation of Ag-I complexes with N,N '-bis(2-pyridyl)oxalamide and the anion of N-(2-pyridyl)oxalamic acid
- Crystallography, morphology, and magnetic properties of Fe nanostructures on faceted alpha-Al2O3 m plane

(Fluorescence microscopy, especially for films, emphasizing DNA, protein, and cellular analyses)

- Simultaneous imaging of different focal planes in fluorescence microscopy for the study of cellular dynamics in three dimensions
- Near-infrared fluorescence microscopy of single-walled carbon nanotubes in phagocytic cells

(Optical microscopy, especially scanning near-field optical microscopy, emphasizing crystals and polymers)

- New dimension in nano-imaging: breaking through the diffraction limit with scanning near-field optical microscopy
- Optical microscopy studies of dynamics within individual polymer-dispersed liquid crystal droplets

(AFM, emphasizing tip dynamics and mechanics)

- Influence of the atomic force microscope tip on the multifractal analysis of rough surfaces
- Imaging using lateral bending modes of atomic force microscope cantilevers

Category 5 (AFM, Film, Tip, Imaging, 1055 records) focuses on AFM, emphasizing surfaces and films, especially probe tip effects and imaging. Prolific performers (Bhushan, B 9, Roberts, CJ 7, Sort, J 6, Wang, L 5, Wang, J 5, Lee, JH 5, Dong, S 5, Dieny, B 5) include a combination of Eastern and Western. Of the leading journals (Langmuir 55, Applied Surface Science 36, Journal of Physical Chemistry B 27, Nanotechnology 24, Physical Review B 23, Journal of Colloid and Interface Science 23), two stand out: Langmuir and Applied Surface Science. Of the prolific countries (USA 271, Peoples R China 162, Japan 139, Germany 100), the USA is dominant. The prolific institutions (Chinese Acad Sci 39, CNRS 17, Univ Illinois 14, Osaka Univ 12) include the University of Illinois, although CAS is still very dominant.

Since this category is also an elemental cluster, a few additional titles will be presented to illustrate the theme:

- Investigation on influencing factors of AFM micro probe nanomachining
- Induced nanoscale deformations in polymers using atomic force microscopy

- Dynamic behavior of dagger-shaped cantilevers for atomic force microscopy
- Using wavelets to analyze AFM images of thin films: Surface micelles and supported lipid bilayers

Category 6 (AFM, Film, Substrate, Deposit, 948 records) focuses on AFM, especially for thin films, emphasizing deposition, layers, and substrates. All the prolific authornames are Asian, and may not be unique. Four journals (Langmuir 42, Applied Surface Science 38, Thin Solid Films 36, Journal of Crystal Growth 32) dominate. Of the prolific countries (USA 192, Peoples R China 184, Japan 110, Germany 79, South Korea 71), USA and China are dominant. The prolific institutions (Chinese Acad Sci 68, Natl Univ Singapore 15, Sungkyunkwan Univ 13, Kyoto Univ 13) are all East Asian, and are clearly dominated by CAS.

Since this category is also an elemental cluster, a few additional titles will be presented to illustrate the theme:

- AFM study of the oxide film formed on dual phase Fe3Al-Fe3AlC intermetallies
- Growth and surface characterization of V2O5 thin films made by pulsed-laser deposition
- Polymyxin B-lipid interactions in Langmuir-Blodgett monolayers of Escherichia coli lipids: A thermodynamic and atomic force microscopy study
- Molecular dynamic study for nanopatterning using atomic force microscopy

Category 7 (AFM, Film, Deposit, Substrate, Growth, 1511 records) focuses on AFM, emphasizing deposition and growth of thin films on substrates and in layers. Prolific authornames are essentially all Asian; may not be unique. Four journals dominate (Applied Physics Letters 84, Langmuir 77, Journal of Applied Physics 72, Thin Solid Films 61). Four countries dominate (USA 441, Peoples R China 176, Germany 143, Japan 137), with USA being most dominant. While CAS dominates most prolific institutions (Chinese Acad Sci 63, Russian Acad Sci 35, Univ Cambridge 23, Univ Calif Berkeley 17, Tsing Hua Univ 16, Univ Illinois 15, Univ Calif Santa Barbara 15, CNRS 15), there is substantial USA institutional representation in this category.

Since this category is also an elemental cluster, a few additional titles will be presented to illustrate the theme:

- Vesicle adsorption and lipid bilayer formation on glass studied by atomic force microscopy
- Nommiformity in ultrathin SiO2 on Si(111) characterized by conductive atomic force microscopy
- Extended, relaxed, and condensed conformations of hyaluronan observed by atomic force microscopy
- In situ atomic force microscopy study of dimensional changes during Li+ ion intercalation/de-intercalation in highly oriented pyrolytic graphite

Category 8 (AFM, Magnetic, 226 records) focuses on AFM, especially magnetics. Prolific authors have mixture of Eastern and Western names; probably unique. Leading journals (Applied Physics Letters 24, Journal of Applied Physics 16, Physical Review B 11, IEEE Transactions on Magnetics 11) physics-focused. Prolific countries (USA 65, Germany 56, Japan 31, Peoples R China 27, France 20) dominated by USA, Germany. Prolific institutions (Chinese Acad Sci 9, Univ Calif Berkeley 8, CNRS 8, Univ Elect Sci & Technol China 7, Univ Strasbourg 1 5, Univ Basel 5, Tufts Univ 5, Oak Ridge Natl Lab 5, N Carolina State Univ 5, Hahn Meitner Inst Berlin Gmbh 5, CNR 5) include substantial USA representation.

Since this category is also an elemental cluster, a few additional titles will be presented to illustrate the theme:

- Metal-coated carbon nanotube tips for magnetic force microscopy
- Micromagnetic studies of cobalt microbars fabricated by nanoimprint lithography and electrodeposition
- Novel detection system for biomolecules using nano-sized bacterial magnetic particles and magnetic force microscopy
- Magnetic force microscopy studies of domain walls in nickel and cobalt films

Category 9 (HRTEM, 296 records) focuses on HRTEM supported by small-angle x-ray scattering. Prolific authors (Yamamoto, T 8, Ikuhara, Y 7, Matsunaga, K 5, Sasaki, T 4, Mizoguchi, T 4, Kaneko, K 4) appear to be all Japanese. Leading journals (Journal of Physical Chemistry B 13, Journal of

Crystal Growth 11, Chemistry of Materials 11, Langmuir 10) are chemistry dominated. Prolific countries (Peoples R China 71, USA 67, Japan 47, Germany 20, France 20) dominated by China, USA. Prolific institutions (Chinese Acad Sci 22, Univ Tokyo 14, Nanjing Univ 6) centered around CAS, University of Tokyo.

This category contains two elemental clusters, and their themes/ representative titles follow:

(Small-angle x-ray scattering)

- Small-angle X-ray scattering of carbon-supported Pt nanoparticles for fuel cell
- SAXS of self-assembled nanocomposite films with oriented two-dimensional cylinder arrays: an advanced method of evaluation

(HRTEM)

- High-resolution transmission electron microscopy study of Ca3CO4O9
- The first observation of carbon nanotubes by spherical aberration corrected high-resolution transmission electron microscopy

Category 10 (TEM, 2249) focuses on TEM. Prolific authornames are mainly Asian, and may not reflect unique authors. Of the leading five journals (Applied Physics Letters 178, Journal of Applied Physics 123, Journal of Physical Chemistry B 56, Journal of Materials Research 54, Langmuir 51), two are overwhelmingly dominant. Of the prolific countries (USA 569, Peoples R China 470, Japan 250, France 176, Germany 173, South Korea 135, Taiwan 106), two are overwhelmingly dominant: China and the USA. The CAS dominates the prolific institutions (Chinese Acad Sci 129, CNRS 50, Russian Acad Sci 44, Univ Sci & Technol China 37, Natl Inst Mat Sci 34).

Since this category is also an elemental cluster, a few additional titles will be presented to illustrate the theme:

- Model of superconducting vortices in layered materials for the interpretation of transmission electron microscopy images
- Microstructure of sol-gel synthesized Al_2O_3-ZrO_2(Y_2O_3) nano-composites studied by transmission electron microscopy

- Analytical transmission electron microscopy and surface spectroscopy of ceramics: The microstructural evolution in titanium-doped chromia polycrystals as a function of sintering conditions
- Crystalline properties and morphological changes in plastically deformed isotatic polypropylene evaluated by X-ray diffraction and transmission electron microscopy
- A new FIB fabrication method for micropillar specimens for three-dimensional observation using scanning transmission electron microscopy

Category 11 (SEM, Film, Particle, Cell, 1652 records) focuses on SEM, emphasizing films, particles, cells, composites. Prolific authors (Locatelli, A 8, Heun, S 8, Zhang, Y 7, Oku, T 7, Liu, Z 7, Liu, WM 7, Nishiwaki, A 6) are a combination of Asian and non-Asian names. Leading journals (Applied Physics Letters 56, Journal of Applied Polymer Science 41, Thin Solid Films 30, Langmuir 27, Journal of Applied Physics 26) are dominated by Applied Physics Letters and Journal of Applied Polymer Science. Prolific countries (USA 357, Peoples R China 258, Germany 171, Japan 169, England 108, France 107) dominated especially by the USA and also by China. CAS dominates the prolific institutions (Chinese Acad Sci 65, Russian Acad Sci 25, CNRS 23, Univ Cambridge 19, CSIC 19, CNR 19).

Since this category is also an elemental cluster, a few additional titles will be presented to illustrate the theme:

- MSWI fly ash particle analysis by scanning electron microscopy-energy dispersive X-ray spectroscopy
- Visualization of the cytostome in Trypanosoma cruzi by high resolution field emission scanning electron microscopy using secondary and backscattered electron imaging
- Growth of vacuum evaporated ultraporous silicon studied with spectroscopic ellipsometry and scanning electron microscopy
- Scanning electron microscopy investigation of Cu-TCNQ micro/nanostructures synthesized via vapor-induced reaction method

Category 12 (SEM, IS, 295 records) focuses on SEM, with secondary emphasis on Infrared Spectroscopy. Prolific authors Include Ren, F 4, Pearton, SJ 4, Kravchenko, I 4, Khanna, R 4. Three journals (Journal of the Electrochemical Society 17, Thin Solid Films 13, Journal of Applied

Polymer Science 13) are dominant. Prolific countries (USA 59, Peoples R China 59, India 24, Italy 17) dominated by USA and China. Prolific institutions (Chinese Acad Sci 11, Zhejiang Univ 7, Univ Sci & Technol China 7, Univ Florida 6, Univ Connecticut 5, CNR 5) dominated by CAS, but some USA institutional presence.

Since this category is also an elemental cluster, a few additional titles will be presented to illustrate the theme:

- Interaction of water with different cellulose ethers: a Raman spectroscopy and environmental scanning electron microscopy study
- Scanning electrochemical microscopy. 55. Fabrication and characterization of micropipet probes
- Polarized micro-Raman spectroscopy of oriented A(B ' B-1/3 "(2/3))O-3 powders and microwave ceramics
- Characterization of the rapid expansion of supercritical solutions by Fourier transform infrared spectroscopy in situ

Category 13 (SEM, XRD, 1451 records) focuses on SEM, with some emphasis on XRD, for films, coatings, and composites. Prolific authornames all Asian; may reflect multiple authors. Leading journals (Surface & Coatings Technology 37, Materials Letters 36, Thin Solid Films 30, Applied Surface Science 29, Materials Chemistry and Physics 24) appear coatings/ materials oriented. Of prolific countries (Peoples R China 441, USA 196, Japan 99, Germany 96, South Korea 87), China is by far the most dominant. Not surprisingly, the Chinese institutes predominate (Chinese Acad Sci 87, Tsing Hua Univ 26, Univ Sci & Technol China 23, Zhejiang Univ 21, Shanghai Jiao Tong Univ 17, Shandong Normal Univ 17), with CAS being the most dominant.

This category contains two elemental clusters, and sample record titles and elemental cluster themes are as follows:

(Electron microscopy, emphasizing particles, powders, and nanotubes)

- Analysis of environmental particles by atomic force microscopy, scanning and transmission electron microscopy
- Microstructure degradation of an anode/electrolyte interface in SOFC studied by transmission electron microscopy

(SEM, especially for films, coatings, composites)

- Scanning electrochemical microscopy in combination with piezoelectric quartz crystal impedance analysis for studying the growth and electrochemistry as well as microetching of poly(o-phenylenediamine) thin films
- Scanning electron microscopy cathodoluminescence studies of piezoelectric fields in an InGaN/GaN quantum-well light-emitting diode
- Visualisation of natural aquatic colloids and particles - a comparison of conventional high vacuum and environmental scanning electron microscopy
- Evaluation of the effect of lichens on ceramic roofing tiles by scanning electron microscopy and energy-dispersive Spectroscopy analyses

Category 14 (SEM, Film, Coating, Deposit, XRD, 2183 records) focuses on SEM and to some extent XRD, with emphasis on films, coatings, composites, particles, alloys, ceramics. Prolific authornames all Chinese; may reflect multiple authors. Leading journals (Rare Metal Materials and Engineering 77, Materials Letters 41, High-Performance Ceramics III, Pts 1 And 2 40, PRICM 5: The Fifth Pacific Rim International Conference on Advanced Materials and Processing, Pts 1-5 35, Journal of Inorganic Materials 31, Chinese Journal of Inorganic Chemistry 29) very applied, some domestic Chinese. China overwhelmingly dominant among prolific countries (Peoples R China 780, Japan 213, USA 207, South Korea 133, India 129, Germany 104). Prolific institutions (Chinese Acad Sci 137, Tsing Hua Univ 64, Zhejiang Univ 46, Tianjin Univ 33, Harbin Inst Technol 27, Univ Sci & Technol China 25, Univ Sci & Technol Beijing 25, Sichuan Univ 23) all Chinese, dominated by CAS.

This category contains six elemental clusters, and cluster themes/ representative titles follow:

(SEM images)

- Application of Monte Carlo simulation method to the nano-scale characterization by scanning electron microscopy
- Monte Carlo simulation of secondary electron and backscattered electron images for a nanoparticle-matrix system
- Feasibility study of multiple-beam scanning electron microscopy for defect inspection

(SEM, especially with energy dispersive spectroscopy)

- Ciro Ferri's frescoes: a study of painting materials and technique by SEM-EDS microscopy, X-ray diffraction, micro FT-IR and photoluminescence spectroscopy
- SEM observation on the nucleation and grain growth of Bi-2223 phase in Ag-sheathed BSCCO tapes

(SEM, TEM, especially for carbon nanotubes)

- Single-walled carbon nanotube-based coaxial nanowires: Synthesis, characterization, and electrical properties
- Carbon nanotubes synthesized in zeolites UTD-1, UTD-18 and UTD-12

(SEM, with secondary emphasis on XRD)

- Charge contrast imaging of gibbsite using the variable pressure SEM
- The use of SIMS, SEM, EPMA, LRS and X-ray diffraction measurements for the examination of corrosive layers and protective coatings on steels and alloys in advanced power stations
- Comparative endoscopic and SEM analyses and imaging for biofilm, growth on porous quartz sand

(SEM, XRD)

- Electrochemical synthesis of lepidocrocite thin films on gold substrate - EQCM, IRRAS, SEM and XRD study
- Chemical bath deposition of Hg doped CdSe thin films and their characterization

(Energy dispersive x-ray, SEM)

- Lignin-hydroxyapatite/tricalcium phosphate biocomposites: SEM/EDX and FTIR characterization
- Characterization of individual silicon-poor particles in atmospheric aerosols by SEM-EDX and application to Kosa particle identification

Category 15 (TEM, Film, Particle, Nanoparticle, STM, 5986 records) focuses on TEM, especially films, particles, nanoparticles, with less emphasis on STM. Prolific authornames all Chinese; may reflect multiple authors. Journal of Physical Chemistry B (179) dominant, followed by Physical Review B 137, Materials Letters 132, Applied Physics Letters 122, Surface Science 113, Langmuir 109. China dominant (1786), followed by USA 1046, Japan 782, Germany 487, South Korea 355, France 316. Prolific institutions (Chinese Acad Sci 394, Tohoku Univ 99, Tsing Hua Univ 98, Univ Sci & Technol China 91, Zhejiang Univ 85, Nanjing Univ 75, Osaka

Univ 72, Univ Tokyo 67, Natl Inst Mat Sci 66) Chinese and Japanese, with CAS dominant.

This category contains fourteen elemental clusters, and cluster themes/ representative titles follow:

(Electron microscopy, emphasizing SEM)

- Towards automation of palynology 1: analysis of pollen shape and ornamentation using simple geometric measures, derived from scanning electron microscope images
- Nanomanipulator-assisted fabrication and characterization of carbon nanotubes inside scanning electron microscope

(Electron microsopy, emphasizing SEM, film deposition)

- Characterization of electrical properties and photosensitivity of SnS thin films prepared by the electrochemical deposition method
- The lanthanide doping effects on the electrical properties of Bi4Ti3O12 thin films fabricated on silicon substrates

(TEM, electron microscope)

- Separation of linear and non-linear imaging components in high-resolution transmission electron microscope images
- Multiscale modeling of surface sputtering in a scanning transmission electron microscope

(STM)

- STM images of molecules on a metallic surface: a fast calculation based on a self-consistent semiempirical molecular orbital method
- An STM study on the growth process of vapor-deposited hydroquinone adlayers on Rh(111) and Pt(111)

(Cyclic voltammetry)

- Aggregation properties of amphiphilic poly(ethylene oxide)-poly(propylene oxide)-poly(ethylene oxide) block copolymer studied by cyclic voltammetry
- Characterization of novel all-plastic electrochromic devices: electro-optic and voltammetric response

(Impedance spectroscopy)

- The preparation of polyaniline waterborne latex nanoparticles and their films with anti-corrosivity and semi-conductivity
- The vacuum-annealed undoped polycrystalline CVD diamond electrodes: the impedance-spectroscopy and photoelectrochemical studies

(Quartz crystal microbalance)

- Simultaneous surface plasmon resonance and quartz crystal microbalance with dissipation monitoring measurements of biomolecular adsorption events involving structural transformations and variations in coupled water
- Quartz crystal microbalance detection of glutathione-protected nanoclusters using antibody recognition

(Confocal microscopy)

- Nanoparticles, molecular biosensors, and multispectral confocal microscopy
- Beam divergence measurements of InGaN/GaN micro-array light-emitting diodes using confocal microscopy

(Probe microscopy)

- Application of scanning probe microscopy to the characterization and fabrication of hybrid nanomaterials
- Quantitative analysis of electronic properties of carbon nanotubes by scanning probe microscopy: From atomic to mesoscopic length scales

(Fluorescence spectroscopy)

- Fluorescence intensity in surface-plasmon field-enhanced fluorescence spectroscopy
- Effect of humic acid on the sorption of Cm(III) onto gamma-Al2O3 studied by the time-resolved laser fluorescence spectroscopy

(Optical spectroscopy)

- Effect of fast thermal annealing on the optical spectroscopy in MBE- and CBE-grown GaInNAs/GaAs QWs: blue shift versus red shift
- Investigations of 1.55-mu m GaInNAs/GaAs heterostructures by optical spectroscopy

(Scanning transmission electron microscopy)

- Symmetries in BF and HAADF STEM image calculations
- Formation of silver clusters by borohydride reduction of AgNO3 in polyacrylate aqueous solutions

(Electron diffraction)

- Stretching of carbon-carbon bonds in a 0.7 nm diameter carbon nanotube studied by electron diffraction
- Coherent nano-area electron diffraction

(TEM, emphasizing nanoparticles)

- Preparation of a Langmuir monolayer of CoFe2O4 nanoparticles at the air/water interface

- Hydrogenation of cis,cis-1,3-cyclooctadiene over MCM-41 embedded with Pd, Ag, and Pd-50/Ag-50 alloy nanoparticles

Category 16 (Film, XRD, XPS, 4978 records) focuses on films, oxidation, catalysis, using XRD and XPS. The top thirty authornames, with one exception, are all Chinese, and may reflect multiple authors. Three journals stand out: Journal of Physical Chemistry B 178, Applied Surface Science 133, Thin Solid Films 123. China dominates the prolific countries (Peoples R China 1262, USA 739, Japan 491, Germany 359, South Korea 321, India 315, France 283). The CAS dominates the prolific institutions (Chinese Acad Sci 272, Tsing Hua Univ 77, Univ Sci & Technol China 63, Zhejiang Univ 62, CSIC 60).

This category contains fourteen elemental clusters, and cluster themes/ representative titles follow:

(XPS, catalysts)
- Discoloration and mineralization of Orange II by using Fe3+-doped TiO2 and bentonite clay-based Fe nanocatalysts
- Catalytic activity of the M/(3ZnO center dot ZrO2) system (M = Cu, Ag, Au) in the hydrogenation of CO2 to methanol

(XPS, Films)
- STM and XPS studies of the oxidation of aniline at Cu(110) surfaces
- Suppression of photo-induced dilation in cyanide treated hydrogenated amorphous silicon films

(XRD, films, catalysts)
- The yield strength calculated by finite element method for sputtered Cu film
- Development of nanograined hexagonal barium ferrite thin films by sol-gel technique

(XRD patterns)
- Influence of the outer surface layers of crystals on the X-ray diffraction intensity of basal reflections
- Characterization of nanocrystalline anatase titania: an in situ HTXRD study

(XRD, films, alloys, composites)
- Preparation and electrode properties of new ternary alloys: REMgNi4 (RE = La, Ce, Pr, Nd)

- Real-time XRD analysis of polystyrene/clay nanocomposites by in-situ polymerization

(XRD, FTIR)

- X-ray diffraction study of stress relaxation in cubic boron nitride films grown with simultaneous medium-energy ion bombardment
- Microhardness, FTIR and transmission spectral studies of Mg2+ and Zn2+ doped nonlinear optical BTCC single crystals

(FTIR, films)

- Studies on the crystallization behavior of nylon-6 in the presence of layered silicates using variable temperature WAXS and FTIR
- Structure and phase transition in self-assembled films of an anti-ferroelectric liquid crystal studied by two-dimensional correlation FTIR spectroscopy

(Infrared Spectroscopy, films)

- Reflection-absorption infrared spectroscopy investigation of the crystallization kinetics of poly(ethylene terephthalate) ultrathin films
- Fourier transform infrared spectroscopy studies on thermal decomposition of tetrakis-dimethyl-amido zirconium for chemical vapor deposition of ZrN

(Secondary Ion Mass Spectrometry)

- Photodegradation of poly(ether sulphone) Part 1. A time-of-flight secondary ion mass spectrometry study
- Ultra-low energy SIMS depth profile analysis of movpe grown InAlGaAs/AlGaAs/GaAs nanostructures

(Dynamic Light Scattering)

- Characterization of polybutadiene-poly(ethyleneoxide) aggregates in aqueous solution: A light-scattering and small-angle neutron-scattering study
- Fractal character of dynamic light scattering of particles

(Optical Microscope)

- Numerical modeling of the subwavelength phase-change recording using an apertureless scanning near-field optical microscope
- Vibration sensitivity of the scanning near-field optical microscope with a tapered optical fiber probe

(Photoluminescence Spectroscopy)

- Abnormal photoluminescence behavior of self-assembled InAs quantum dots with bimodal size distribution
- Time-resolved photoluminescence studies of indium-rich InGaN alloys

(Mossbauer Spectroscopy)

- A Mossbauer spectroscopic study of the iron redox transition in eastern Mediterranean sediments
- The Mossbauer study of magnetic-permeability-enhancement effect in the Fe86-xNbxB14 (x=5, 6) amorphous alloys

(Electron Spectroscopy, Auger)

- Auger and XPS characterization of a multi layered Ti-Co-Si system for self aligned silicides purposes: a stoichiometry and chemical investigation
- Electron spectroscopy of the interface carbon layer formation on the cleavage surfaces of the layered semiconductor In4Se3 crystals

SUMMARY AND CONCLUSIONS

A wide variety of instruments are used in nanoscience and nanotechnology research. Key among these instruments are XRD, electron microscope variants, atomic force microscopy, scanning tunneling microscopy, and spectroscopy variants.

Key materials, properties, phenomena, and nanostructures measured by the leading instruments are as follows:

- Materials: TiO2, Ti, Si, SiO2, and polymers
- Properties: Morphology/ surface morphology, thickness/diameter/particle size, surface roughness/surface area, mechanical properties/optical properties/thermal properties, crystal structure/crystallinity
- Phenomena: Deposition, oxidation, crystallization, catalytic activity, nucleation, adsorption, polymerization, adhesion, decomposition/ degradation
- Thin films, nanocomposites, nanowires, nanotubes, monolayers/self-assembled monolayers

Key findings from the correlation maps are as follows:

- Instrumentation auto-correlation map showed that the main network is in x-ray diffraction and electron microscopy. This is an indication that a well-equipped chemistry and/or material science laboratory usually contains a variety of instruments for characterizing various material properties. The instrument factor matrix showed similar grouping of a diversity of instruments in the same laboratory.

- Instrumentation-materials cross-correlation map showed that the main group consisted of electron microscopes and variants. Many of the instruments are used to characterize materials of interest to semiconductor and microelectronics research.
- Similarly the instrumentation-properties cross-correlation map is focused mostly on the electronic properties of materials of interest to microelectronics research such as electron microscopy and atomic force microscopy.
- Same instruments are used to investigate the growth and fabrication phenonema in the instrumentation-phenomena cross-correlation map.
- Because of the dominance of nanoelectronics research, many nanostructures are focused on electronic applications and thus the Instrumentation-nanostructures cross-correlation map also showed the emphasis on instruments for characterizing the electronic structures.

The hierarchical taxonomy offered the following insights:

- In this nanotechnology instrumentation study, ***China produced about 25% more papers than the USA***. By contrast, in the full nanotechnology study, the USA produced about 25% more papers than China.
- Much of China's over-production occurred in the XRD-related categories, but there was some over-production in the transmission electron microscopy and NMR-calorimetry related categories as well.
- USA dominance appears to be in atomic force microscopy areas
- Because of the large Chinese and South Korean contributions to the nanotechnology instrumentation literature, author name analysis at aggregate levels is not effective; these Asian names are usually monosyllable, many times with no middle names. Due to the relatively high frequency of paper publications, there is good possibility that the same last name represents multiple authors. Potential name disambiguation is under study.
- Even though the USA has a large presence overall, relatively few USA institutions are listed among the most prolific in the nanotechnology instrumentation papers. The Asian and European efforts appear concentrated in relatively few but large institutions.

APPENDIX 6. MEDICAL AND NON-MEDICAL APPLICATIONS

In the updated nanotechnology study, all of the technical structural analyses of the total nanotechnology database show Applications being a key driver in nanoscience and nanotechnology research. The objectives of this Appendix are to examine the nanotechnology Applications literature in depth, and especially show Applications relationships to each other and to use of common materials, properties, phenomena, and nanostructures.

APPROACH

The first part of the following approach describes how the main nanotechnology non-medical Applications were identified, as well as their direct and indirect relationships. The second part of the approach addresses identification of the medical Applications.

1. Non-Medical Applications

A phrase frequency analysis was performed of the ~65000 records downloaded from the 2005 nanotechnology database, and hundreds of thousands of phrases were generated. All single word, adjacent double word, and adjacent triple word phrases were extracted and corrected to eliminate phrases containing trivial words at the beginning or end, and their occurrence frequencies were recorded. Approximately 60000 phrases were examined visually, starting from the highest frequency. Every non-medical Applications-related phrase was extracted. Then, the root phrase for each Application (e.g., cataly*, tribolog*, etc) was inserted into the phrase search engine, and all variants of the non-medical Applications terminology were retrieved, including the lowest frequency variants Approximately 860 phrases resulted. Additionally, phrases related to materials, properties, phenomena, and nanostructures were extracted during the visual inspection process. The non-medical Applications phrases were related to each other and to common materials, properties, phenomena, and nanostructures with the use of correlation maps and co-occurrence matrices.

2. Medical Applications

A different procedure was used for the medical Applications. A document fuzzy clustering analysis (Karypis, 2006), where documents are divided into groups based on their text similarities and where documents can be assigned to more than one group, was performed on the ~65000 total nanotechnology records retrieved for the overall nanotechnology study. The resulting hierarchical taxonomy was inspected visually, and the largest sub-network that included all medical Applications (hereafter called the Health sub-network) was identified. A meta-level taxonomy of the Health sub-network (the highest two hierarchical levels) was generated, then a taxonomy of the elemental (lowest level) clusters was generated. These clusters were analyzed for infrastructure and technical content.

For analytical purposes, non-medical applications were segregated from medical applications by design, although there was of necessity some small inclusion of medical applications in the non-medical component. In the remainder of this Appendix, the non-medical applications will be referred to as Applications, and the medical applications will be referred to as Health.

The 401 most cited nanotechnology papers published since 1991 were also retrieved. A short Applications-related analysis was done of this retrieved database as well.

There are five main sections to this Appendix, for the Applications and Health. The first four are for the Applications, and include:

- lists of the key nanotechnology applications, and emphasize those referenced most frequently.
- key findings of co-occurrence matrices, showing the relation of the major nanotechnology applications to materials, properties, phenomena, and nanostructures.
- correlation mapping of the nanotechnology applications to each other, especially how they relate to common materials, properties, phenomena, and nanostructures.
- a factor matrix analysis, which presents a more quantitative description of the relationships shown on the maps.

The fifth section applies to Health. It uses fuzzy clustering to generate a medical Applications taxonomy, and then generates the infrastructure and technical thrusts of each medical cluster.

RESULTS

Nanotechnology Applications

<u>Nanotechnology Applications Types</u>

Variant terminologies of each Application were combined, and the resultant list of Application types is shown in Table A6-1. There are two major types of terms. One type describes specific Applications, such as devices, solar cells, fuel cells, lithography, etc, and tends not to be ambiguous. The other type is multi-use terminology, and can refer to specific products/ Applications as well as experimental components and systems (e.g., electrodes, electrolytes, copolymers, lasers, solid state, etc). The correlation process, as reflected in the correlation maps and the factor matrix, tends to group the specific Applications with the product components of the multi-terminology categories. In the latter part of this section, when metrics are presented for each of the major Applications thrusts, only the specific Applications will be included. Thus, the metrics will serve as the lower bound on total Applications.

While many Application types are listed, the top six dominate the first tier, focusing on catalysts, lasers, devices, sensors, electrodes, and copolymers. In general, many of the applications are typical of the most advanced and exotic chemicals and materials. It is not surprising that the applications are exploiting the unique properties of chemicals and materials at the nanoscale, in areas such as catalysis and sensing information electronics, anti-corrosive coatings, tribology, and lubricants. If the contents of Table A6-1 are used as the category headings of an Applications taxonomy, and the full 860 Applications phrases are used as the contents of an Applications taxonomy, then a flat Applications taxonomy (one level only) can be constructed (Table A6-2). The contents of these two tables serve as starting points for many of the analyses in this section.

Additionally in order to assess the importance of application relative to impact, the 401 most cited nanotechnology papers were examined for Applications phrases, down to a phrase record frequency of two. Few were found; highly cited papers tend to be at a very fundamental level, and focus heavily on the science relative to the Applications. In other words, science oriented papers tend to be cited more than application oriented papers. Applications mentioned in these highly cited papers include: Catalysis/

Photocatalysis; Device(s); Transistors (Field-Effect); Optoelectronics; Light-Emitting Diodes. Many of these are in the electronics and photonics application areas.

TABLE A6-1. LIST OF APPLICATIONS (after combining similar terms)

#REC	APPLICATIONS	#REC	APPLICATIONS	#REC	APPLICATIONS
2036	catalysts	58	piezoelectricity	18	nanoelectromech sys
1513	lasers	57	actuators	18	photosensitizers
1491	devices	57	molecular dev	17	electroluminescent dev
1040	sensors	56	gate dielectrics	17	field-emission gun
936	electrodes	55	reactive ion etching	17	scratch resistance
722	copolymers	55	resonators	17	SQUID
540	applications	53	biotechnology	15	lithium cells
519	electrolytes	51	chemical etching	15	ultrafiltration
472	lithography	49	fabricated devices	14	electrochromic dev
428	electronics	48	new technology	14	flat panel displays
387	wiring	47	recording media	14	QWIPs
329	diodes	42	oxidation resistance	13	control systems
315	corrosion	42	qubits	13	microchips
315	storage	42	wet etching	13	nanomachining
269	solid-state	38	nanofluidics	13	new devices
237	tribology	37	biological appl	12	dechlorination
235	solar cells	37	cementation	12	generators
217	transistors	37	imprinting	12	inductors
213	detectors	37	molecular sieves	11	explosives
201	optoelectronics	37	photonic appl	11	memory cells
179	waveguides	37	screen-printing	11	micromachining
172	switching	34	memory dev	10	antireflection coating
166	optical appl	33	spintronics	10	MOS devices
151	batteries	31	injection molding	10	supercond thin films
141	capacitors	31	tapes	9	gel filtration
140	friction coeff	31	transducers	9	microlenses
140	wear resistance	27	electrooxidation	8	biomedical devices
120	motors	27	sensitizers	8	device simulation
120	oligomers	26	dry etching	7	CMOS devices
112	scaffolds	25	high-temperature appl	7	hardware
104	chips	25	semiconductor dev	7	micromirror
97	disks	24	ceramic coatings	7	nanotube dev
94	carrier	24	macroinitiators	7	quantum computer
93	fuel cells	23	microsystems	7	remote sensing
92	latexes	23	photoinitiators	6	coating systems
90	circuits	22	activators	6	robot
89	microelectronics	21	bearings	6	water system
86	MEMS	21	microreactors	5	assay system
84	biomedical appl	20	biochips	5	CNT emitters
83	combustion	20	light-emitting dev	5	defluorination
81	lubrication	20	nanoreactors	5	integrated optical dev
80	adhesives	20	plastics	5	magnetic devices
78	photovoltaics	20	printing	5	metal-semicond junct
77	microfluidics	19	computer	5	micromanipulator
76	electrochemical appl	19	field emitters	5	wear coefficient

70	conducting polymers	19	gate insulators
67	semiconduct nanotubes	19	resistors

TABLE A6-2 - ONE LEVEL TAXONOMY OF APPLICATIONS

- Catalysts (Photo, Electro, Platinum, Bimetallic, Oxide)
- Lasers (Deposition, Ablation, Sapphire, Excimer, Semiconductor, Laser Tweezers, Desorption Ionization, Quantum Dot, Vertical-Cavity Surface-Emitting, Pump, Distributed Feeback, Solid-State, Quantum Cascade, Quantum Well, Edge-Emitting, Waveguide, Matrix Assisted)
- Sensors (Glucose/ Amperometric/ SPR/ DNA Biosensors, Immunosensors, Gas, Chemical, Optical, Pressure, Electrochemical, Temperature, pH, Humidity, Oxygen, Force)
- Electrodes (Gold, Glassy Carbon, Gate, Composite, Graphite, Platinum, ITO, TiO_2, Enzyme, Ferromagnetic, Carbon Paste, Diamond, Calomel, Photo, CNT, SnO_2, BDD, Silver, Copper)
- Copolymers (Block, Graft, Amphiphilic)
- Electrolytes (Poly, Polymer, Composite, Gel, YSZ)
- Lithography (Electron Beam, Photo, Nanoimprint, Soft, Optical, Nanosphere, Dip-Pen Nano, Deep Ultraviolet, Interference, Scanning Probe, X-Ray, EUV, AFM, Immersion, Projection, Stereo, Interferometric)
- Diodes (Light-Emitting, Laser, Photo, Schottky, Barrier, Tunneling, Junction, P-I-N, Wave)
- Corrosion (Resistance/Protection/Inhibition)
- Storage (Hydrogen, Charge, Data, Energy, Information, Oxygen, Ion)
- Tribology (Wear Resistance/ Rate/ Mechanisms, Friction Coefficient, Lubrication, Lubricant Films, Solid Lubricants, Scratch Resistance)
- Solar Cells (Dye-Sensitized, Photovoltaics, Organic, Silicon, Thin Film, Polymer, Photoelectrochemical, Hybrid, Heterojunction)
- Transistors (Field-Effect, MOSFETs, Single-Electron, Thin Film, Heterojunction Bipolar, Electron Mobility)
- Detectors (Photo, Infrared, QWIPs, UV)
- Etching (Chemical, Reactive Ion, Electrochemical, Dry, Plasma, Wet, Isotropic/Anisotropic, Sputter, ICP, Photo, Silicon, HF, Anodic, Oxide)
- Optoelectronics
- Waveguides (Optical, Ridge, Planar, Photonic Crystal)
- Switching
- Batteries (Lithium-Ion)
- Capacitors (Super, MOS, Electrochemical, MIM, Ferroelectric, Platinum, Film, PZT, Silicon, Double Layer, Embedded)
- Motors (Molecular, Brownian)
- Gate (Dielectrics, Insulators, Stacks)
- Scaffolds (Tissue Engineering, Composite, PLGA)
- Chips (Sensor, Bio, Microfluidic)
- Hard Disk (Drives)
- Fuel Cells (Oxide, Methanol, Polymer Electrolyte)
- Circuits (Integrated)
- Electromechanical Systems (Micro, Nano)
- Adhesives (Self-Etch, Resins, Conductive, Polyurethane)

- Piezoelectric (Ceramics, Quartz Crystal)
- Actuators (Piezoelectric)
- Resonators (Nanomechanical, Dielectric, Ring, Quartz)
- Recording (Magnetic Media, Optical, Data, Holographic)
- Oxidation Resistance
- Cements (Resin, Bone)
- Imprinting
- Molecular Sieves (Mesoporous, Carbon)
- Screen Printing
- Memory (Random Access, Nonvolatile Devices, Ferroelectric, Optical, Flash)
- Spintronics
- Injection Molding
- Transducers (Signal, Ultrasonic)
- Photosensitizers
- Bearings
- Reactors (Nano, Micro)
- Plastics
- Computers
- Field Emitters (Arrays, CNT, Field Emission Gun)
- Resistors
- Superconducting Quantum Interference Device (SQUID)
- Filtration (Gel, Ultra)
- Displays (Flat Panel, Liquid Crystal)
- Dechlorination
- Generators
- Inductors
- Explosives
- Coatings (Antireflection)
- Superconducting (Thin Films, Wires)
- Microlenses (Arrays)
- Micromirror
- Quantum Computer
- Remote Sensing
- Robotics
- Defluorination
- Micromanipulator

Applications-Measured Quantity Co-occurrence Matrices

An interesting nanotechnology research question revolves around which Applications are associated with specific input quantities (e.g., materials, properties, phenomena, nanostructures, etc). This section shows those Applications commonly associated with different materials, properties, phenomena, and nanostructures. Following sections expand to groups of Applications commonly associated with these quantities.

The TechOasis (Search, 2006) software was used to construct co-occurrence matrices of the most frequent nanotechnology Applications with associated quantities. The co-occurrence frequencies represent the number of records in which a specific Application co-occurs with a specific term.

Six of the most widely referenced nanotechnology Applications (according to Table A6-1) were matrixed with: a) the materials-related terms strongly associated with each Application; b) the materials properties-related terms strongly associated with each Application; c) the nanoscale phenomena-related terms strongly associated with each Application; d) the nanostructure-related terms strongly associated with each Application. These results follow.

Application-Materials Co-Occurrence Matrix

Table A6-3 contains six of the most widely referenced nanotechnology Applications (according to Table A6-1) and the materials-related terms strongly associated with each Application. While many terms are listed for each application, a few are pervasive, and are highlighted in the table. *TiO2, Pt, Si, gold, and polymers tend to stand out as the most pervasive material types* related to the most frequently mentioned Applications.

TABLE A6-3. APPLICATIONS-MATERIALS CO-OCCURRENCE MATRIX

- **Catalysts** (TiO2, 151; Pt, 80; Ni, 53; anatase, 49; Pd, 42; Fe, 41; alumina, 39; gold, 38; SiO2, 37; titania, 37; metal, 36; Cu, 34; nickel, 32; platinum, 31; cobalt, 30; rutile, 30)
- **Lasers** (Nd, 66; silicon, 36; Si, 29; Ti, 28; ZnO, 23; glass, 21; sapphire, 16; Ni, 15; MgO, 14; TiO2, 13; SiO2, 13; diamond, 12; GaAs, 12; Fe, 11)
- **Sensors** (proteins, 44; protein, 28; gold, 27; polymer, 25; ZnO, 12; Pt, 12; polymers, 12; SnO2, 12; metal, 10; composites, 10; Cu2, 10; silicon, 9; TiO2, 9; Pd, 9; chitosan, 9)
- **Electrodes** (Pt, 25; gold, 20; protein, 12; Ni, 12; composite, 11; copper, 10; alloy, 10; TiO2, 9; SiO2, 9; Ag, 9; platinum, 9; proteins, 8; Cu, 8; Au, 8; alloys, 8; lithium, 8)
- **Electrolytes** (polymer, 15; TiO2, 13; copper, 9; PEO, 8; Ag, 8; lithium, 8; graphite, 8; Al2O3, 8; Li, 7; titanium, 7; polymers, 6; Cu, 6; silicon, 6; nickel, 6; SiO2, 6)
- **Lithography** (silicon, 16; polymer, 13; polymers, 12; SiO2, 11; metal, 8; gold, 7; silicon wafer, 7; Al2O3, 6; Pt, 6; PMMA, 6; Au, 6; silicon wafers, 6; glass, 5; silicon dioxide, 5)

Applications-Properties Co-occurrence Matrix

Table A6-4 contains six of the most referenced nanotechnology Applications, and the material properties-related terms strongly associated with each Application. While a number of terms are listed for each Application, a few are pervasive, and are highlighted in the table. *Morphology, thickness /diameter/particle size, optical properties, catalytic performance, and electrochemical properties tend to stand out as the most pervasive material properties* related to the most frequently referenced Applications.

TABLE A6-4. APPLICATIONS-PROPERTIES CO-OCCURRENCE MATRIX

- **Catalysts** (morphology, 95; diameter, 95; catalytic performance, 76; particle size, 70; surface area, 64; crystallinity, 39; catalytic properties, 35; thickness, 28; crystal structure, 27; pore volume, 23; physical properties, 22; morphologies, 21; surface properties, 19; crystallite size, 19; surface morphology, 18)
- **Lasers** (thickness, 68; morphology, 47; substrate temperature, 47; optical properties, 45; diameter, 40; surface morphology, 36; surface roughness, 31; crystallinity, 30; particle size, 24; magnetic properties, 19; film thickness, 19; dielectric constant, 19; refractive index, 19; mechanical properties, 18; grain size, 18)
- **Sensors** (thickness, 37; morphology, 31; diameter, 25; optical properties, 20; surface morphology, 13; refractive index, 13; grain size, 11; bioactivity, 11; conductance, 10; mechanical properties, 9; capacitance, 9; surface properties, 8; conductivity, 8; porosity, 8; electrical resistance, 8; surface area, 8; fluorescence intensity, 8)
- **Electrodes** (electrochemical properties, 37; thickness, 31; morphology, 27; electrochemical behavior, 27; diameter, 20; surface morphology, 15; current density, 15; conductance, 13; capacitance, 13; conductivity, 10; surface roughness, 10; specific capacitance, 10; electrical conductivity, 9; roughness, 9; bioactivity, 9; impedance, 9)
- **Electrolytes** (morphology, 38; thickness, 37; ionic conductivity, 22; conductivity, 21; diameter, 19; ionic strength, 12; electrochemical behavior, 11; current density, 11; surface roughness, 11; electrochemical properties, 9; porosity, 8; molecular weight, 8; surface morphology, 7; capacitance, 7; activation energy, 7; particle size, 7; mechanical properties, 7; salt concentration, 7)
- **Lithography** (thickness, 23; diameter, 17; film thickness, 7; magnetic properties, 7; surface roughness, 6; optical properties, 5; current density, 4; thicknesses, 4; coercivity, 4; spatial distribution, 4; shape anisotropy, 4; morphology)

Applications-Phenomena Co-occurrence Matrix

Table A6-5 contains six of the most referenced nanotechnology Applications and the nanoscale phenomena strongly associated with each Application. While a number of terms are listed for each application, a few are pervasive, and are highlighted in the table. *Deposition, absorption, oxidation, immobilization, catalysis, degradation, and self-assembly tend to stand out as the most pervasive nanoscale phenomena* related to the most widely referenced Applications.

TABLE A6-5. APPLICATIONS-PHENOMENA CO-OCCURRENCE MATRIX

- **Catalysts** (photocatalytic activity, 183; catalytic activity, 171; catalysis, 171; oxidation, 101; degradation, 72; photocatalytic degradation, 57; decomposition, 56; adsorption, 54; deposition, 53; impregnation, 53; photocatalytic activities, 50; hydrolysis, 41; hydrogenation, 36; catalytic activities, 32; photocatalytic oxidation, 32)
- **Lasers** (deposition, 62; irradiation, 45; emission, 28; ablation, 26; absorption, 24; photoluminescence, 19; PL, 18; crystallization, 17; oxidation, 15; radiation, 15; diffusion, 13; nucleation, 12; photoluminescence PL, 12; transmittance, 12)
- **Sensors** (immobilization, 39; absorption, 27; deposition, 26; surface plasmon resonance, 18; oxidation, 17; fluorescence, 16; hybridization, 14; catalysis, 13; self-assembly, 12; electron transfer, 11; diffusion, 10; encapsulation, 9; storage, 8; catalytic activity, 8; regeneration, 7; conformational change, 7)
- **Electrodes** (oxidation, 53; electron transfer, 40; deposition, 33; immobilization, 29; adsorption, 28; electrocatalytic activity, 15; self-assembly, 14; electrochemical response, 13; electrochemical reduction, 11; electron transport, 11; catalytic activity, 10; charge transport, 10; diffusion, 9; nucleation, 8)
- **Electrolytes** (adsorption, 30; deposition, 18; diffusion, 10; oxidation, 9; self-assembly, 9; surface modification, 8; illumination, 8; corrosion, 6; condensation, 6; anodization, 6; complexation, 6; immobilization, 5; decomposition, 5; transport, 5; polymerization, 5)
- **Lithography** (deposition, 18; adhesion, 10; oxidation, 7; self-assembly, 7; magnetization, 7; adsorption, 6; evaporation, 5; replication, 5; photoluminescence, 4; irradiation, 4; illumination, 3; anodization, 3; UV irradiation, 3; cell adhesion, 3; emission, 3; communication, 3; migration, 3; scattering, 3; metallization, 3; plastic deformation, 3; magnetization reversal, 3)

Applications-Nanostructures Co-Occurrence Matrix

Table A6-6 contains six of the most referenced nanotechnology Applications and the nanostructures-related terms strongly associated with each Application. While a number of terms are listed for each Application, a few are pervasive, and are highlighted in the table. *Thin films, nanowires, nanotubes (especially carbon), and self-assembled monolayers tend to stand out as the most pervasive nanostructures* related to the most widely referenced Applications.

TABLE A6-6. APPLICATIONS-NANOSTRUCTURES CO-OCCURRENCE MATRIX

- **Catalysts** (carbon nanotubes, 57; CNTs, 56; nanowires, 50; nanotubes, 44; thin films, 28; carbon nanotubes CNTs, 27; nanostructures, 22; tiO2 nanoparticles, 19; Pt nanoparticles, 17; SWNTs, 16; nanorods, 14; metal nanoparticles, 14; nanocomposites, 13; nanostructure, 12)
- **Lasers** (thin films, 89; QDs, 13; thin film, 12; metal nanoparticles, 11; nanowires, 9; quantum dots, 9; CNTs, 8; nanostructures, 8; nanocrystals, 8; quantum wells, 7; carbon nanotubes, 6; nanotubes, 6; SWNTs, 6; silver nanoparticles, 6)
- **Sensors** (thin films, 24; carbon nanotubes, 23; nanotubes, 23; nanowires, 21; nanostructures, 16; CNTs, 11; monolayer, 11; nanorods, 10; SWNTs, 9; MWCNTs, 8; thin film, 7; MWNTs, 7; ZnO nanorods, 7; single-walled carbon nanotubes, 7; monolayers, 7; nanocomposites, 7; self-assembled monolayer SAM, 7)
- **Electrodes** (carbon nanotubes, 26; monolayer, 25; thin films, 20; MWNTs, 20; nanotubes, 19; thin film, 16; SAM, 16; SWNTs, 15; self-assembled monolayer, 14; CNTs, 13; self-assembled monolayers SAMs, 11; self-assembled monolayer, 10; nanowires, 9; SAMs, 9; self-assembled monolayers, 8; multi-walled carbon nanotubes, 8)
- **Electrolytes** (carbon nanotubes, 9; nanotubes, 8; nanostructures, 7; nanopores, 7; monolayer, 5; thin film, 4; CNTs, 4; nanowires, 4; tiO2 nanoparticles, 4; thin films, 3; MWNTs, 3; carbon nanotubes CNTs, 3; nanocomposites, 3; nanocrystals, 3; nanofibers, 3)
- **Lithography** (nanostructures, 14; thin films, 11; nanowires, 9; monolayer, 6; self-assembled monolayers, 6; self-assembled monolayers SAMs, 6; SWNTs, 5; quantum dots, 5; nanopores, 3; SAM, 3; self-assembled monolayer, 3; monolayers, 3; nanowire, 3; nanodots, 3

Correlation Maps

Many nanotechnology Applications have commonalities. In order to understand the relationships among the Applications, two approaches are used. The first, presented in this section, is correlation mapping. Here, Applications are grouped by their direct correlation with each other (essentially co-occurrence within the same Abstract) or by correlation with a third quantity (e.g., similar materials used). The second approach, presented in the next section, is factor analysis and the associated factor matrix. Factor analysis is used to further quantify the relationships shown on the map, and to relate the Applications more directly to the infrastructure and the associated science. In the interests of space, only one factor matrix is presented.

Figure A6-1 is an auto-correlation map of the linkages among the most widely referenced Applications. The map identifies linkages through common occurrence of the Applications in the same Abstracts. The map was constructed iteratively. The most frequently appearing forty Applications were plotted initially. All Applications not included in a network were eliminated, and the map re-plotted. A few of the very weakly connected Applications went under the threshold and were decoupled from the network in the subsequent map, but are included in Figure A6-1.

Five weakly connected sub-networks can be discerned from Figure A6-1:

- Electronic Devices and Components (upper left corner)
- Optical Switching (center left)
- Tribology and Corrosion (lower left)
- Optoelectronic Sensors (center)
- Electrochemical Conversion and Catalysis (center right)

FIGURE A6-1 – APPLICATIONS AUTO-CORRELATION MAP

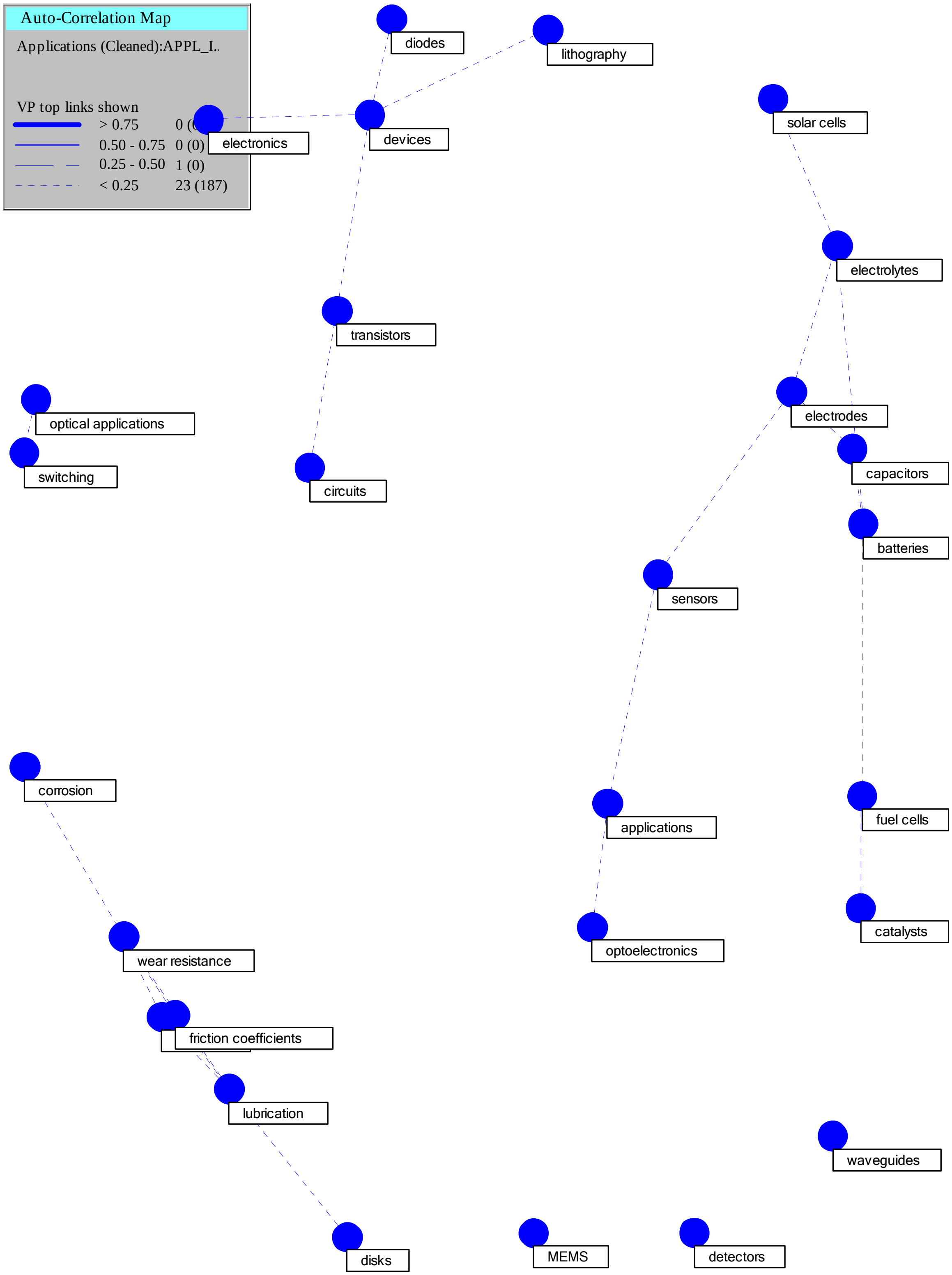


Figure A6-2 is a cross-correlation map (constructed iteratively) of the linkages among the most widely referenced Applications by their common use of materials. Two main Applications groups are discernible: a small strongly-connected tribology-based group at center left, and a large complex electronic devices and systems-based group at upper right. The TechOasis software shows that the main tribology materials connectors are Composites, Ti, and Steel (in other words, these are the key materials that members of the tribology network share). In the larger group: photoelectronics (catalysts [especially photocatalysts], solar cells) and electrochemistry are connected by TiO2; sensors (electrodes, sensors) are connected by Proteins and Gold; the lithography section of electronic devices is connected through Si and Polymers; the optical/ waveguide Applications are connected by Si and Glass; and the nanowires/ optoelectronics link is based on ZnO and Si.

FIGURE A6-2 - APPLICATIONS-MATERIALS CROSS-CORRELATION MAP

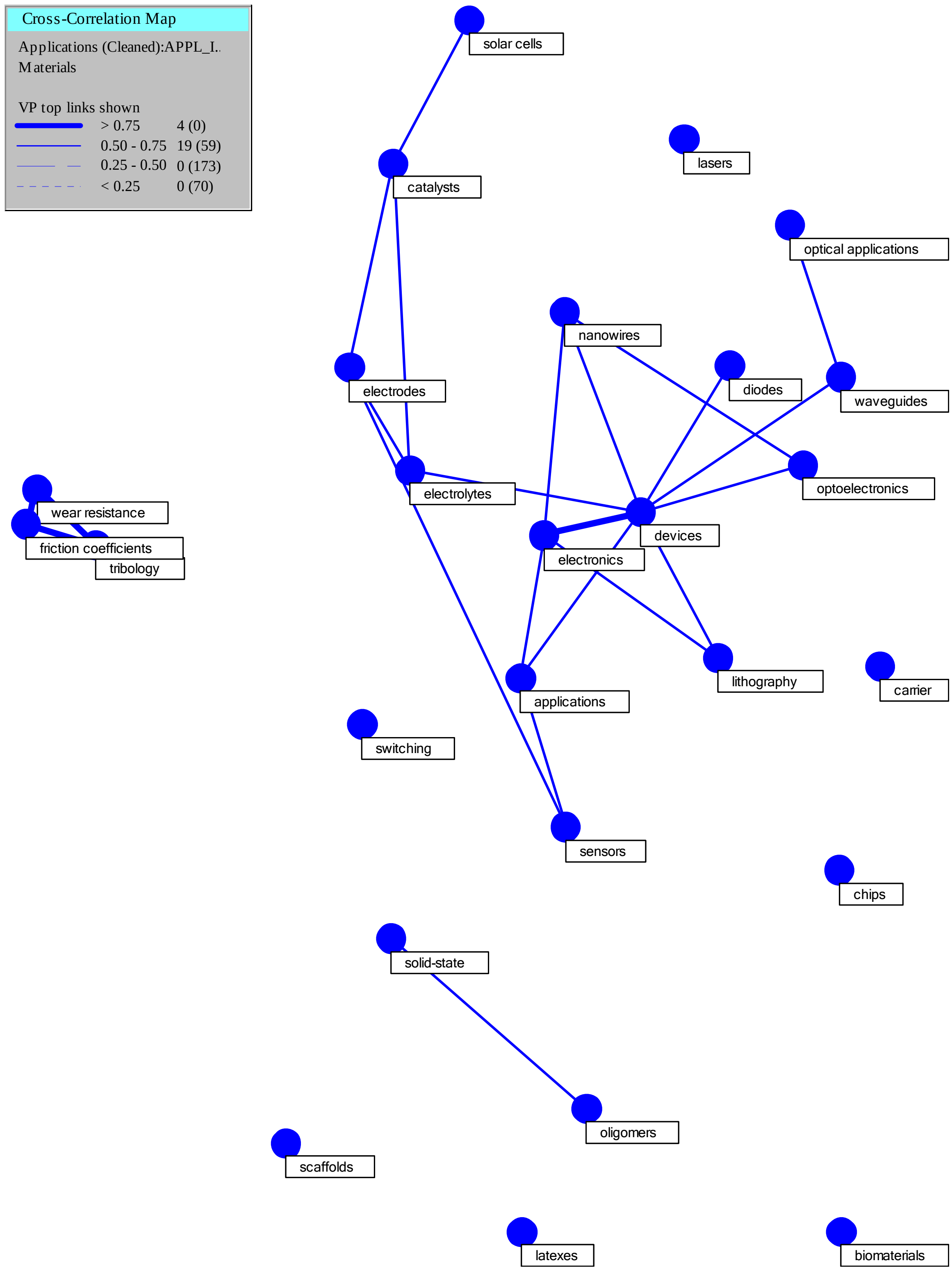


Figure A6-3 is a cross-correlation map (constructed iteratively) of the linkages among the most widely used Applications by their common properties. Three connected groups are evident: a small tribology group at lower left, a small optical circuitry group at lower right, and a large electronic devices-based group in the center.

The tribology group connectors are Friction, Wear Resistance, and Hardness; the optical circuitry group connectors are Thickness, Optical Properties, and Refraction; the wiring segment of the main group is connected through Conductance, Diameter, and Morphology; and the strongly-connected electrochemistry core of the main group is connected through Electrochemistry, Morphology, Diameter, and Thickness. These applications are all exploiting the unique properties of materials at the nanoscale.

FIGURE A6-3 – APPLICATIONS-PROPERTIES CROSS-CORRELATION MAP

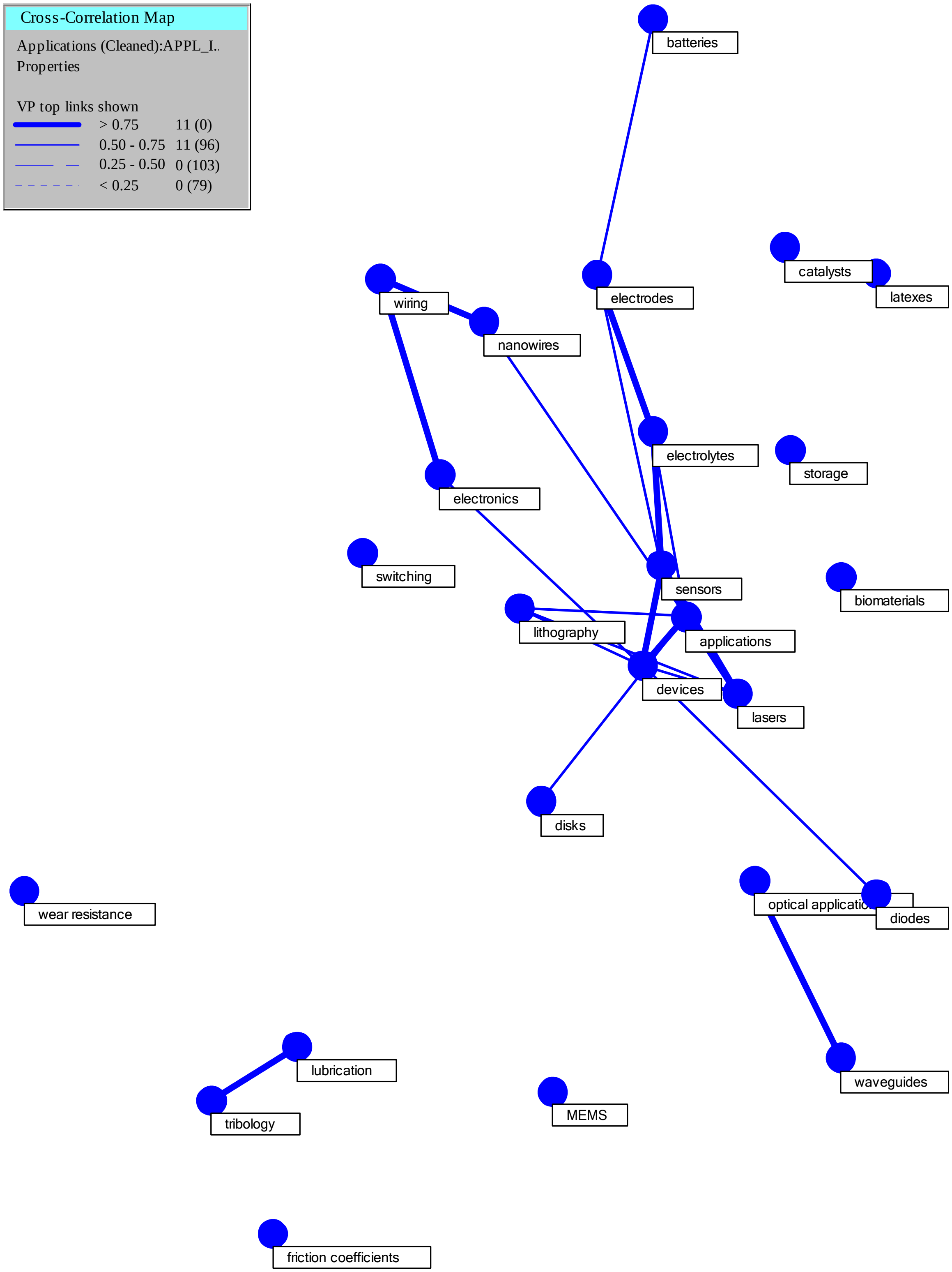


Figure A6-4 is a cross-correlation map (constructed iteratively) of the linkages among the most widely referenced Applications by their common phenomena. It consists of two networked groups: a smaller tribology-based group (lower left), and a large devices-centered group (upper center). The tribology group (strongly linked to MEMS) is connected through Adhesion, Lubrication and Deposition. The common link through much of the devices group (lithography, lasers, solar cells) is Deposition; the connectors of devices to transistors are Transport and Degradation; and the connectors in the electrochemistry wing (electrodes, electrolytes, sensors) are Oxidation, Deposition, and Adsorption.

FIGURE A6-4 – APPLICATIONS - PHENOMENA CROSS-CORRELATION MAP

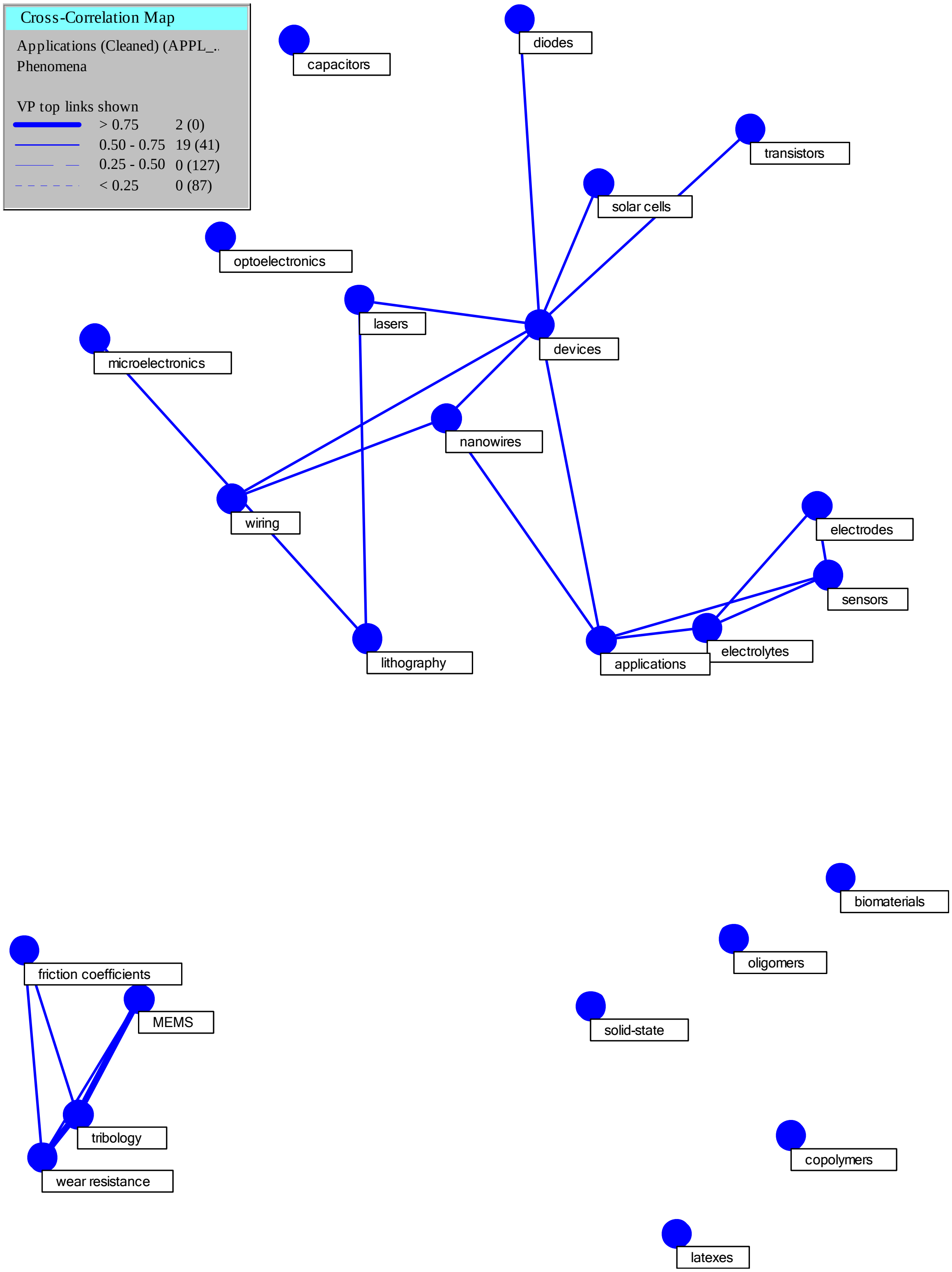
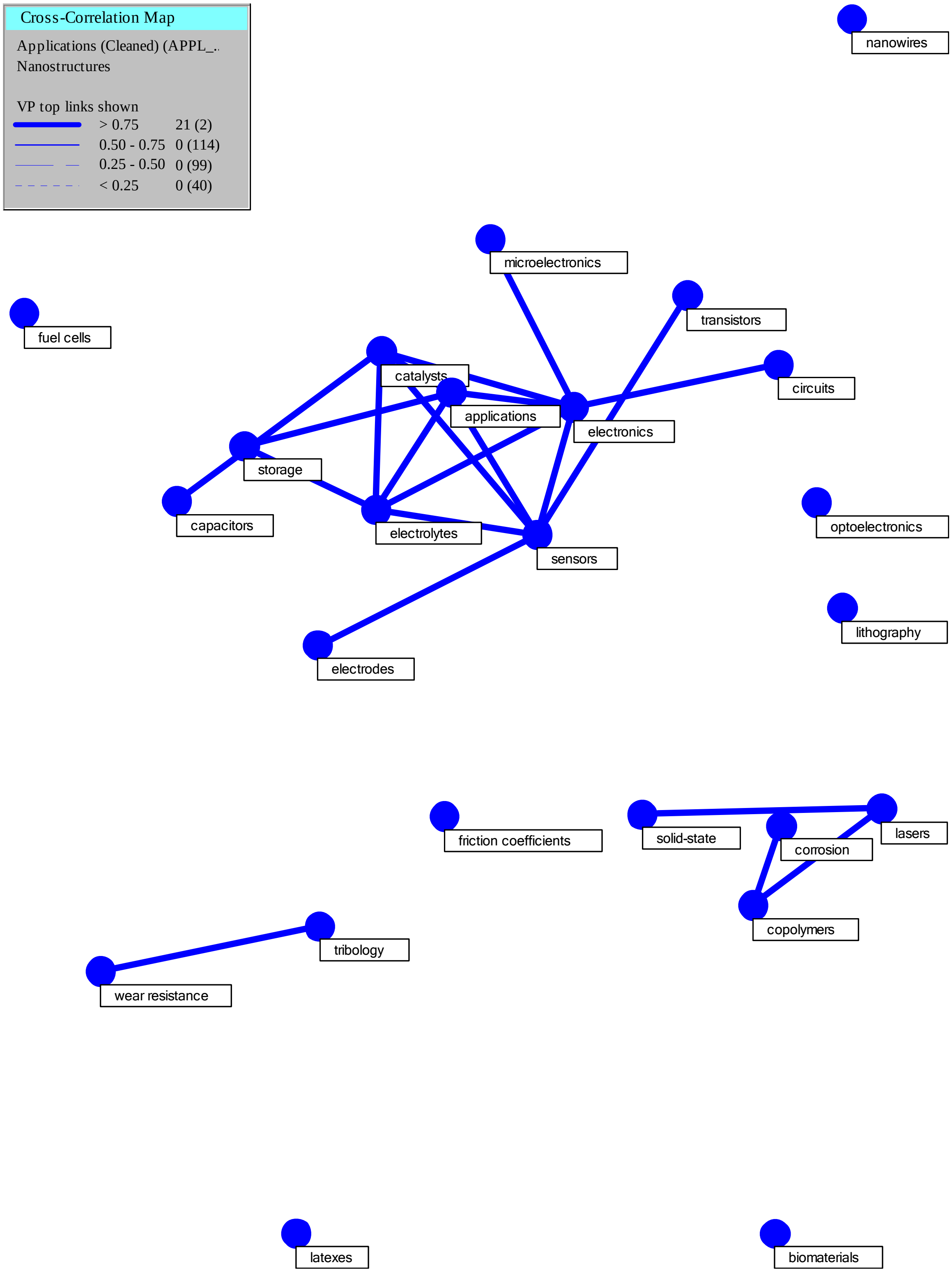


Figure A6-5 is a cross-correlation map (constructed iteratively) of the linkages among the most widely used Applications by their common nanostructures. Two small networks are evident (tribology-based at lower left, corrosion-based at lower right), and a large network based on electronics/ electrochemistry (center). All networks have strong internal links. The tribology network is linked through Nanocomposites and Carbon Nanotubes. The corrosion network is linked through Thin Films, with additional QD links on the laser-solid state arm and Nanocomposite links on the corrosion-copolymer arm.

The electrochemistry segment of the larger network is linked mainly through Nanotubes (especially Carbon Nanotubes), and the electrochemistry/ electronics link adds a Nanowire similarity component as well. The sensors segment adds Thin Films as a linking mechanism.

FIGURE A6-5 – APPLICATIONS - NANOSTRUCTURES CROSS-CORRELATION MAP



Specific Applications Thrusts/ Metrics

To help quantify further the relations shown on the auto-correlation map (Figure A6-1), a factor analysis of the Applications database was performed. The 860 phrases extracted initially as Applications types were inspected further, and only those phrases that could be related unambiguously to Applications were retained for factor analysis and subsequent metrics. These phrases and their associated metrics thus provide a lower bound to the amount of nanotechnology non-medical Applications. Similar phrases were then aggregated, resulting in about 150 aggregated phrases.

A factor analysis was performed on the 150 aggregated phrases in order to identify the pervasive groups in the nanotechnology specific Applications database. Based on the groupings identified in the auto-correlation map, six factors were eventually selected for the analysis, after the number of factors was varied parametrically. The resulting six factor matrix is shown in Table A6-7.

The first column contains the aggregated phrases that were judged to determine the theme of the factors. The key phrases that were used to determine the theme of each factor are listed sequentially, in descending absolute value of their factor loading (the factor loading, which is the matrix entry, represents the contribution of the phrase to the factor theme). Thus, the phrases that determine the theme of Factor 1 range from Optoelectronics to Electronics. Obviously, the theme of this factor is Optoelectronics. The shaded regions in the factor matrix identify the most critical phrases in determining a factor's theme.

The six factors (themes) are summarized as follows:

- Factor 1: Optoelectronics
- Factor 2: Tribology
- Factor 3: Lithography
- Factor 4: Control Systems
- Factor 5: Devices
- Factor 6: Microsystems

As can be seen from the table, the aggregated phrase "devices" is influential in determining the themes of both Factors 1 and 5. However, as shown in the auto-correlation map, "devices" plays a central role in the device components network (transistors, diodes, circuits), and hence becomes the theme of Factor 5.

To understand the infrastructure associated with each of these group themes, as well as the relevant science associated with each Application, Table A6-8 was constructed. In addition to the six group themes, three additional themes are listed that did not display on the auto-correlation map. “Catalysts” was selected due to its high frequency. “Sensors” was the combination of the phrases “sensors” and “detectors”, which are both high frequency and very similar. “Electrochemistry” showed up as a separate network branch on the auto-correlation map, and the combination of “batteries”/”capacitors”/ “fuel cells” was selected to represent “electrochemistry”.

There are ten rows (after the title row) in Table A6-8. Nine of the rows contain one of the nine themes described above, and the tenth row is for the aggregation of all the specific Applications, defined by the ~150 phrases discussed initially. The first column contains the theme name (italics), followed by the number of records associated with the specific Application (theme), then followed by a list of the most prolific countries and their output record numbers for the theme.

Thus, for the first theme listed (the themes are listed by numbers of records, in descending order), Catalysis, there are 2036 records, and 595 of these records contain at least one author with a Chinese address. Probably the most under-represented of the themes (in terms of numbers of records) is Electrochemistry, since it did not include the high frequency but ambiguous terms such as electrode(s), electrolyte(s), etc. Those themes for which China is the most prolific producer are shaded; the darker the shading, the larger is China’s lead. The USA leads in Total Applications and in six out of nine themes in the high-tech research areas such as devices, sensors, and lithography. China leads in three themes in the traditional areas such as catalysis, tribology, and electrochemistry.

The second column lists most prolific institutions. The institution listings are not uniform, and the institution names are aggregated differently by different software packages. Institutions not aggregated previously were aggregated for this table by visual inspection. In particular, in the USA, campuses of a state university system were aggregated into one institution. Thus, separate California campuses became University of California. This unit becomes more comparable with the multi-institution Chinese Academy of Science, Russian Academy of Science, or Max Planck Institute.

The pervasive institutions are summarized in the Total Applications row. While two of the top three institutions are Chinese, the USA is well represented by the large University of California and University of Illinois state university systems. The third column lists the journals containing the most articles for each theme. Applied Physics Letters appears in the top layer in seven of the nine themes and is by far the leader in overall publications. Journal of Physical Chemistry B appears in four of the nine themes, as does Journal of Applied Physics.

The fourth column lists the phrases of all types that tend to occur most frequently in the Abstracts of the theme-associated records, in descending frequency order. The entries in this column indicate the science areas associated with the specific Applications. Thus, for Catalysis, the important instrumentation is shown (XRD, TEM, XPS, SEM, FTIR, etc), the key materials (TiO_2, platinum, silica, nickel, iron, etc), the key phenomena (oxidation, growth, nitrogen adsorption, degradation, etc), the key properties (diameter, particle sizes, surface area, etc), the key nanostructures (films, particles, nanoparticles, crystals, etc), and key reactants and by-products (hydrogen, CO, methane, CO_2, methanol, etc). Some frequently occurring technologies or very generic phrases were removed from the display (e.g., materials, nanotechnology, devices, room temperature, etc).

TABLE A6-7. APPLICATIONS FACTOR MATRIX

FACTOR	1	2	3	4	5	6
optoelectronics	-0.436	0.025	-0.037	0.009	-0.063	0.073
solar cells	-0.374	-0.054	-0.004	-0.063	-0.083	-0.085
devices	-0.348	-0.025	0.008	0.154	0.37	0.086
light-emitting devices	-0.293	-0.012	-0.002	-0.034	-0.055	-0.015
photovoltaics	-0.278	-0.041	0.005	-0.026	-0.025	-0.061
applications	-0.268	0.082	0.01	0.02	-0.046	0.192
diodes	-0.262	-0.052	-0.023	-0.019	0.157	-0.056
photonic applications	-0.24	0.018	-0.018	-0.009	-0.035	0.063
electronics	-0.226	-0.002	0.023	0.036	0.137	0.073
tribology	-0.04	0.678	-0.004	0.045	0.034	-0.284
friction coefficients	-0.031	0.578	-0.005	0.04	0.03	-0.281
wear resistance	-0.026	0.505	-0.02	0.012	-0.022	-0.195
composite coatings	-0.03	0.266	-0.035	-0.048	-0.005	-0.076
lubrication	0.007	0.262	0.079	0.159	0.03	-0.183
wear coefficient	-0.018	0.184	-0.014	-0.002	0.012	-0.09
reactive ion etching	0.041	-0.016	-0.562	0.251	-0.032	0.001
lithography	0.001	-0.011	-0.494	0.267	0.077	0.039
wet etching	0.007	-0.01	-0.435	0.127	0.03	-0.009
dry etching	-0.008	-0.016	-0.407	0.116	0.015	-0.023
actuators	-0.02	-0.09	0.228	0.464	0.03	-0.096
disks	0.02	-0.035	0.191	0.394	-0.017	-0.186
control systems	0.038	-0.093	0.205	0.385	0.041	-0.134
MEMS	0.065	0.091	0.144	0.332	0.088	0.116
transistors	-0.035	-0.02	0.02	-0.088	0.557	0.02
gate dielectrics	0.069	0.007	-0.009	-0.087	0.461	0.048
gate insulators	0.036	-0.009	0.034	-0.071	0.346	0.002
circuits	-0.056	-0.022	-0.046	0.002	0.309	-0.006
microsystems	0.106	0.19	0.061	0.103	0	0.464
microfluidics	0.089	0.177	-0.014	0.122	-0.014	0.408
microelectronics	-0.055	0.159	0.057	0.021	0.025	0.369
chips	-0.012	0.101	0.032	0.079	0.069	0.282

TABLE A6-8. CENTRAL APPLICATIONS THEMES AND INFRASTRUCTURE

THEME/ #RECORDS/ COUNTRIES	INSTITUTIONS	JOURNALS	RELATED SCIENCE
CATALYSIS (2036) Peoples R China 595 USA 314 Japan 191 South Korea 141 France 111 Germany 109	Chinese Acad Sci 141 Tsing Hua Univ 45 CSIC 41 Zhejiang Univ 35 Univ Calif 32 Max Planck Inst 25	Applied Catalysis A-General 97 Journal Of Physical Chemistry B 94 Journal Of Catalysis 86 Catalysis Today 84	Catalysis, XRD, TEM, XPS, SEM, TiO2, hydrogen, infrared spectroscopy, FTIR, CO, water, carbon nanotubes, electron microscopy, oxidation, growth, platinum, diameter, sol-gel, films, nitrogen adsorption, silica, particles, methane, particle sizes, nickel, Raman spectroscopy, degradation, calcinations, CO2, nanoparticles, iron, surface area, methanol, ammonia, crystals
DEVICES (1783) USA 597 Japan 199 Peoples R China 167 South Korea 146 Germany 144 England 112	Univ Calif 88 Chinese Acad Sci 51 Natl Chiao Tung Univ 37 Univ Illinois 32 CNRS 28 Univ Cambridge 25	Applied Physics Letters 197 Physical Review B 65 Journal Of Applied Physics 64 Japanese Journal Of Applied Physics 36 Ieee Transactions On Electron Devices 35	Fabrication, films, electrons, XRD, AFM, thickness, transistors, structures, silicon, growth, substrate, electrodes, TEM, channels, nanotubes, conductivity, silicon substrates, PL, quantum dots, electron microscopy, annealing, thin films, electrical properties, nanowires, SEM, silica, deposits, optical properties, XPS, transport, nanostructures, nanotechnology, nanoparticles, SAMS, dielectric, hydrogen
OPTOELECTRONICS (1746) USA 503 Peoples R China 288 Japan 184 Germany 160 South Korea 102 England 97	Chinese Acad Sci 95 Univ Calif 74 Max Planck Inst 30 Tsing Hua Univ 25 Russian Acad Sci 24	Applied Physics Letters 114 Journal Of Applied Physics 57 Physical Review B 52 Thin Solid Films 52 Journal Of Physical Chemistry B 52	Films, electron transport, XRD, TEM, fabrication, growth, solar cells, electrons, Thickness, PL, AFM, optical properties, SEM, carbon nanotubes, molecular electronics, quantum dots, electron microscopy, nanotubes, silicon, conductivity, structures, nanoparticles, thin films, diameter, deposits, substrate, hydrogen, TiO2, electrodes, nanostructures, nanotechnology, annealing, XPS, polymer, particles, electrical properties, luminescence, nanowires, semiconductors, wavelength, silica, silicon substrates
SENSORS (1232) USA 410 Peoples R 190	Univ Calif 46 Chinese Acad Sci 32 Hunan Univ 22	Sensors And Actuators B-Chemical 110 Biosensors & Bioelectronics 47 Applied Physics Letters 42	Biosensors, detection limit, films, materials, fabrication, proteins, electrodes, XRD, AFM, SEM, hydrogen peroxide, enzymes, carbon nanotubes, thickness, nanoparticles,

China Japan 94 Germany 74 South Korea 65 England 54	Nanjing Univ 21 Univ Illinois 19 CNR 18	Analytical Chemistry 36 Langmuir 30 Talanta 30	immobilization, binding, cyclic voltammetry CV, TEM, glucose, thin films, Ph, substrate, Ethanol, XPS, gold nanoparticles, antibody, electron microscopy, water, gold, CO, Nanotubes, deposits, adsorption, response time, diameter, SAMS, electrode surface, hydrogen, polymer, wavelength, optical properties, nanowires
LITHOGRAPHY (552) USA 187 Japan 79 South Korea 58 Germany 46 France 38 Peoples R China 36	Univ Calif 23 CNRS 20 Northwestern Univ 15 Natl Univ Singapore 14 Chinese Acad Sci 13 Univ Illinois 12	Journal Of Vacuum Science & Technology B 43 Applied Physics Letters 42 Microelectronic Engineering 30 Nanotechnology 27 Journal Of Applied Physics 24	Fabrication, photolithography, electron beam lithography, substrate, AFM, films, silicon substrates, silicon, thickness, deposits, structures, etching, SEM, diameter, arrays, SAMS, nanostructures, electron microscopy, Growth, polymer, TEM, XPS, quantum dots, Silica, nanowires, metals, annealing, silicon wafers, nanoparticles, thin films, gold, wavelength, glass substrates, electrodes, lasers, adhesion, waveguides, water, optical properties, particles, resistivity, self-assembly, monolayers, microstructures, nanoscale
TRIBOLOGY (508) Peoples R China 162 USA 99 Japan 60 South Korea 29 Germany 28 England 25	Chinese Acad Sci 46 Ohio State Univ 17 Shanghai Jiao Tong Univ 11 Sungkyunkwan Univ 8 Tsing Hua Univ 8	Wear 51 Surface & Coatings Technology 50 Thin Solid Films 30 Tribology Letters 18 Rare Metal Materials And Engineering 11 Materials Science And Engineering A 11	wear resistance, tribological properties, friction coefficient, coatings. Friction, hardness, SEM, XRD, films, microstructures, electron microscopy, mechanical properties, TEM, XPS, AFM, wear rate, thickness, worn surfaces, adhesion, microhardness, substrate, Raman spectroscopy, titanium, elastic modulus, nanoindentation, surface roughness, silicon, nanoparticles, steel, alloys, deposits, particles, nitrogen, additives, corrosion resistance, composite, water, nanocomposites, silicon substrates, SAMS, carbon nanotubes, phase composition, high hardness, resistivity, roughness, hydrogen, argon
ELECTROCHEMISTRY (443) Peoples R China 99 USA 92 South Korea 47	Chinese Acad Sci 17 Tsing Hua Univ 11 Seoul Natl Univ 11 Natl Tsing Hua Univ 8	Journal Of Power Sources 36 Journal Of The Electrochemical Society 24 Electrochimica Acta 22 Electrochemical And Solid State Letters 16	XRD, electrodes, SEM, cyclic voltammetry CV, TEM, electrochemical properties, XPS, films, carbon nanotubes, electrolytes, hydrogen, electron microscopy, platinum, capacitance, thickness, membranes, water, CO, fabrication, silicon, nanoparticles, deposits, diameter, crystals, electrical properties, lithium, microstructures,

Japan 46 France 36 Taiwan 32		Applied Physics Letters 12 Journal Of Physical Chemistry B 11	AFM, nanocomposites, particle sizes, current density, anodization, nanotubes, cathode, particles, growth, carbons, conductivity, electrochemical, porosity, annealing, electrons, pores, discharge capacity
MICROSYSTEMS (279) USA 86 Germany 28 Peoples R China 26 Japan 24 France 22	Univ Calif 13 Tech Univ Denmark 11 CNRS 8 Univ Tokyo 6 Univ Illinois 5 Max Planck Inst 5 Purdue Univ 5	Analytical Chemistry 17 Lab On A Chip 10 Applied Physics Letters 9 Nanotechnology 8 Journal Of Applied Physics 6 Langmuir 6	Fabrication, substrate, films, silicon, nanotechnology, deposits, channels, proteins, SEM, AFM, particles, structures, microchannels, thickness, microstructures, DNA, XRD, TEM, nanoparticles, diameter, polymer, metals, copper, arrays, gold, binding, electron microscopy, annealing, thin films, antibody, electrodes, XPS, carbon nanotubes, hydrogen, diffusion, surfactants, Biosensors, adhesion, lasers. Nanotubes, carbons, porosity, coatings, nanoscale, physical properties, surface roughness
CONTROL SYSTEMS (241) USA 70 Peoples R China 38 Japan 35 South Korea 29	Chinese Acad Sci 12 Yonsei Univ 7 Nagoya Univ 6 Univ Calif 5 Univ Illinois 5 Ohio State Univ 5 Tsing Hua Univ 5 Shanghai Jiao Tong Univ 5 Northwestern Univ 5	Microsystem Technologies- 39 Journal Of Microelectromechanical Systems 8 Journal Of Micromechanics And Microengineering 7 Applied Physics Letters 6 Journal Of Applied Physics 6 Journal Of Physical Chemistry B 6	SEM, thickness, XRD, fabrication, films, AFM, microstructures, mechanical properties, structures, TEM, hardness, friction, silicon substrates, substrate, silicon, coatings, water, deposits, diameter, carbon nanotubes, adhesion, surface roughness, particles, electron microscopy, thin films, silicon wafers, growth, nanostructures, residual stresses, crystals, nanotechnology, metals, electrodes, XPS, nanoscale, nanowires, SAMS, self-assembly, elastic modulus, Young's modulus, simulations, gold, nanotubes, deformation, electric fields
<u>TOT APPLICATIONS</u> (10236) USA 2601 Peoples R China 1852 Japan 1109 Germany 747 South Korea 737 France 563 England 461 Taiwan 405	Chinese Acad Sci 450 Univ Calif 294 Tsing Hua Univ 149 CNRS 133 Max Planck Inst 120 CNR 100 Univ Illinois 97 CSIC 96 Natl Inst Adv Ind Sci & Technol 92 Natl Univ 91	Applied Physics Letters 479 Journal Of Physical Chemistry B 230 Journal Of Applied Physics 218 Thin Solid Films 185 Physical Review B 181 Nanotechnology 146 Langmuir 141 Sensors And Actuators B-Chemical 133 Surface & Coatings Technology 112 Nano Letters 108	XRD, TEM, films, SEM, XPS, electron microscopy, AFM, fabrication, thickness, growth, hydrogen, water, substrate, carbon nanotubes, microstructures, nanoparticles, particles, diameter, TiO2, deposits, coatings, Structures, electrodes, silicon, CO, infrared spectroscopy FTIR, electrons, biosensors, catalytic activity, oxidation, silica, thin films, nanotubes, silicon substrates, PL, photocatalytic activity, crystals, Raman spectroscopy, mechanical properties, particle sizes, proteins, catalysis, sol-gel, gold, storage, metals, optical properties, annealing, adsorption, platinum, polymer, corrosion, quantum dots,

Italy 382 Spain 284 India 276 Canada 222 Russia 207	Singapore Russian Acad Sci 90 Seoul Natl Univ 90 Univ Tokyo 83 Zhejiang Univ 82 Natl Chiao Tung Univ 82 Tohoku Univ 81 Northwestern Univ 81	Journal Of Vacuum Science & Technology B 108 Applied Surface Science 99	nanostructures, hardness, nanowires, corrosion resistance, copper, degradation, nickel, conductivity, nitrogen, pH, cyclic voltammetry CV, wear resistance, tribological properties, nanotechnology, friction, resistivity, electron transport, SAMS, iron, electrical properties, wavelength, waveguides, detection limit, friction coefficient, ammonia, methane, adhesion, pores, SWNTs, TGA, titanium, alumina, silver, carbons, oxides, channels, scaffolds

Abbreviations:
AFM-Atomic Force Microscopy
NMR-Nuclear Magnetic Resonance
EM-Electron Microscopy
XRD-X-Ray Diffraction
RS-Raman Spectroscopy
TEM-Transmission Electron Microscopy
HRTEM-High Resolution Transmission Electron Microscopy
SEM-Scanning Electron Microscopy
DSC-Differential Scanning Calorimetry
IS-Infrared Spectroscopy
STM-Scanning Tunneling Microscopy
XPS-X-Ray Photoelectron Spectroscopy

Nanotechnology Health

Nanotechnology Health Types

The document clustering approach used to identify the Health types was a recent algorithmic upgrade of our CLUTO software package (Karypis, 2006) called fuzzy clustering, where a record could be assigned to multiple clusters. Fuzzy clustering, compared to non-fuzzy clustering, is important for articles that have multiple thrusts, such as Health applications articles in a research database.

There were 256 elemental clusters specified for the algorithm. This produced a hierarchical taxonomy of about 500 nodes, ranging from the root node at the highest level (Containing all ~65000 records) to the 256 elemental nodes at the lowest level. All the elemental nodes were examined, and the sub-network that included all Health-related elemental clusters was identified. Twenty-two elemental clusters total were in the Health sub-network. Of these 22 elemental clusters, 19 related directly to Health. The resultant 19 clusters are of different types. Some address specific Health problems (e.g., Tumor Treatment, Sentinal Lymph Node Cancer), some address Health Treatment mechanisms (e.g., Drug Release, Drug Delivery), some address biomaterial types (e.g., Cells, DNA, Biofilms, Virus Proteins, Amyloid Fibrils), but most are Health-related phenomena and processes (e.g., Peptide Sequences, Binding and Affinity, Detection, Sensing). The higher level taxonomy categories will now be discussed, followed by a discussion of the elemental clusters.

Higher Level Taxonomy Categories

Table A6-9 contains a summary of the infrastructure, pervasive thrusts, and related science for the 19 elemental clusters. Characteristics of the highest level category (node) in the Health sub-network are summarized in the last row on Table A6-9. Because about fifteen percent of the elemental clusters in the 22 cluster Health sub-network were not strictly Health-related, the results on this row should be considered a good approximation. In addition, the numbers of records listed for the highest level node (and all nodes on Table A6-9) include counts of records from different elemental clusters (due to the fuzzy nature of the clustering), and therefore have intrinsic multiple counts.

TABLE A6-9. CENTRAL HEALTH THEMES AND INFRASTRUCTURE

THEME/ #RECORDS/ COUNTRIES	INSTITUTIONS	JOURNALS	RELATED SCIENCE
DRUG RELEASE (235 Records) usa 58 peoples r china 55 india 37 south korea 31 japan 24 germany 23	natl univ singapore 11 zhejiang univ 9 korea res inst chem technol 8 chonbuk natl univ 6	journal of controlled release 30 international journal of pharmaceutics 28 drug development and industrial pharmacy 9 journal of microencapsulation 8 european journal of pharmaceutics and biopharmaceutics 8	polymer, hydrogel, nanoparticles, chitosan, microsphere, molecular.weight, particle.size, water.soluble, light.scattering, ethylene glycol, cross linking, differential scanning calorimetry, scanning electron microscopy, poly lactic acid, atomic force microscopy, transmission electron microscopy, dynamic light scattering, fourier transform infrared, bovine serum albumin, poly ethylene glycol, poly lactide glycolide
DRUG DELIVERY (197 Records) usa 79 peoples r china 36 india 31 germany 26 japan 23 italy 21 france 19 south korea 18 england 18	natl univ singapore 10 univ michigan 8 zhejiang univ 7 postgrad inst med educ & res 7	journal of controlled release 36 international journal of pharmaceutics 23 journal of drug delivery science and technology 11 biomaterials 10	nanoparticles, cancer, cancer cells, cellular uptake, size distribution, tumor cells, scanning electron microscopy, poly lactide glycolide, solid lipid nanoparticles, poly ethylene glycol, blood brain barrier, transmission electron microscopy, bovine serum albumin, confocal laser scanning microscopy
TUMOR TREATMENT (208 Records) usa 107 japan 24 germany 22	univ texas 7 univ michigan 7 chinese acad sci 7 washington univ 6 ohio state univ 5	journal of controlled release 11 journal of magnetism and magnetic materials 10 pharmaceutical research 8 magnetic resonance in medicine 6	liposomes, mice, cells, nanoparticles, tumor cells, tumor growth, contrast agents, endothelial cells, flow cytometry, cell lines, magnetic resonance imaging, scanning electron microscopy, transmission electron microscopy, blood brain barrier, superparamagnetic iron oxide nanoparticles, surface plasmon resonance, , tumor bearing mice, central nervous system, tumor necrosis factor, atomic force microscopy

peoples r china 19 france 19 south korea 18		biomaterials 6	
SENTINEL LYMPH NODE CANCER (112 Records) usa 50 england 12 netherlands 9 italy 8 germany 6 japan 5 france 5	massachusetts gen hosp 5 harvard univ 4 univ barcelona 3 mit 3 hosp clin barcelona 3 brigham & womens hosp 3 beth israel deaconess med ctr 3 amer biosci inc 3	european journal of nuclear medicine and molecular imaging 7 urology 4 journal of clinical oncology 4	lymphoscintigraphy, metastases, lymph node, risk factors, breast cancer, sentinel node, magnetic resonance imaging, squamous cell carcinoma, scanning electron microscopy, von willebrand factor, lymph node biopsy, low density lipoprotein, high density lipoprotein, intercellular adhesion molecule
TISSUE CELLS (269 Records) usa 92 peoples r china 36 japan 36 singapore 30 germany 26 south korea 23 england 23	natl univ singapore 24 tsing hua univ 7 mit 7 johns hopkins univ 7	biomaterials 45 tissue engineering 22 journal of biomedical materials research part a 19 asbm6: advanced biomaterials vi 9	cells, tissues, collagen, scaffold, bone, osteoblast, extracellular matrix, cell adhesion, cell culture, endothelial cells, cell proliferation, cell attachment, cell morphology, calcium phosphate, osteoblast cells, bone tissue, self assembly, tissue culture, phosphatase activity, cell growth, scanning electron microscopy, atomic force microscopy, transmission electron microscopy, x-ray photoelectron spectroscopy, alkaline phosphatase activity, polymerase chain reaction, mesenchymal stem cells, poly lactic glycolic acid, bone marrow stromal cells
CELLS, EMPHASIZING	univ calif 28	biomaterials 25	Cells, adhesion, apoptosis, endothelial.cells, cell lines, cell surface, cell adhesion, cancer cells, epithelial cells, cell

ADHESION (605 Records) usa 254 germany 86 japan 82 peoples r china 52 south korea 46 canada 30 england 28 france 27	harvard univ 20 johns hopkins univ 16 univ tokyo 11 natl univ singapore 11 cnrs 11 chinese acad sci 11	journal of biomedical materials research part a 16 langmuir 14 biophysical journal 12	proliferation, cell growth, cell death, extracellular matrix, stem cells, tumor cells, flow cytometry, atomic force microscopy, transmission electron microscopy, scanning electron microscopy, surface plasmon resonance, smooth muscle cells, green fluorescent protein, human umbilical vein, magnetic resonance imaging, superparamagnetic iron oxide nanoparticles
BIOFILMS (83 Records) usa 33 japan 9 germany 8 england 8 south korea 6 peoples r china 6 canada 6	montana state univ 4 chinese acad sci 3 univ calif 3	water science and technology 4 on the convergence of bio-information-, et al 4	biofilm, muscles, bacteria, biofilm formation, infection, colon, pathogen, tissue, strain, epithelial cells, pseudomonas aeruginosa, staphylococcus epidermidis, escherichia coli, scanning electron microscopy, transmission electron microscopy, atomic force microscopy, extracellular polymeric substances, confocal laser scanning, polymerase chain reaction
VIRUS PROTEINS (205 Records) usa 228 germany 70 japan 66 peoples r china 34	univ calif 30 osaka univ 12 univ texas 11 univ illinois 8 linkoping univ 8 chinese acad sci 8	langmuir 29 journal of biological chemistry 27 biochemical and biophysical research communications 14 journal of virology 13 journal of molecular biology 12	protein, virus, capside, gene, sequence, escherichia coli, wild type, virus particles, capside assembly, capside protein, self assembly, atomic force microscopy, transmission electron microscopy, surface plasmon resonance, amino acid sequence, green fluorescent protein, tobacco mosaic virus, open reading frame, density gradient centrifugation, amino acid

italy 34 france 32 england 32		biochemistry 12	
PROTEIN INTERACTIONS (641 Records) usa 247 germany 85 japan 65 peoples r china 55 italy 50 england 44 france 35	univ calif 26 chinese acad sci 19 univ illinois 12 univ texas 10 max planck inst 9 univ washington 8 tokyo inst technol 8 osaka univ 8 linkoping univ 8	langmuir 37 analytical chemistry 17 proc NAS-USA 16 biomacromolecules 16	protein, binding, surface, membranes, unfolding, fluorescence, protein adsorption, mass spectrometry, protein surface, x-ray diffraction, atomic force microscopy, surface plasmon resonance, bovine serum albumin, scanning electron microscopy, transmission electron microscopy, differential scanning calorimetry, human serum albumin, green fluorescent protein, polyacrylamide gel electrophoresis, protein protein interactions, quartz crystal microbalance, fourier transform infrared, self assembled monolayer, poly ethylene glycol, tandem mass spectrometry
AMYLOID FIBRILS (114 Records) usa 50 england 15 japan 14 italy 9 germany 8 sweden 7	univ cambridge 8 osaka univ 6 niddkd 5 japan sci & technol agcy 5 fukui univ 4 univ calif 4	biochemistry 16 biophysical journal 8 journal of molecular biology 7 journal of biological chemistry 7	amyloid.fibrils, protein, peptide, alzheimers disease, collagen, protofibril, prion, beta sheet structure, fibril formation, self assembly, amyloid beta, neurodegenerative diseases, collagen fibrils, amyloid deposits, thioflavin fluorescence, atomic force microscopy, transmission electron microscopy, paired helical filaments
PEPTIDE SEQUENCES (187 Records) usa 86 japan 28	mit 8 univ calif 5	langmuir 13 analytical chemistry 10 journal of the american chemical society 9	peptide, binding, sequences, amino acids, peptide nanotubes, neuropeptides, structure, protein, circular dichroism, antimicrobial peptides, peptide sequence, alpha helix, molecular dynamics, model peptide, surface plasmon resonance, atomic force microscopy, amino acid residues, transmission electron microscopy, amino acid sequence, matrix laser desorption,

israel 14 germany 14 australia 14 canada 12		journal of biological chemistry 9 biochemistry 7 biophysical journal 6	quartz crystal microbalance, tandem mass spectrometry, differential scanning calorimetry, self assembled monolayers, solid phase peptide
BINDING AND AFFINITY (415 Records) usa 211 japan 51 germany 47 england 45 france 34	chinese acad sci 13 cnrs 12 lund univ 11 univ calif 10 univ penn 9 univ oxford 9 nci 9 scripps res inst 8	journal of biological chemistry 44 biochemistry 35 biochemical and biophysical research communications 19 journal of the american chemical society 16	binding, receptors, affinity, protein, interaction, surface plasmon resonance, ligand, high affinity, binding affinity, binding sites, amino acid, active site, ligand binding, binding protein, cell surface, dissociation rate, atomic force microscopy, site directed mutagenesis, amino acid residues, human immunodeficiency virus, high affinity binding, isothermal titration calorimetry, low density lipoprotein, equilibrium dissociation constants, immobilized sensor chip, expressed escherichia coli, human serum albumin, transmission electron microscopy, quartz crystal microbalance, molecular dynamics simulations, epidermal growth factor, fluorescence resonance energy
IMMUNOSENSORS (248 Records) usa 74 peoples r china 54 japan 30 germany 16 england 16 south korea 15	hunan univ 10 univ turku 7 kyushu univ 7 sw china normal univ 6 sogang univ 6	analytical chemistry 22 biosensors & bioelectronics 17 analytica chimica acta 13 sensors and actuators b-chemical 12 langmuir 12	antibodies, antigens, assays, detection, igg, immobilization, immunoassays, binding, protein, immunosensor, gold, monoclonal antibody, immunosorbent assay, antigen antibody, assay elisa, antigen binding, gold surface, gold nanoparticles, escherichia coli, antibody binding, surface plasmon resonance, enzyme linked immunosorbent assay, atomic force microscopy, quartz crystal microbalance, self assembled monolayer, bovine serum albumin, electrochemical impedance spectroscopy, transmission electron microscopy
DETECTION, EMPHASIZING SURFACE PLASMON RESONANCE (162 Records) usa 93	tsing hua univ 11 arizona state univ 10 kyushu univ 9 chinese acad sci 9 univ calif 8 max planck inst polymer res 7	sensors and actuators b-chemical 31 analytical chemistry 28 biosensors & bioelectronics 18 analytical biochemistry 10	detection, sensor, chip, biosensor, mass spectrometry, liquid chromatography, real time, sensor chip, refractive index, sensor surface, gold surface, self assembled, gold nanoparticles, metal ions, surface plasmon resonance, bovine serum albumin, laser desorption ionization

japan 47 peoples r china 44 germany 40 south korea 34	cnr 7 acad sci czech republ 7	analytica chimica acta 9	
BIOSENSORS (92 Records) usa 38 peoples r china 28 south korea 9 japan 9 germany 9	univ calif 6 chinese acad sci 5 univ twente 4 pacific nw natl lab 4 louisiana tech univ 4 csic 4	biosensors & bioelectronics 14 analytical biochemistry 6 langmuir 5 electroanalysis 5 chemical communications 5 analytical chemistry 5	enzymes, immobilization, glucose oxidase, enzyme activity, enzyme loading, glucose biosensor, immobilized enzyme, electrode surface, catalytic activity, free enzyme, glassy carbon electrode, steady state current, glucose oxidase, scanning electron microscopy, direct electron transfer, multi wall carbon nanotubes, surface plasmon resonance
DNA DETECTION (282 Records) usa 166 peoples r china 81 japan 67 germany 54 france 27 england 27	chinese acad sci 18 univ calif 17 purdue univ 8	analytical chemistry 21 nucleic acids research 20 langmuir 20 nano letters 16 journal of nanoscience and nanotechnology 16 biosensors & bioelectronics 14	dna, oligonucleotid, target dna, dna hybridization, gold nanoparticles, nucleic acids, single stranded dna, surface plasmon resonance, double stranded dna, polymerase chain reaction, atomic force microscopy, x-ray photoelectron spectroscopy, peptide nucleic acid, self assembled monolayers, quartz crystal microbalance
DNA MOLECULES (411 Records) usa 149 japan 66 peoples r china 64	chinese acad sci 19 russian acad sci 12 univ calif 10 univ tokyo 9 osaka univ 9	nano letters 20 langmuir 18 nucleic acids research 16 proc NAS-USA 12	dna molecules, dna binding, dna fragments, self assembly, bound dna, dna protein, dna sequence, dna complexes, dna hybridization, target dna, atomic force microscopy, double stranded dna, surface plasmon resonance, single stranded dna, transmission electron microscopy, calf thymus dna, x-ray photoelectron spectroscopy, scanning electron microscopy

germany 42 france 26 england 26	delft univ technol 8			
DNA, EMPHASIZING GENE DELIVERY AND TRANSFECTIION (110 Records) usa 66 peoples r china 37 japan 23 south korea 15 germany 15 england 13 france 10	chinese acad sci 7 univ calif 5 kyoto univ 5 delft univ technol 5	journal of controlled release 11 langmuir 9 bioconjugate chemistry 9 nucleic acids research 7	dna, gene, transfection, chitosan, plasmid dna, gene delivery, transfection efficiency, dna complexes, dna nanoparticles, gene transfer, gene therapy, gene expression, surface charge, particle size, atomic force microscopy, transmission electron microscopy, poly ethylene glycol, gene delivery systems, polymerase chain reaction, nonviral gene delivery, green fluorescent protein, plasmid dna encodingdynamic light scattering	
CELLS, EMPHASIZING MEMBRANES AND BACTERIA (348 Records) usa 416 germany 128 japan 111 peoples r china 97 england 66 france 56	univ calif 37 harvard univ 27 univ tokyo 15 johns hopkins univ 14 univ penn 13 natl univ singapore 13 chinese acad sci 13	biomaterials 39 langmuir 25 biophysical journal 18 journal of membrane science 17 journal of biomedical materials research part a 17	cells, membranes, bacteria, vesicles, cytoplasm, cell wall, transmission electron microscopy, scanning electron microscopy, atomic force microscopy, green fluorescent protein, human immunodeficiency virus, confocal laser scanning microscopy, whole cell patch clamp, gram negative bacteria, surface plasmon resonancell wall, quantum dots, fourier transform infrared, single particle tracking, bacterial cell surface, plasma membrane, escherichia coli, bacterial cells, epithelial cells,	
TOT HEALTH+ (6512)	univ calif 205	langmuir 213 analytical chemistry 127	cells, protein, dna, membranE, bindING, drugS, fluorescence, peptides, surface, nanoparticles, detection, interaction, surface plasmon resonance, atomic force	

usa	2106	chinese acad sci	153	biomaterials	126	microscopy, scanning electron microscopy, transmission electron microscopy, differential scanning calorimetry, x-ray photoelectron spectroscopy, bovine serum albumin, poly ethylene glycol, single stranded dna, double stranded dna, green fluorescent protein, fourier transform infrared, quartz crystal microbalance, polymerase chain reaction, self assembled monolayer, drug delivery systems, magnetic resonance imaging, confocal laser scanning, dynamic light scattering, , enzyme linked immunosorbent assay, resonance energy transfer, cell surface, x-ray diffraction, escherichia coli, amino acid, particle size, drug release, cell line, cell adhesion, dna molecules, mass spectrometry, endothelial cells	
peoples r china	735	natl univ singapore	94	journal of physical chemistry b	120		
japan	696	osaka univ	78	biophysical journal	104		
germany	625	univ texas	68	journal of biological chemistry	102		
england	364	harvard univ	68	journal of the american chemical society	97		
france	337	univ illinois	62	journal of controlled release	96		
south korea	325	natl inst adv ind sci & technol	57	biochemistry	88		
italy	262	russian acad sci	56	Proc NAS-USA	82		
canada	217	tsing hua univ	55				
india	170	univ tokyo	54				
		cnrs	54				

In this highest level category in the Health sub-network, the USA appears to have a commanding lead (~3/1) over its nearest competitor (China). However, these results must be considered in context. First, in total SCI articles, the USA had about four times as many records as China when these data were obtained. Second, for overall nanotechnology, the USA had about 25% more records than China for 2005. Third, for nanotechnology instrumentation, China actually had 25% more records than the USA. Fourth, relative to China, the USA had a commanding lead in overall biomedical articles, as our recent text mining study on China showed (Kostoff et al, 2006). When all these facts are integrated, it appears that China is placing substantial emphasis on its nanotechnology medical research relative to its overall medical research.

The USA has substantial institutional representation in the top ten (California, Texas, Harvard, Illinois). These university publication numbers include all the state campuses. Thus, University of California system includes UCB, UCSB, UCSF, etc.

While the leading journals have a strong chemistry component, a number of them cross disciplines among physics, chemistry, biology, and materials.

The science associated with the total Health-type applications in the highest level category can be divided into four major categories: instrumentation, materials, structures, phenomena. The key elements of each of these categories are as follows:

Instrumentation: surface plasmon resonance, atomic force microscopy, scanning electron microscopy, transmission electron microscopy, differential scanning calorimetry, x-ray photoelectron spectroscopy, fourier transform infrared spectroscopy, quartz crystal microbalance, magnetic resonance imaging, confocal laser scanning, enzyme linked immunosorbent assay, laser scanning microscopy, x-ray diffraction, mass spectrometry.

Materials: protein, DNA, peptides, drugs, bovine serum albumin, poly ethylene glycol, single stranded DNA, double stranded DNA, green fluorescent protein, lipids, human serum albumin, Escherichia Coli, antibodies, tissues, enzymes, genes, oligonucleotides, gold, nucleic acid.

Structures: cells, membranes, surfaces, nanoparticles, self-assembled monolayers, cell surfaces, endothelial cells, receptors.

Phenomena: fluorescence, interaction, polymerase chain reaction, dynamic light scattering, resonance energy transfer, particle size, drug release, cell adhesion, binding, affinity, gene expression, transfection efficiency.

The highest level category is divided by the fuzzy clustering algorithm into two categories, with one category being about seven times the size (number of records) as the other category. The larger category is centered around cells, proteins, and membranes, while the smaller category is strongly focused on DNA. The larger category's main journals (langmuir 185, biomaterials 120, journal of physical chemistry b 112, analytical chemistry 108, journal of biological chemistry 97, biophysical journal 95) focus on chemistry, physics, biology, and materials, while the smaller category's main journals (langmuir 30, nano letters 29, nucleic acids research 27, analytical chemistry 27, journal of the american chemical society 21, journal of nanoscience and nanotechnology 21) focus on chemistry and nanotechnology. The only journal in common at the top is Langmuir.

The larger category's main country performers (usa 1867, peoples r china 620, japan 608, germany 561, england 323, france 301, south korea 299) are remarkably similar to the smaller category's main country performers (usa 273, peoples r china 123, japan 106, germany 78, england 46, france 43, south korea 33).

Lower Level Taxonomy Categories

Characteristics of the lower level taxonomy categories (elemental clusters) are summarized in the rows of Table A6-9. There are five main groupings: Cancer Treatment (Drug Release, Drug Delivery, Tumor Treatment, Sentinel Lymph Node Cancer), Cells (Tissue Cells, Cells (emphasizing Adhesion), Cells (emphasizing Membranes and Bacteria), Biofilms), Proteins (Protein Interactions, Amyloid Fibrils, Peptide Sequences, Binding and Affinity), Sensing and Detection (Immunosensors, Detection (emphasizing Surface Plasmon Resonance), Biosensors), and DNA (DNA Detection, DNA (emphasizing Gene Delivery and Transfection). Only one group deals with a specific disease (Cancer Treatment), one is functional (Sensing and Detection), and the other three are based on fundamental biological materials at different aggregation levels (Cells, Proteins, DNA).

Because of the large number of elemental clusters, only the highlights or unusual features of each will be discussed, starting from the top row. Following each discussion are representative article titles from the cluster in bold italics, to illustrate the theme more concretely.

1. Drug Release: USA, China dominant. India ranks much higher in this cluster relative to its overall Health types ranking. Even though Singapore is not listed as a leading country, the University of Singapore stands out as the institutional leader. No USA presence in leading institutions. The journals appear rather applied and focused. Materials and structures appear to be the science emphasis.
Physical characterization of controlled release of paclitaxel from the TAXUS(TM) Express(2TM) drug-eluting stent.
Potential of guar gum microspheres for target specific drug release to colon.

2. Drug Delivery: USA dominant. Again, India ranks high, and University of Singapore leads. Journals are again pharmaceutical oriented, and very applied. Again, no USA presence in leading institutions. Strong cancer focus in the science.
Highly specific HER2-mediated cellular uptake of antibody-modified nanoparticles in tumour cells.
Developement and characterization of biodegradable nanospheres as delivery systems of anti-ischemic adenosine derivatives.

3. Tumor Treatment: USA has commanding lead. American institutions dominate. Some physics journals along with pharmaceuticals. Laboratory research at cellular level, with magnetic physics emphasis, seems to dominate science.
Enhanced tumour uptake of Doxorubicin loaded poly(butyl cyanoacrylate) nanoparticles in mice bearing Dalton's lymphoma tumour.
MRI after magnetic drug targeting in patients with advanced solid malignant tumors.

4. Sentinel Lymph Node Cancer: Again, USA and USA institutions dominant. Many hospitals represented. Journals applied, and clinically oriented. Cancer detection focus in science.
SPECT-CT for topographic mapping of sentinel lymph nodes prior to gamma probe-guided biopsy in head and neck squamous cell carcinoma.

Diagnostic performance of nanoparticle-enhanced magnetic resonance Imaging in the diagnosis of lymph node metastases in patients with endometrial and cervical cancer.

5. Tissue Cells: USA has commanding lead. Singapore surprisingly high. National University of Singapore again leader, by a wide margin. Journals strongly biomaterials oriented. Science strongly focused on structure: cells, tissues, and bones.
Nano-fibrous scaffolds for tissue engineering.
Self-organization of rat cardiac cells into contractile 3-D cardiac tissue.

6. Cells, emphasizing Adhesion: USA with commanding lead. Strong USA university participation; also from National University of Singapore. Journals have strong biomaterials/ biophysics orientation. Science strongly focused on cell growth, interactions, and death.
Development of a rare cell fractionation device: Application for cancer detection.
Nanostructured designs of biomedical materials: Applications of cell sheet engineering to functional regenerative tissues and organs.

7. Biofilms: USA dominant. Montana State University not seen before. Very applied journals. Science strongly focused on films and infection.
Tooth development in a scincid lizard, Chalcides viridanus (Squamata), with particular attention to enamel formation.
Adherence and biofilm formation of Staphylococcus epidermidis and Mycobacterium tuberculosis on various spinal implants.

8. Virus proteins: USA with commanding lead. Strong USA university representation, with University of California system dominant. Strong biochemistry journal emphasis. Strong virus research.
Identification of a region in the herpes simplex virus scaffolding protein required for interaction with the portal.
Mass spectroscopic characterization of the coronavirus infectious bronchitis virus nucleoprotein and elucidation of the role of phosphorylation in RNA binding by using surface plasmon resonance.
Expression of human papillomavirus type 16 L1 protein in transgenic tobacco plants.

9. Protein Interactions: USA with commanding lead. USA institutions strong. Science focused on protein binding, other surface phenomena.

Analysis of protein interactions on protein arrays by a wavelength interrogation-based surface plasmon resonance biosensor.
Biosensors: basic features and application for fatty acid-binding protein, an early plasma marker of myocardial injury.
A central role for protein aggregation in neurodegenerative disease; Mechanistic and structural studies of human stefins.

10. Amyloid Fibrils: USA with commanding lead. Except for University of California system, USA universities not among most prolific. Biochemical/ biophysical journals. Science linked to Alzheimer's Disease and other neurodegenerative diseases.
Structure and function of amyloid in Alzheimer's disease.
Surface plasmon resonance for the analysis of beta-amyloid interactions and fibril formation in 1Alzheimer's disease research.
Structure and morphology of the Alzheimer's amyloid fibril.

11. Peptide Sequences: USA with commanding lead. Israel, Australia surprisingly high. MIT major institutional player, followed by University of California system. Science focused on binding, sequencing.
Novel electrochemical biosensing platform using self-assembled peptide nanotubes.
Plasma levels of AGE peptides in type 1 diabetic patients are associated with serum creatinine and not with albumin excretion rate: Possible role of AGE peptide-associated endothelial dysfunction.
Interactions of primary amphipathic cell penetrating peptides with model membranes: Consequences on the mechanisms of intracellular delivery of therapeutics.

12. Binding and Affinity: USA with overwhelming lead, solid institutional representation. Biochemistry focus. Science focused on binding, reception, and affinity.
Biomacromolecule surface recognition using nanoparticles.
Two-step mechanism of binding of apolipoprotein E to heparin.
Formation of viscoelastic protein layers on polymeric surf aces relevant to platelet adhesion.

13. Immunosensors: No infrastructure element dominant, as in previous cases. No USA institutional representation in upper tier. Strong use of immune system components in science.

Enhancement of the sensitivity of surface plasmon resonance (SPR) immunosensor for the detection of anti-GAD antibody by changing the pH for streptavidin immobilization.
Development of functionalized terbium fluorescent nanoparticles for antibody labeling and time-resolved fluoroimmunoassay application.

14. Detection, emphasizing Surface Plasmon Resonance: USA with strong lead. Strong chemistry focus; some electronics. Science focused on sensors, use of gold.
The fabrication of protein chip based on surface plasmon resonance for detection of pathogens.
Intracellular monitoring of superoxide dismutase expression in an Escherichia coli fed-batch cultivation using on-line disruption with at-line surface plasmon resonance detection.
Surface plasmon resonance detection of endocrine disruptors using immunoprobes based on self-assembled monolayers.

15. Biosensors: USA lead; China strong second. Research focus on enzyme-based biosensors that involve enzyme immobilization.
A novel glucose biosensor based on the nanoscaled cobalt phthalocyanine-glucose oxidase biocomposite.
Multiwall carbon nanotube (MWCNT) based electrochemical biosensors for mediatorless detection of putrescine.
Biosensors in drug discovery and drug analysis.

16. DNA Detection: USA with commanding lead. Strong USA institutional representation. Science focus is on DNA at surfaces for use in DNA biosensors.
A biosensor monitoring DNA hybridization based on polyaniline intercalated graphite oxide nanocomposite
Detection of DNA and protein molecules using an FET-type biosensor with gold as a gate metal

17. DNA Molecules: USA with commanding lead. Chinese Academy of Science institutional leader. Russian Academy of Science strong institutional presence, even though Russia not major player. Science focuses on DNA binding and DNA networks.
Atomic force microscopy study of the structural effects induced by echinomycin binding to DNA.

Impedance sensing of DNA binding drugs using gold substrates modified with gold nanoparticles.

18. DNA, emphasizing Gene Delivery and Transfection: USA has strong lead. University of California system only USA presence in institutional leaders. Science focus on gene delivery and transfection efficiency.
Optical tracking of organically modified silica nanoparticles as DNA carriers: A nonviral, nanomedicine approach for gene delivery
Nanoparticle based systemic gene therapy for lung cancer: Molecular mechanisms and strategies to suppress nanoparticle-mediated inflammatory response
Calcium phosphate nanoparticles as a novel nonviral vector for efficient trasfection of DNA in cancer gene therapy

19. Cells, emphasizing Membranes and Bacteria: Commanding USA lead. Commanding USA organizational representation, with University of Californai system at forefront. Biomaterials literature emphasis. Science focuses on cell membranes and bacterial adhesion.
Microtubule-dependent matrix metalloproteinase-2/matrix metalloproteinase-9 exocytosis: Prerequisite in human melanoma cell invasion
Long-term effects of HIV-1 protease inhibitors on insulin secretion and insulin signaling in INS-1 beta cells
Early stages of HIV replication: How to hijack cellular functions for a successful infection
Membrane-based on-line optical analysis system for rapid detection of bacteria and spores

The USA is the leader in all 19 clusters. China took second place in seven clusters, Japan in six, Germany in four, and England in two. In terms of main institutions, University of California system led in five clusters, Chinese Academy of Science led in four, and University of Singapore led in three. University of Singapore has strong presence in pharmaceuticals and biomaterials, Chinese Academy of Science has strong presence in DNA and binding, and University of California system has strong presence in cells and protein interactions.

These results require further context. The four major institutions discussed are of different size, have different funding levels, and have different manpower and other resources. For example, in 2005, there were 3399

Articles and Reviews in the SCI/SSCI that contained at least one author with a National University of Singapore address, and there were a total of 6622 authors listed on these records. The corresponding numbers for the other major institutions are: Chinese Academy of Science, 14347 records, 19089 authors; Russian Academy of Science, 11216 papers, 30137 authors; University of California system, 27954 records, 84667 authors.

Thus, for the National University of Singapore to be the publication leader in three thrust areas requires a considerable concentration of its relative modest resources relative to the other major institutions.

For the technology transfer community, these results contain some important messages. First, while there are some pervasive infrastructure results throughout the elemental clusters (e.g., USA is always most productive, China, Japan, Germany, England typically rank high), there are many individual differences. To understand the specific research infrastructure related to specific Health applications, disaggregated evaluations are necessary. While the present analysis had a reasonable level of disaggregation, users interested in very specific medical applications will want to conduct much more disaggregated analyses. There are substantial differences between the overall nanotechnology Health results and very specific Health applications results.

Additionally, while there are some instruments that pervade the different elemental clusters, there are substantial instrumentation, material, nanostructure, and phenomenological differences among the clusters. Again, the individual cluster research can differ substantially from the overall nanotechnology Health applications average. Users who are interested in tracking the nanotechnology Health-related research for technology transfer purposes are well-advised to conduct specific analyses of the above type for each application. For investors, identifying which research areas pervade multiple applications would be extremely valuable, and the same recommendations are made as for technology transfer application.

While the instrumentation and nanostructures are similar in the Applications and Health phrases, the phrases uniquely contained in the Health themes include proteins, drugs, antibody, bacteria, DNA, Ph, peptides, tissues, drug release, drug delivery, genes, cytotoxicity, lever, brain, bone, etc. Thus, while there are fundamental research issues that span both types of applications, mainly in the techniques, there are many unique issues when specific materials and phenomena are encountered.

SUMMARY AND CONCLUSIONS

The study has identified the main nanotechnology Applications, both medical and non-medical, as well as the related science and infrastructure. These relationships will allow the potential user communities to become involved with the Applications-related science and performers at the earliest stages, to help guide the science conversion towards specific user needs most efficiently.

The pervasive materials, materials properties, phenomena, and nanostructures related to the most frequently mentioned non-medical nanotechnology Applications were identified, as follows:

- *TiO2, Pt, Si, gold, and polymers tend to stand out as the most pervasive material types*
- *Morphology, thickness /diameter/particle size, optical properties, catalytic performance, and electrochemical properties tend to stand out as the most pervasive material properties*
- *Deposition, absorption, oxidation, immobilization, catalysis, degradation, and self-assembly tend to stand out as the most pervasive nanoscale phenomena*
- *Thin films, nanowires, nanotubes (especially carbon), and self-assembled monolayers tend to stand out as the most pervasive nanostructures*

The pervasive instrumentation, materials, structures, and phenomena related to the most frequently mentioned nanotechnology Health applications were identified, as follows:

- **Instrumentation:** *surface plasmon resonance, atomic force microscopy, scanning electron microscopy, transmission electron microscopy, differential scanning calorimetry, x-ray photoelectron spectroscopy, fourier transform infrared spectroscopy, quartz crystal microbalance, magnetic resonance imaging, confocal laser scanning, enzyme linked immunosorbent assay, laser scanning microscopy, x-ray diffraction, mass spectrometry.*

- **Materials:** *protein, DNA, peptides, drugs, bovine serum albumin, poly ethylene glycol, single stranded DNA, double stranded DNA, green fluorescent protein, lipids, human serum albumin, Escherichia Coli, antibodies, tissues, enzymes, genes, oligonucleotides, gold, nucleic acid.*

- **Structures:** *cells, membranes, surfaces, nanoparticles, self-assembled monolayers, cell surfaces, endothelial cells, receptors*

- **Phenomena:** *fluorescence, interaction, polymerase chain reaction, dynamic light scattering, resonance energy transfer, particle size, drug release, cell adhesion, binding, affinity, gene expression, transfection efficiency*

Maps were constructed to show groupings of related Applications into broader thematic areas. An autocorrelation map of the most widely referenced non-medical Applications showed five weakly-connected sub-networks:

- Electronic Devices and Components
- Optical Switching
- Tribology and Corrosion
- Optoelectronic Sensors
- Electrochemical Conversion and Catalysis

A medical Applications categorization constructed from visual inspection of the fuzzy clustering categories showed five thematic categories:

- Cancer Treatment
- Sensing and Detection
- Cells

- Proteins
- DNA

Factor analyses were performed to show non-medical thematic areas from a slightly different perspective. A six factor analysis showed the following themes:

- Factor 1: Optoelectronics
- Factor 2: Tribology
- Factor 3: Lithography
- Factor 4: Control Systems
- Factor 5: Devices
- Factor 6: Microsystems

The main non-medical Applications thrusts identified above were augmented by important, but non-networked thrusts, and the nine resulting themes were related to science and infrastructure by co-occurrence matrices. Also, the total non-medical Applications were combined into one unit, and related to science and infrastructure by co-occurrence matrices. For non-medical Applications:

- The USA leads in total Applications publications and in six out of nine themes in the high-tech research areas such as devices, sensors, and lithography. China leads in publications in three traditional area themes such as catalysis, tribology, and electrochemistry.
- In total Applications, two of the top three institutions are Chinese. However, the USA is well represented by the large University of California and University of Illinois state university systems.
- Applied Physics Letters appears in the top layer in seven of the nine themes and is by far the leader in total Applications publications. Journal of Physical Chemistry B appears in four of the nine themes, as does Journal of Applied Physics.
- For total Applications, the key underlying science areas include XRD, TEM, films, SEM, XPS, electron microscopy, AFM, fabrication, thickness, growth, hydrogen, substrate, carbon nanotubes, microstructures, nanoparticles, particles, diameter, TiO_2, deposits, coatings, electrodes, silicon, CO, infrared spectroscopy FTIR, electrons, biosensors, catalytic activity, oxidation, silica, thin films, nanotubes, silicon substrates, PL, photocatalytic activity, crystals,

Raman spectroscopy, mechanical properties, particle sizes, proteins, catalysis, sol-gel, gold, storage, metals, optical properties, annealing, adsorption, platinum, polymer, corrosion, quantum dots.

- Instrumentation and the associated growth of nanostructures dominate the science efforts at present.

For medical Applications, analysis of nineteen thematic categories obtained from fuzzy clustering of the total 2005 nanotechnology database revealed the following:

- The USA is the publication leader in total Health types, and in all the thematic areas as well, most by a wide margin. China was the second most prolific in seven thematic areas, Japan in six, Germany in four, and England in two.
- The University of California system led in five clusters, the Chinese Academy of Science led in four, and the National University of Singapore led in three. The University of California and the Chinese Academy of Science were the most prolific in the non-medical Applications as well, but their orders were reversed. The National University of Singapore is a prolific contributor, especially in pharmaceuticals and biomaterials.
- The journal Langmuir contains the most articles in total Health, and is in the top layer of ten of nineteen themes. The only journals in common in the top layers of Applications and Health are Langmuir and Journal of Physical Chemistry B.
- For total Health, the key underlying science areas include cells, proteins, DNA, membranes, binding, drugs, fluorescence, peptides, nanoparticles, detection, lipids, antibodies, immobilization, tissues, receptors, enzymes, genes, drug delivery, self assembly, cell surface, detection limit, escherichia coli, amino acid, molecular weight, particle size, real time, serum albumin, drug release, cell line, cell adhesion, dna molecules, endothelial cells, surface plasmon resonance, atomic force microscopy, scanning electron microscopy, transmission electron microscopy, differential scanning calorimetry, x-ray photoelectron spectroscopy, bovine serum albumin, poly ethylene glycol, single stranded dna, double stranded dna, green fluorescent protein, fourier transform infrared spectroscopy, quartz crystal microbalance, polymerase chain reaction, self assembled monolayer, magnetic resonance imaging, confocal laser scanning,

dynamic light scattering, enzyme linked immunosorbent assay, resonance energy transfer, extracellular matrix, laser scanning microscopy, human serum albumin, and poly lactic acid.

Thus, the instrumentation and nanostructure growth science areas still play a key role, but unique health-related issues/ phraseology such as proteins, drugs, antibodies, bacteria, DNA, peptides, tissues, collagen, genes, etc, are strong science interests that focus on the unique aspects of Health nanotechnology research.

APPENDIX 7 – TAXONOMY CLUSTER DETAILS

CATEGORY 1 - 508A1a (6 leaf clusters)

Quantum Dots (2028 REC)

THRUST

()

- Investigation of electronic transport properties of quantum dots, focusing on Kondo and Fano effects (192 Records) Cluster 83
- Spin in quantum dots, especially electron spin, spin-orbit interactions, spin dynamics, and spin relaxation; properties of quantum dots in magnetic fields (274 Records) Cluster 78
- Optical properties of quantum dots, namely exciton states and dynamics, fabrication and use of quantum dot lasers (401 Records) Cluster 116
- Self-assembly, growth, and properties of quantum dots, especially CdSe and Ge/Si quantum dots (577 Records) Cluster 120
- Quantum dots, particularly CdSe, GaAs, and InAs quantum dots, and their photoluminescence and emission properties (239 Records) Cluster 48
- Engineering and properties of quantum dots, especially InAs, GaAs, and InAs/GaAs, many of which are grown on GaAs layers/ matrices (345 Records) Cluster 39

- # CLUSTER 83
  Investigation of electronic transport properties of quantum dots, focusing on Kondo and Fano effects (192 Records)

(USA leader, with Germany and China following. German institutions leading. USA institutions include MIT.)

Cluster Syntax Features

Descriptive Terms

dot 17.0%, kondo 16.9%, quantum 8.1%, quantum.dot 6.5%, coupl 3.1%, conduct 1.8%, transport 1.7%, fano 1.5%, regim 1.4%, coulomb 1.3%, quantum.dots 1.2%, double.quantum 1.2%, tunnel 1.1%, lead 1.1%, double.quantum.dot 0.9%

Discriminating Terms

kondo 11.7%, dot 8.6%, quantum.dot 3.9%, quantum 3.0%, film 1.9%, coupl 1.4%, fano 1.0%, surfac 1.0%, coulomb 0.8%, double.quantum 0.8%, regim 0.7%, transport 0.7%, nanoparticl 0.7%, double.quantum.dot 0.6%, layer 0.6%

Single Word Terms

dot 191, quantum 186, conduct 109, coupl 108, electron 101, transport 90, two 84, kondo 82, lead 74, system 72, regim 71, state 65, current 64, tunnel 61, temperatur 59

Double Word Terms

quantum.dot 138, quantum.dots 76, double.quantum 38, transport.properties 28, differential.conductance 27, coulomb.blockade 25, transport.quantum 24, kondo.regime 21, dot.coupled 21, magnetic.field 20, aharonov.bohm 17, double.dot 16, kondo.quantum 16, energy.levels 15, electronic.transport 14

Triple Word Terms

double.quantum.dot 32, quantum.dot.coupled 19, transport.quantum.dot 19, double.quantum.dots 11, boson.mean.field 10, slave.boson.mean 10, dot.coupled.two 9, quantum.dot.kondo 9, kondo.quantum.dots 9, phys.rev.lett 8, negative.differential.conductance 8, quantum.dots.coupled 8, kondo.quantum.dot 7, coupled.ferromagnetic.leads 7, quantum.dot.system 7

Term Cliques

55.80% dot quantum coupl transport quantum.dots double.quantum tunnel
56.84% dot quantum coupl conduct transport coulomb quantum.dots tunnel
55.38% dot quantum coupl conduct transport regim coulomb quantum.dots lead

53.70% dot quantum coupl conduct transport fano regim quantum.dots lead
56.10% dot quantum quantum.dot coupl double.quantum tunnel double.quantum.dot
58.85% dot quantum quantum.dot coupl fano double.quantum.dot
60.42% dot quantum quantum.dot coupl transport double.quantum tunnel
60.87% dot quantum quantum.dot coupl conduct transport coulomb tunnel
58.97% dot quantum quantum.dot coupl conduct transport regim coulomb lead
57.29% dot quantum quantum.dot coupl conduct transport fano regim lead
52.20% dot kondo quantum conduct transport fano regim quantum.dots lead
55.79% dot kondo quantum quantum.dot conduct transport fano regim lead

Sample Cluster Record Titles

Theory of transport through quantum-dot spin valves in the weak-coupling regime

Observation of Fano resonances in single-wall carbon nanotubes

Coulomb blockade and non-Fermi-liquid behavior in quantum dots

Electronic transport through a quantum dot network

Low-temperature transport through a quantum dot between two superconductor leads

Theory of Fano-Kondo effect of transport properties through quantum dots

Controlling Fano and Dicke effects via a magnetic flux in a two-site Anderson model

Kondo effect in carbon nanotubes at half filling

Interference effects in the conductance of multilevel quantum dots

Cluster Metrics

Authors

konig, j 6
schon, g 5
lopez, r 5
simon, p 4
martinek, j 4
lei, xl 4
flensberg, k 4
dong, b 4
choi, ms 4
barnas, j 4
baranger, hu 4

zhang, zy 3
weymann, i 3
vorojtsov, s 3
von delft, j 3

Sources

physical review b 76
physical review letters 30
physica e-low-dimensional systems & nanostructures 8
journal of the physical society of japan 8
journal of physics-condensed matter 5
applied physics letters 5
physica b-condensed matter 4
journal of applied physics 4
solid state communications 3
physical review e 3
international journal of modern physics b 3
europhysics letters 3
communications in theoretical physics 3
physics letters a 2
physica status solidi b-basic solid state physics 2

Keywords

physics, condensed matter 100
physics, multidisciplinary 55
transport 50
single-electron transistor 30
anderson model 19
physics, applied 18
equilibrium 18
states 14
quantum dots 14
kondo effect 14
systems 13
coulomb-blockade 12
quantum dot 11
impurity 11
conductance 11

Publication Year

2005 171
2004 21

Country

usa 48
germany 35

peoples r china 30
japan 26
switzerland 12
south korea 11
israel 11
england 11
france 10
denmark 10
canada 10
poland 9
sweden 7
brazil 7
taiwan 6

Institution

univ karlsruhe 10
ruhr univ bochum 8
shanghai jiao tong univ 7
polish acad sci 7
cnrs 7
weizmann inst sci 6
univ geneva 6
univ cambridge 6
tohoku univ 6
nanjing univ 6
mit 6
ben gurion univ negev 6
univ tokyo 5
univ regensburg 5
korea univ 5

DataBase

science citation index 192

- # CLUSTER 78
  Spin in quantum dots, especially electron spin, spin-orbit interactions, spin dynamics, and spin relaxation; properties of quantum dots in magnetic fields (274 Records)

(USA more dominant, with Germany and China following. Strong USA institutional leadership. UC Santa Barbara tied for lead with Ohio University. Other leading USA institutions include Harvard, US Navy [NRL], Suny-Buffalo.).

Cluster Syntax Features

Descriptive Terms
spin 23.2%, dot 13.4%, quantum 11.3%, quantum.dot 4.1%, magnet 3.6%, magnetic.field 3.5%, quantum.dots 3.2%, field 2.5%, state 1.7%, qubit 1.5%, electron 1.4%, coupl 0.9%, interact 0.9%, orbit 0.8%, entangl 0.8%

Discriminating Terms
spin 14.0%, dot 6.7%, quantum 5.0%, quantum.dot 2.5%, magnetic.field 2.1%, film 2.1%, quantum.dots 1.7%, qubit 1.1%, surfac 1.0%, nanoparticl 0.7%, magnet 0.7%, layer 0.6%, carbon 0.6%, structur 0.6%, particl 0.6%

Single Word Terms
dot 271, quantum 268, spin 208, electron 199, field 168, magnet 166, state 153, interact 130, two 126, coupl 107, system 94, function 82, energi 80, singl 78, polar 73

Double Word Terms
quantum.dot 177, quantum.dots 165, magnetic.field 129, ground.state 43, electron.spin 37, spin.orbit 36, magnetic.fields 34, semiconductor.quantum 33, spin.relaxation 30, two.electron 28, two.dimensional 28, external.magnetic 27, coupled.quantum 26, exchange.interaction 25, spin.polarization 25

Triple Word Terms
external.magnetic.field 23, semiconductor.quantum.dots 21, double.quantum.dot 20, coupled.quantum.dots 18, quantum.dots.spin 18, spin.orbit.coupling 18, quantum.dot.spin 15, electron.quantum.dot 15, quantum.dots.magnetic 15, spin.orbit.interaction 14,

semiconductor.quantum.dot 13, perpendicular.magnetic.field 11, function.magnetic.field 11, zero.magnetic.field 10, strong.magnetic.field 10

Term Cliques
58.09% dot quantum state qubit electron entangl
60.09% dot quantum magnet magnetic.field quantum.dots field state electron coupl interact orbit
64.39% dot quantum quantum.dot state qubit electron interact
60.48% dot quantum quantum.dot magnet magnetic.field field state electron coupl interact orbit
63.78% spin dot quantum quantum.dots state electron coupl entangl
61.41% spin dot quantum magnet magnetic.field quantum.dots state electron coupl interact orbit
61.81% spin dot quantum quantum.dot magnet magnetic.field state electron coupl interact orbit

Sample Cluster Record Titles

Effect of an impurity on 3-electron quantum dots in magnetic fields

Dissipative dynamics of spins in quantum dots

Currents in a many-particle parabolic quantum dot under a strong magnetic field

Hyperfine interaction in a quantum dot: Non-Markovian electron spin dynamics

Landau Fermi-liquid picture of spin density functional theory: Strutinsky approach to quantum dots

Spin-orbit and electronic interactions in narrow-gap quantum dots

Diluted magnetic semiconductor quantum dots: An extreme sensitivity of the hole Zeeman splitting on the aspect ratio of the confining potential

Ground state of two-dimensional quantum-dot helium in zero magnetic field: Perturbation, diagonalization, and variational theory

Evolution of localized electron spin in a nuclear spin environment

Cluster Metrics

Authors

peeters, fm 10
loss, d 10
ulloa, se 7
marcus, cm 7
gossard, ac 6
swirkowicz, r 5
rudzinski, w 5
kouwenhoven, lp 5
hu, xd 5
harju, a 5
hanson, mp 5
barnas, j 5
yacoby, a 4
wilczynski, m 4
vink, it 4

Sources

physical review b 110
physical review letters 31
physica e-low-dimensional systems & nanostructures 20
applied physics letters 8
journal of physics-condensed matter 7
physical review a 6
new journal of physics 5
materials science-poland 5
journal of superconductivity 4
journal of applied physics 4
europhysics letters 4
science 3
physics letters a 3
physica status solidi b-basic solid state physics 3
journal of the physical society of japan 3

Keywords

physics, condensed matter 152
physics, multidisciplinary 60
quantum dots 32
physics, applied 24
states 24
computation 21
transport 19
dots 16
systems 15
spectroscopy 14
dynamics 14
relaxation 13

wells 12
physics, condensed matter 12
magnetic-field 10

Publication Year
2005 235
2004 38
2006 1

Country
usa 86
germany 37
peoples r china 32
japan 27
russia 20
poland 19
italy 16
netherlands 15
switzerland 14
france 14
canada 13
england 11
finland 10
belgium 10
israel 9

Institution
univ calif santa barbara 12
ohio univ 12
chinese acad sci 11
univ basel 10
russian acad sci 10
polish acad sci 10
univ antwerp 9
delft univ technol 9
harvard univ 8
usn 7
univ regensburg 7
suny buffalo 7
natl res council canada 7
adam mickiewicz univ poznan 7
helsinki univ technol 6

DataBase
science citation index 274

- CLUSTER 116

  Optical properties of quantum dots, namely exciton states and dynamics, fabrication and use of quantum dot lasers (401 Records)

(USA dominant, followed by Germany/ England/ China. Top single institutions are University of Cambridge, University of Sheffield, University of Michigan. USA leaders also include UCSB, University of Texas.Concentrated British effort.)

Cluster Syntax Features

Descriptive Terms

dot 26.2%, quantum.dot 24.2%, quantum 19.4%, exciton 1.5%, photon 1.4%, quantum.dots 0.9%, state 0.7%, singl 0.7%, laser 0.6%, energi 0.4%, quantum.dot.lasers 0.4%, dot.lasers 0.4%, excit 0.4%, semiconductor 0.3%, coupl 0.3%

Discriminating Terms

quantum.dot 17.1%, dot 15.4%, quantum 10.2%, film 2.0%, surfac 0.9%, exciton 0.8%, nanoparticl 0.7%, carbon 0.7%, photon 0.6%, particl 0.6%, nanotub 0.6%, magnet 0.5%, oxid 0.5%, deposit 0.5%, crystal 0.5%

Single Word Terms

quantum 400, dot 400, state 147, electron 143, singl 136, energi 121, structur 112, two 110, optic 98, function 89, layer 89, coupl 89, system 86, temperatur 83, emiss 82

Double Word Terms

quantum.dot 393, quantum.dots 152, single.quantum 44, dot.lasers 38, gaas.quantum 34, ground.state 34, semiconductor.quantum 32, self.assembled 29, single.photon 28, room.temperature 27, electron.hole 23, two.dimensional 22, wetting.layer 21, three.dimensional 20, dot.laser 17

Triple Word Terms
quantum.dot.lasers 38, single.quantum.dot 38, gaas.quantum.dot 29, semiconductor.quantum.dot 26, quantum.dot.laser 17, self.assembled.quantum 15, spherical.quantum.dot 14, molecular.beam.epitaxy 14, quantum.dot.cellular 14, quantum.dot.semiconductor 13, quantum.dot.infrared 13, quantum.dot.structures 13, dot.cellular.automata 13, inas.gaas.quantum 12, inas.quantum.dot 11

Term Cliques
43.81% dot quantum.dot quantum laser quantum.dot.lasers dot.lasers excit semiconductor coupl
45.69% dot quantum.dot quantum state laser quantum.dot.lasers dot.lasers excit coupl
49.52% dot quantum.dot quantum exciton quantum.dots energi excit semiconductor coupl
51.40% dot quantum.dot quantum exciton quantum.dots state energi excit coupl
46.68% dot quantum.dot quantum exciton photon quantum.dots singl excit semiconductor coupl
48.38% dot quantum.dot quantum exciton photon quantum.dots state singl excit coupl

Sample Cluster Record Titles

Characteristics of MOCVD-grown thin p-clad InGaAs quantum-dot lasers

The dynamics of coherently driven exciton in a single quantum dot

Effect of thermal annealing and strain engineering on the fine structure of quantum dot excitons

Binding of electrons, holes, and excitons in symmetric strained InP/In0.49Ga0.51P triple quantum-dot molecules

Photoconductivity studies of treated CdSe quantum dot films exhibiting increased exciton ionization efficiency

Spin-photon dynamics of quantum dots in two-mode cavities

The role of Auger recombination in the temperature-dependent output characteristics (T-0 = infinity) of p-doped 1.3 mu m quantum dot lasers

Ground state of excitons in quantum-dot quantum-well nanoparticles: stochastic variational method

Optical properties of PbS quantum dot doped sol-gel films

Cluster Metrics

Authors
bhattacharya, p 11
bimberg, d 10
hopkinson, m 9
shields, aj 8
ritchie, da 8
forchel, a 7
atkinson, p 7
petroff, pm 6
mowbray, dj 6
liu, hy 6
wasilewski, z 5
wang, kl 5
ulloa, se 5
see, p 5
mi, z 5

Sources
physical review b 60
applied physics letters 41
physica e-low-dimensional systems & nanostructures 39
electronics letters 15
physical review letters 12
journal of applied physics 12
ieee photonics technology letters 10
ieee journal of quantum electronics 8
journal of the korean physical society 7
journal of physics-condensed matter 7
superlattices and microstructures 6
physical review a 6
microelectronics journal 6
journal of physics d-applied physics 6
physics letters a 5

Keywords
physics, condensed matter 132
physics, applied 73
engineering, electrical & electronic 58
physics, multidisciplinary 45
physics, applied 36

quantum dots 30
states 28
optics 27
gaas 22
transport 20
growth 19
quantum dot 18
optics 18
quantum dots 18
spectroscopy 17

Publication Year

2005 360
2004 39
2006 1
2003 1

Country

usa 103
germany 56
england 46
peoples r china 44
japan 30
france 28
russia 22
south korea 19
canada 17
taiwan 14
italy 12
switzerland 10
spain 10
scotland 9
poland 9

Institution

univ cambridge 14
russian acad sci 14
univ sheffield 13
univ michigan 13
chinese acad sci 11
univ calif santa barbara 10
tech univ berlin 10
univ tokyo 9
natl res council canada 9
cnrs 9
univ wurzburg 8

toshiba res europe ltd 8
univ texas 7
univ dortmund 7
univ toronto 6

DataBase
science citation index 401

- # CLUSTER 120
  Self-assembly, growth, and properties of quantum dots, especially CdSe and Ge/Si quantum dots (577 Records)
  (USA dominant, followed by Germany, Japan, China. Main institutions are almost exclusively non-universities: Russian Academy of Science (RAS), Chinese Academy of Science (CAS), University of Tokyo, Tokyo Institute of Technology, CNRS, CEA. USA leaders include UCLA, UCB.)

Cluster Syntax Features

Descriptive Terms
dot 38.4%, quantum.dots 20.5%, quantum 18.9%, cdse 0.8%, exciton 0.7%, quantum.dot 0.7%, state 0.4%, optic 0.4%, energi 0.4%, electron 0.4%, semiconductor 0.3%, semiconductor.quantum.dots 0.3%, ge 0.3%, phonon 0.2%, semiconductor.quantum 0.2%

Discriminating Terms
dot 24.9%, quantum.dots 14.5%, quantum 10.3%, film 1.9%, surfac 0.8%, carbon 0.7%, nanoparticl 0.6%, particl 0.6%, nanotub 0.5%, structur 0.5%, cdse 0.5%, oxid 0.5%,

crystal 0.4%, deposit 0.4%, layer 0.4%

Single Word Terms

dot 576, quantum 524, electron 236, energi 175, optic 162, state 158, structur 157, size 137, two 134, semiconductor 123, properti 121, singl 119, temperatur 113, self 112, field 108

Double Word Terms

quantum.dots 504, quantum.dot 170, self.assembled 69, semiconductor.quantum 62, optical.properties 36, cdse.quantum 33, assembled.quantum 33, two.dimensional 32, room.temperature 28, gaas.quantum 27, band.gap 27, dots.quantum 26, electron.microscopy 25, dot.size 24, electron.hole 24

Triple Word Terms

semiconductor.quantum.dots 62, self.assembled.quantum 33, assembled.quantum.dots 31, cdse.quantum.dots 29, quantum.dots.quantum 26, gaas.quantum.dots 22, molecular.beam.epitaxy 21, coupled.quantum.dots 20, quantum.dots.embedded 20, transmission.electron.microscopy 19, gan.quantum.dots 16, ge.quantum.dots 16, atomic.force.microscopy 16, quantum.dots.grown 16, quantum.dots.high 15

Term Cliques

46.66% dot quantum.dots quantum quantum.dot optic energi electron ge phonon
38.13% dot quantum.dots quantum exciton quantum.dot state optic energi semiconductor semiconductor.quantum.dots phonon semiconductor.quantum
45.56% dot quantum.dots quantum exciton quantum.dot state optic energi electron phonon
39.50% dot quantum.dots quantum cdse exciton quantum.dot optic energi semiconductor semiconductor.quantum.dots semiconductor.quantum
48.06% dot quantum.dots quantum cdse exciton quantum.dot optic energi electron

Sample Cluster Record Titles

In situ growth of CdSe quantum dots on MWCNTs with thioglycollic acid as the stabilizer

Electron correlations, spontaneous magnetization and momentum density in quantum dots

Raman scattering studies of Ge/Si islands under hydrostatic pressure

Metallic nano dots realized by a subtractive self organization process

Formation and properties of selectively grown Ge/Si quantum dots

[Molecular epitaxy and the electronic properties of Ge/Si heterosystems with quantum dots]

[On the excitation wavelength dependence of the luminescence yield of colloidal CdSe quantum dots]

[Exciton related resonant Raman scattering from CdSe quantum dots in an amorphous GeS2 thin film matrix]

Cluster Metrics

Authors
mariette, h 8
nikiforov, ai 7
ohtsu, m 6
yakimov, ai 5
xue, qk 5
wang, qq 5
mohanta, d 5
kawazoe, t 5
choudhury, a 5
arakawa, y 5
zunger, a 4
tsai, mj 4
tartakovskii, ai 4
tamargo, mc 4
smith, lm 4

Sources
physical review b 93
applied physics letters 61
physica e-low-dimensional systems & nanostructures 25
physical review letters 19
journal of applied physics 17
nano letters 11
journal of physics-condensed matter 11
journal of crystal growth 11
chemical communications 11
nanotechnology 10
journal of physical chemistry b 10
acta physica polonica a 9
microelectronics journal 7
journal of the american chemical society 7
acta physica sinica 6

Keywords
physics, condensed matter 162
physics, applied 112
physics, multidisciplinary 66
nanocrystals 53
growth 49
chemistry, multidisciplinary 48
quantum dots 46
quantum dots 38
photoluminescence 35
materials science, multidisciplinary 34
gaas 34
states 30
nanoparticles 30
nanocrystals 29
chemistry, physical 28

Publication Year
2005 508
2004 69

Country
usa 177
germany 73
japan 61
peoples r china 57
france 40
russia 37
england 30
taiwan 21
south korea 21
poland 21
italy 17
spain 16
canada 16
sweden 14
austria 14

Institution
russian acad sci 23
chinese acad sci 21
univ tokyo 16
tokyo inst technol 13
cnrs 13
cea 10

univ toronto 9
tohoku univ 9
natl taiwan univ 9
univ grenoble 1 8
japan sci & technol agcy 8
univ sheffield 7
univ oxford 7
univ calif los angeles 7
univ calif berkeley 7

DataBase
science citation index 577

- # CLUSTER 48
  Quantum dots, particularly CdSe, GaAs, and InAs quantum dots, and their photoluminescence and emission properties (239 Records)

(USA moderately dominant, with Japan, Korea, and China close behind. Chinese, Korean and Russian institutes lead. USA leaders include Notre Dame University, Virginia Commonwealth University.)

Cluster Syntax Features

Descriptive Terms
qd 48.9%, dot 7.6%, quantum.dots 6.9%, quantum 5.4%, dots.qds 3.4%, quantum.dots.qds 3.4%, cdse 1.8%, gaa 0.7%, ina 0.7%, photoluminesc 0.5%, emiss

0.3%, layer 0.3%, energi 0.3%, self 0.3%, exciton 0.3%

Discriminating Terms

qd 33.6%, quantum.dots 4.0%, dot 3.2%, dots.qds 2.3%, quantum.dots.qds 2.3%, film 1.8%, quantum 1.7%, cdse 1.0%, surfac 0.7%, nanoparticl 0.7%, particl 0.7%, carbon 0.6%, nanotub 0.5%, crystal 0.5%, structur 0.5%

Single Word Terms

dot 239, quantum 239, qd 236, photoluminesc 92, energi 91, optic 90, layer 86, temperatur 81, self 78, electron 78, size 76, structur 75, assembl 70, properti 69, gaa 68

Double Word Terms

quantum.dots 228, dots.qds 200, quantum.dot 62, self.assembled 61, qds.grown 33, assembled.quantum 32, beam.epitaxy 32, molecular.beam 32, optical.properties 29, room.temperature 29, atomic.force 24, inas.quantum 24, force.microscopy 22, electron.microscopy 20, cdse.quantum 20

Triple Word Terms

quantum.dots.qds 200, molecular.beam.epitaxy 32, self.assembled.quantum 32, assembled.quantum.dots 27, inas.quantum.dots 24, atomic.force.microscopy 22, dots.qds.grown 20, cdse.quantum.dots 20, transmission.electron.microscopy 17, semiconductor.quantum.dots 15, dots.qds.embedded 14, gaas.quantum.dots 14, force.microscopy.afm 13, ingaas.quantum.dots 13, quantum.dots.grown 11

Term Cliques

64.63% qd dot quantum.dots quantum quantum.dots.qds dots.qds photoluminesc emiss energi self exciton
66.79% qd dot quantum.dots quantum quantum.dots.qds dots.qds photoluminesc emiss layer energi self
63.11% qd dot quantum.dots quantum quantum.dots.qds dots.qds gaa ina photoluminesc layer energi self
65.65% qd dot quantum.dots quantum quantum.dots.qds dots.qds cdse photoluminesc emiss layer energi

Sample Cluster Record Titles

Quantum dot-antibody and aptamer conjugates shift fluorescence upon binding bacteria

Direct determination of strain and composition in InGaAs nano-islands using anomalous grazing incidence x-ray diffraction

Electronic coupling effect on carrier dynamics in InAs/GaAs vertically stacked QD layers

Long wavelength vertically stacked InAs/GaAs(001) quantum dots with a bimodal size

[distribution: Optical properties and electronic coupling]

[Self-assembled quantum dots for single-dot optical investigations]

[Abnormal photoluminescence behavior of self-assembled InAs quantum dots with bimodal size distribution]

[Spatially-resolved optical studies on intermixing of InGaAs quantum-dot laser structures by using an AlAs native oxide and thermal annealing]

[The luminescence properties of the colloidal GaAs and CMS semiconductor quantum dots]

[A Si-based quantum-dot light-emitting diode]

Cluster Metrics

Authors

lee, ji 9
lee, s 7
furdyna, jk 7
wang, zg 6
dobrowolska, m 6
song, jd 5
park, yj 5
kim, tw 5
han, ik 5
zhang, jy 4
xu, b 4
noh, sk 4
nakayama, m 4
maaref, h 4
hopkinson, m 4

Sources

applied physics letters 25
physica e-low-dimensional systems & nanostructures 20
physical review b 15
journal of applied physics 14
journal of crystal growth 10
journal of the korean physical society 9
journal of physical chemistry b 7
applied surface science 7
superlattices and microstructures 6
journal of vacuum science & technology b 6
solid state communications 5

semiconductors 5
nano letters 5
japanese journal of applied physics part 1-regular papers short notes & review papers 5
japanese journal of applied physics part 2-letters & express letters 4

Keywords
physics, condensed matter 54
physics, applied 54
photoluminescence 28
growth 27
gaas 25
chemistry, physical 24
quantum dots 23
nanocrystals 21
quantum dots 20
photoluminescence 19
engineering, electrical & electronic 18
physics, multidisciplinary 17
spectroscopy 17
molecular-beam epitaxy 15
physics, applied 15

Publication Year
2005 213
2004 26

Country
usa 61
japan 47
south korea 37
peoples r china 34
germany 18
france 15
taiwan 14
russia 13
england 9
italy 6
canada 6
singapore 5
netherlands 5
brazil 5
tunisia 4

Institution
chinese acad sci 11
korea inst sci & technol 10

russian acad sci 9
univ tokyo 8
univ notre dame 8
korea univ 7
hanyang univ 7
univ tsukuba 6
natl chiao tung univ 6
yonsei univ 5
wuhan univ 5
virginia commonwealth univ 5
univ sheffield 5
sungkyunkwan univ 5
natl taiwan univ 5

DataBase
science citation index 239

- CLUSTER 39
  Engineering and properties of quantum dots, especially InAs, GaAs, and InAs/GaAs, many of which are grown on GaAs layers/ matrices (345 Records)

(USA/ Japan/ Germany essentially tied for lead. University Tokyo/ CAS essentially tied for institutional lead. USA leaders include University of New Mexico.)

Cluster Syntax Features

Descriptive Terms
ina 26.9%, dot 11.8%, gaa 7.4%, quantum 6.7%, quantum.dots 6.2%, qd 3.5%, inas.gaas 3.5%, inas.quantum 3.1%, inas.quantum.dots 1.9%, inas.gaas.quantum 1.7%, gaas.quantum 1.6%, gaas.quantum.dots 1.1%, quantum.dot 1.0%, photoluminesc 0.6%, inp 0.6%

Discriminating Terms
ina 17.9%, dot 5.6%, gaa 4.2%, quantum.dots 3.5%, quantum 2.4%, inas.gaas 2.4%, qd 2.1%, inas.quantum 2.1%, film 2.0%, inas.quantum.dots 1.3%, inas.gaas.quantum 1.2%, gaas.quantum 1.0%, surfac 0.8%, gaas.quantum.dots 0.7%, nanoparticl 0.7%

Single Word Terms
quantum 334, ina 333, dot 326, gaa 247, layer 150, photoluminesc 149, qd 146, self 142, temperatur 141, electron 125, structur 120, assembl 115, energi 113, grown 111, optic 108

Double Word Terms
quantum.dots 275, inas.quantum 167, inas.gaas 143, quantum.dot 140, gaas.quantum 129, self.assembled 111, dots.qds 93, assembled.inas 69, molecular.beam 67, beam.epitaxy 67, inas.qds 60, room.temperature 56, ground.state 51, atomic.force 40, assembled.quantum 39

Triple Word Terms
inas.quantum.dots 133, inas.gaas.quantum 114, quantum.dots.qds 93, gaas.quantum.dots 93, self.assembled.inas 69, molecular.beam.epitaxy 65, gaas.quantum.dot 45, inas.quantum.dot 42, self.assembled.quantum 39, assembled.inas.quantum 37, quantum.dots.grown 35, assembled.quantum.dots 35, atomic.force.microscopy 33, transmission.electron.microscopy 28, assembled.inas.gaas 24

Term Cliques
59.78% ina dot quantum qd inas.quantum quantum.dot photoluminesc inp
64.67% ina dot quantum quantum.dots qd inas.quantum photoluminesc inp
67.50% ina dot quantum quantum.dots qd inas.quantum inas.quantum.dots photoluminesc
61.67% ina dot gaa quantum inas.gaas inas.gaas.quantum gaas.quantum quantum.dot photoluminesc
61.77% ina dot gaa quantum qd inas.gaas.quantum gaas.quantum quantum.dot photoluminesc
62.12% ina dot gaa quantum quantum.dots inas.gaas inas.gaas.quantum gaas.quantum gaas.quantum.dots photoluminesc
62.20% ina dot gaa quantum quantum.dots qd inas.gaas.quantum gaas.quantum gaas.quantum.dots photoluminesc
70.40% ina dot gaa quantum quantum.dots qd inas.quantum.dots photoluminesc

Sample Cluster Record Titles

Temperature dependence of the zero-phonon linewidth in InAs/GaAs quantum dots

Lateral coupling of InxGa1-xAs/GaAs quantum dots investigated using differential transmission spectroscopy

Cleaved-edge overgrowth of aligned quantum dots on strained layers of InGaAs

Theoretical study of quantum confined Stark shift in InAs/GaAs quantum dots

Thermally stimulated current in self-organized InAs quantum dots

Universal shapes of self-organized semiconductor quantum dots: Striking similarities between InAs/GaAs(001) and Ge/Si(001)

Quantitative investigations of optical absorption in InAs/InP (311)B quantum dots emitting at 1.55 mu m wavelength

Capping process of InAs/GaAs quantum dots studied by cross-sectional scanning tunneling microscopy

Near room temperature droplet epitaxy for fabrication of InAs quantum dots

Cluster Metrics

Authors

arakawa, y 15
wolter, jh 13
notzel, r 12
kim, js 11
liu, hy 10
hopkinson, m 10
chi, jy 10
wang, zg 9
lee, ji 9
ustinov, vm 8
noh, sk 8
kim, tw 8
bimberg, d 8
yoon, e 7
skolnick, ms 7

Sources

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journal of crystal growth 34
physica e-low-dimensional systems & nanostructures 32
physical review b 28
journal of applied physics 23
semiconductors 12
journal of vacuum science & technology b 12
journal of the korean physical society 11
microelectronics journal 9
japanese journal of applied physics part 2-letters & express letters 8
japanese journal of applied physics part 1-regular papers brief communications & review papers 7
ieee photonics technology letters 7
semiconductor science and technology 5
physical review letters 5
nanotechnology 5

Keywords
physics, applied 114
physics, condensed matter 79
gaas 73
growth 49
photoluminescence 43
engineering, electrical & electronic 39
lasers 38
crystallography 34
physics, multidisciplinary 33
molecular beam epitaxy 33
molecular-beam epitaxy 32
quantum dots 31
islands 31
quantum dots 30
optical-properties 28

Publication Year
2005 316
2004 28
2006 1

Country
usa 45
japan 43
germany 43
south korea 38
england 35
france 33
taiwan 30

peoples r china 26
russia 22
netherlands 17
sweden 12
italy 12
spain 9
canada 9
brazil 9

Institution
univ tokyo 19
chinese acad sci 18
hanyang univ 15
russian acad sci 14
natl chiao tung univ 14
eindhoven univ technol 14
cnrs 11
univ sheffield 10
ind technol res inst 10
univ new mexico 9
univ cambridge 8
tech univ berlin 8
seoul natl univ 8
natl taiwan univ 8
korea adv inst sci & technol 8

DataBase
science citation index 345

CATEGORY 2 - 508A1b ***(4 leaf clusters)***

Quantum Wells, Wires, and States (1298 REC)

THRUST

()

- Quantum wells containing combinations of gallium, indium, arsenic, nitrogen, and aluminum, especially those grown by molecular beam epitaxy (265 Records) Cluster 146
- Quantum wells, especially intersubband absorption and transitions (326 Records) Cluster 133
- Quantum wires, including those with impurities (133 Records) Cluster 72
- Quantum states and systems (329 Records) Cluster 223

- CLUSTER 146
  Quantum wells containing combinations of gallium, indium, arsenic, nitrogen, and aluminum, especially those grown by molecular beam epitaxy (265 Records)

(USA/ Japan tied for country lead. RAS/ CAS are institutional leaders. USA leaders include University of Arkansas. Applied physics journals predominate, as was the case for the previous Quantum Dot clusters.)

Cluster Syntax Features

Descriptive Terms
gaa 33.3%, quantum 4.4%, molecular.beam 1.9%, epitaxi 1.9%, gainna 1.9%, molecular.beam.epitaxy 1.9%, beam.epitaxy 1.8%, grown 1.8%, well 1.7%, ingaa 1.5%,

quantum.wells 1.5%, gaas.quantum 1.4%, photoluminesc 1.3%, algaa 1.1%, beam 1.1%

Discriminating Terms

gaa 22.9%, film 2.0%, quantum 1.4%, gainna 1.4%, molecular.beam 1.3%, molecular.beam.epitaxy 1.2%, beam.epitaxy 1.2%, ingaa 1.0%, well 1.0%, gaas.quantum 1.0%, epitaxi 0.9%, quantum.wells 0.9%, algaa 0.7%, nanoparticl 0.7%, qw 0.7%

Single Word Terms

gaa 236, quantum 192, grown 148, structur 146, epitaxi 134, temperatur 123, beam 116, photoluminesc 114, molecular 110, well 100, layer 95, electron 94, high 89, energi 86, substrat 86

Double Word Terms

molecular.beam 110, beam.epitaxy 108, quantum.wells 96, gaas.quantum 79, grown.molecular 48, room.temperature 46, quantum.structures 34, grown.gaas 34, low.temperature 34, gaas.substrates 31, wells.qws 28, two.dimensional 27, gainnas.gaas 27, optical.properties 27, ingaas.gaas 26

Triple Word Terms

molecular.beam.epitaxy 108, grown.molecular.beam 48, gaas.quantum.wells 40, quantum.wells.qws 28, source.molecular.beam 22, quantum.wells.grown 21, gainnas.gaas.quantum 20, beam.epitaxy.mbe 19, solid.source.molecular 18, gaas.quantum.structures 14, two.dimensional.electron 14, gaas.single.quantum 13, room.temperature.photoluminescence 13, wells.qws.grown 12, quantum.structures.grown 12

Term Cliques

49.15% gaa quantum ingaa algaa
43.65% gaa quantum epitaxi gainna well ingaa quantum.wells gaas.quantum photoluminesc
45.83% gaa quantum molecular.beam epitaxi gainna molecular.beam.epitaxy beam.epitaxy grown well quantum.wells gaas.quantum photoluminesc beam

Sample Cluster Record Titles

Excitation and pressure effects on low temperature photoluminescence from GaAs/GaInP heterostructures

Parallel magnetotransport in multiple quantum well structures

Photoreflection studies of band offsets at the heterojunction in strained short-period GaAs/GaAsP superlattices

The behaviour of optical and structural properties of GaInNAs/GaAs quantum wells upon annealing

[Effect of hydrogen on modulation-doped AlGaAs/InGaAs/GaAs heterostructures: a photoluminescence study]

[Epitaxy and characterisation of dilute III-As-1-N-y(y) on GaAs and InP]

[Growth of GaNxAs1-x atomic monolayers and their insertion in the vicinity of GaInAs quantum wells]

[Elucidation of the emission red-shift with increasing growth temperature of MBE-grown GaInNAs/GaAs quantum wells]

[Effect of nitrogen ions on the properties of InGaAsN quantum wells grown by plasma-assisted molecular beam epitaxy]

Cluster Metrics

Authors
yoon, sf 11
pessa, m 10
niu, zc 8
fan, wj 8
zvonkov, bn 7
misiewicz, j 7
maaref, h 7
kudrawiec, r 7
wu, rh 6
wang, sm 6
ulloa, jm 6
sfaxi, l 6
salamo, gj 6
sadeghi, m 6
pavelescu, em 6

Sources
applied physics letters 42
journal of crystal growth 29
journal of applied physics 21
iee proceedings-optoelectronics 20
physical review b 17
semiconductors 13
physica e-low-dimensional systems & nanostructures 10
journal of vacuum science & technology b 10
semiconductor science and technology 8
japanese journal of applied physics part 2-letters & express letters 6
physica status solidi a-applications and materials science 5

compound semiconductors 2004, proceedings 5
thin solid films 4
jetp letters 4
crystal research and technology 4

Keywords
physics, applied 77
physics, condensed matter 56
engineering, electrical & electronic 50
gaas 45
molecular-beam epitaxy 37
photoluminescence 35
crystallography 34
growth 27
molecular beam epitaxy 25
optics 24
alloys 24
physics, applied 23
telecommunications 22
quantum-wells 21
lasers 20

Publication Year
2005 220
2004 44
2006 1

Country
usa 38
japan 37
russia 32
france 28
germany 27
peoples r china 23
england 18
poland 13
finland 13
spain 12
singapore 12
taiwan 11
south korea 9
italy 9
tunisia 8

Institution
russian acad sci 19

chinese acad sci 19
cnrs 13
nanyang technol univ 12
tampere univ technol 11
fac sci monastir 8
univ sheffield 6
univ arkansas 6
hokkaido univ 6
chalmers univ technol 6
af ioffe phys tech inst 6
univ strathclyde 5
univ politecn madrid 5
natl chiao tung univ 5
wroclaw univ technol 4

DataBase
science citation index 265

- CLUSTER 133
  Quantum wells, especially intersubband absorption and transitions (326 Records)

(USA dominant, with many countries vying for second place [Germany/ England/ Japan/ Russia/ China/ France]. RAS institutional leader. USA leaders include UCSB, University of Iowa, University of Arizona, Stanford University.).

Cluster Syntax Features

Descriptive Terms

well 24.6%, quantum.wells 20.1%, quantum 15.8%, intersubband 1.5%, optic 1.1%, gaa 1.0%, qw 0.9%, multiple.quantum 0.9%, band 0.8%, carrier 0.7%, transit 0.6%, multipl 0.6%, strain 0.5%, hole 0.4%, absorpt 0.4%

Discriminating Terms

well 17.6%, quantum.wells 14.3%, quantum 7.8%, film 2.0%, intersubband 1.0%, surfac 0.9%, nanoparticl 0.7%, particl 0.7%, carbon 0.7%, qw 0.6%, multiple.quantum 0.6%, nanotub 0.6%, oxid 0.5%, crystal 0.5%, deposit 0.5%

Single Word Terms

quantum 325, well 301, optic 143, electron 132, structur 128, energi 116, gaa 98, temperatur 98, transit 94, band 90, field 83, experiment 77, two 77, high 75, multipl 73

Double Word Terms

quantum.wells 296, multiple.quantum 62, wells.qws 40, electric.field 37, optical.properties 35, two.dimensional 33, quantum.structures 28, room.temperature 27, gaas.quantum 26, semiconductor.quantum 24, single.quantum 24, gaas.algaas 23, wells.grown 21, intersubband.transitions 19, electron.hole 19

Triple Word Terms

quantum.wells.qws 40, multiple.quantum.wells 38, semiconductor.quantum.wells 23, gaas.quantum.wells 23, quantum.wells.grown 20, single.quantum.wells 19, two.dimensional.electron 15, molecular.beam.epitaxy 14, gan.quantum.wells 13, transmission.electron.microscopy 12, gaas.algaas.quantum 11, algaas.quantum.wells 11, quantum.wells.optical 11, double.quantum.wells 11, dimensional.electron.gas 11

Term Cliques

42.82% well quantum.wells quantum multiple.quantum band carrier multipl strain hole absorpt
47.93% well quantum.wells quantum qw band carrier strain hole
52.02% well quantum.wells quantum gaa qw strain hole
55.57% well quantum.wells quantum optic qw band strain
55.92% well quantum.wells quantum optic gaa qw strain
40.85% well quantum.wells quantum intersubband multiple.quantum band transit multipl strain hole absorpt
45.60% well quantum.wells quantum intersubband gaa transit strain hole absorpt
43.34% well quantum.wells quantum intersubband optic multiple.quantum band transit multipl strain absorpt
48.64% well quantum.wells quantum intersubband optic gaa transit strain absorpt

Sample Cluster Record Titles

Simultaneous determination of the index and absorption gratings in multiple quantum well photorefractive devices designed for laser ultrasonic sensor

Intersubband absorption from 2 to 7 mu m in strain-compensated double-barrier InxGa1-As-x multiquantum wells

Multisubband effect in spin dephasing in semiconductor quantum wells

Carrier diffusion in low-dimensional semiconductors: A comparison of quantum wells, disordered quantum wells, and quantum dots

Interplay of Coulomb and nonparabolicity effects in the intersubband absorption of electrons and holes in quantum wells

Magnetotransport probing of the quality of the heterointerfaces and degree of symmetry of the potential profile of quantum wells in the valence band of the Ge1-xSix/Ge/Ge1-xSix heterosystem

Intersubband absorption of light in selectively doped asymmetric double tunnel-coupled quantum wells

Intersubband transitions in quantum wells under intense laser field

Near-infrared intersubband transitions in delta-doped InAs/AlSb multi-quantum wells

Enhanced photoluminescence from GaAsSb quantum wells

Cluster Metrics

Authors

coldren, la 7
skogen, ej 6
hopkinson, m 6
harrison, p 6
sokmen, i 5
raring, jw 5
navaretti, p 5
liu, hy 5
herrera, m 5
gutierrez, m 5
gonzalez, d 5

garcia, r 5
gaggero-sager, lm 5
aleshkin, vy 5
zhang, yh 4

Sources
physical review b 45
applied physics letters 41
journal of applied physics 26
journal of crystal growth 14
semiconductors 10
microelectronics journal 10
ieee photonics technology letters 10
superlattices and microstructures 8
physica e-low-dimensional systems & nanostructures 8
semiconductor science and technology 7
ieee journal of quantum electronics 7
acta physica polonica a 7
japanese journal of applied physics part 1-regular papers brief communications & review papers 6
international journal of modern physics b 5
chinese physics letters 5

Keywords
physics, condensed matter 96
physics, applied 90
engineering, electrical & electronic 54
gaas 34
physics, applied 30
physics, multidisciplinary 29
optics 24
molecular-beam epitaxy 23
semiconductors 23
heterostructures 23
physics, condensed matter 22
photoluminescence 18
absorption 17
mu-m 15
materials science, multidisciplinary 14

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2005 284
2004 41
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Country

usa 86
germany 35
england 31
japan 30
russia 29
peoples r china 29
france 28
south korea 18
italy 14
mexico 13
brazil 10
turkey 9
taiwan 9
poland 9
spain 8

Institution

russian acad sci 26
univ sheffield 17
univ calif santa barbara 11
chinese acad sci 11
cnrs 7
univ leeds 6
univ iowa 6
univ arizona 6
stanford univ 6
univ tokyo 5
univ marburg 5
univ cadiz 5
japan sci & technol agcy 5
hanyang univ 5
dokuz eylul univ 5

DataBase

science citation index 326

- # CLUSTER 72
  Quantum wires, including those with impurities (133 Records)

(USA leader, followed by China, Germany, Japan. Many institutions making first appearance in results. Trakya University and Yerevan State University are leading new institutions, and USA leaders include University of Illinois, Stevens Institute of Technology, Arizona State University, and Argonne National Labs.).

Cluster Syntax Features

Descriptive Terms
wire 35.6%, quantum 12.4%, quantum.wire 11.7%, quantum.wires 8.5%, impur 1.8%, conduct 1.2%, phonon 1.1%, qwr 1.0%, gaa 0.6%, energi 0.5%, electron 0.5%, field 0.5%, state 0.5%, dimension 0.4%, confin 0.4%

Discriminating Terms
wire 22.8%, quantum.wire 8.0%, quantum.wires 5.8%, quantum 5.3%, film 1.9%, impur 1.0%, surfac 0.8%, nanoparticl 0.7%, qwr 0.6%, carbon 0.6%, particl 0.6%, layer 0.6%, nanotub 0.5%, crystal 0.5%, phonon 0.5%

Single Word Terms
quantum 132, wire 127, electron 76, energi 51, state 47, on 45, dimension 41, conduct 41, two 39, field 37, gaa 37, structur 36, interact 36, model 33, function 32

Double Word Terms
quantum.wire 77, quantum.wires 75, one.dimensional 24, electric.field 14, binding.energy 13, gaas.quantum 12, semiconductor.quantum 11, density.states 11, two.dimensional 11, magnetic.field 11, dimensional.quantum 10, cross.section 10, ground.state 10, electron.phonon 9, phonon.interaction 9

Triple Word Terms
electron.phonon.interaction 8, dimensional.quantum.wires 8, quasi.one.dimensional 8, quantum.wires.qwrs 7, semiconductor.quantum.wire 7, one.dimensional.quantum 6, gaas.quantum.wires 6, quantum.wires.electric 5, quantum.wires.electron 5, external.electric.field 4, binding.energy.shallow 4, semiconductor.quantum.wires 4, double.quantum.wire 4, cylindrical.quantum.wire 4, gaas.quantum.wire 4

Term Cliques
41.25% quantum impur gaa energi electron field confin
46.51% quantum quantum.wires impur gaa energi electron field
44.27% quantum quantum.wire impur energi electron field state confin
52.63% wire quantum gaa energi electron dimension confin
52.20% wire quantum gaa energi electron field confin

59.77% wire quantum qwr state
52.26% wire quantum phonon gaa electron confin
57.89% wire quantum quantum.wires gaa energi electron dimension
57.47% wire quantum quantum.wires gaa energi electron field
58.40% wire quantum quantum.wires phonon gaa electron
50.38% wire quantum quantum.wires phonon qwr gaa
54.23% wire quantum quantum.wire energi electron state dimension confin
53.85% wire quantum quantum.wire energi electron field state confin
57.27% wire quantum quantum.wire phonon electron confin
58.11% wire quantum quantum.wire conduct electron state dimension

Sample Cluster Record Titles

Hydrostatic pressure effects on the donor impurity-related photoionization cross-section in cylindrical-shaped GaAs/GaAlAs quantum well wires

Carrier relaxation in GaAs v-groove quantum wires and the effects of localization

Crossover of conductance and local density of states in a single-channel disordered quantum wire

Binding energy of relativistic hydrogenic impurities in cylindrical quantum well wires under an applied electric field

Magnetic field and intense laser radiation effects on the interband transitions in quantum well wires

Shallow hydrogen-induced donor in monocrystalline silicon and quantum wires

Electron transport through quantum wires and point contacts

Effect of spin-orbit interaction on the plasma excitations in a quantum wire

Conductivity in quantum wires in a homogeneous magnetic field

Cluster Metrics

Authors

zhang, l 3
zeng, yp 3
ye, xl 3
xu, b 3
wang, zg 3

vartanian, al 3
sokmen, i 3
schonhammer, k 3
sari, h 3
meden, v 3
lei, w 3
kasapoglu, e 3
hasegawa, h 3
chen, yh 3
barnabe-theriault, x 3

Sources

physical review b 33
physica e-low-dimensional systems & nanostructures 11
physica b-condensed matter 5
applied physics letters 5
microelectronics journal 4
journal of physics-condensed matter 4
journal of applied physics 4
physical review letters 3
journal of crystal growth 3
european physical journal b 3
compound semiconductors 2004, proceedings 3
surface review and letters 2
physica status solidi b-basic solid state physics 2
physica status solidi b-basic research 2
physica status solidi b-basic solid state physics 2

Keywords

physics, condensed matter 64
physics, multidisciplinary 18
physics, applied 18
dots 18
transport 11
scattering 11
wells 10
systems 10
engineering, electrical & electronic 9
states 9
dimensional electron-gas 8
physics, condensed matter 8
gaas 8
conductance 8
materials science, multidisciplinary 7

Publication Year

2005 115
2004 17
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Country
usa 27
peoples r china 19
germany 15
japan 13
turkey 7
england 6
spain 5
russia 5
poland 5
taiwan 4
south korea 4
brazil 4
switzerland 3
italy 3
iran 3

Institution
trakya univ 4
chinese acad sci 4
yerevan state univ 3
univ tokyo 3
univ illinois 3
univ gottingen 3
stevens inst technol 3
panyu polytech 3
hokkaido univ 3
dokuz eylul univ 3
cumhuriyet univ 3
arizona state univ 3
argonne natl lab 3
univ valle 2
univ oxford 2

DataBase
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- # CLUSTER 223
  Quantum states and systems (329 Records)

(USA dominant; China, Germany follow. Main institutions are RAS, Tsing Hua University, CAS. Leading USA institutions include Princeton University, UCSB, University of Arkansas.).

Cluster Syntax Features

Descriptive Terms
quantum 48.8%, state 2.5%, system 1.1%, electron 0.8%, coher 0.7%, energi 0.7%, equat 0.7%, classic 0.7%, model 0.6%, reson 0.6%, confin 0.6%, coupl 0.6%, dimension 0.6%, quantum.hall 0.5%, subband 0.5%

Discriminating Terms
quantum 34.0%, film 2.1%, surfac 1.0%, state 0.8%, nanoparticl 0.7%, carbon 0.7%, deposit 0.6%, oxid 0.6%, crystal 0.5%, particl 0.5%, classic 0.5%, polym 0.4%, coher 0.4%, quantum.hall 0.4%, nanotub 0.4%

Single Word Terms
quantum 329, electron 140, state 122, system 110, structur 97, two 97, energi 90, model 84, function 72, field 69, on 66, optic 64, densiti 62, depend 62, dimension 61

Double Word Terms
two.dimensional 37, quantum.wells 29, quantum.confinement 24, quantum.hall 22, quantum.mechanical 21, schrodinger.equation 18, magnetic.field 18, quantum.structures 17, electric.field 17, quantum.states 17, ground.state 17, double.quantum 15, quantum.systems 15, one.dimensional 14, quantum.structure 13

Triple Word Terms
two.dimensional.electron 11, quantum.information.processing 7, quantum.point.contact 7, two.level.system 6, density.functional.theory 6, quantum.hall.regime 6, dimensional.electron.gas 6, quantum.monte.carlo 6, fractional.quantum.hall 6, metal.insulator.transition 5, integer.quantum.hall 5, cavity.quantum.electrodynamics 4, angle.resolved.photoemission 4, quantum.electric.field 4, double.quantum.structure 4

Term Cliques
36.78% quantum equat confin dimension
38.53% quantum equat model confin
41.26% quantum system equat dimension
37.20% quantum system equat model reson
36.47% quantum system equat classic model
38.60% quantum state electron energi coupl subband
35.52% quantum state electron energi confin dimension subband
41.59% quantum state electron energi model coupl
41.34% quantum state electron energi model confin
35.13% quantum state system electron dimension quantum.hall subband
39.61% quantum state system electron coupl subband
35.07% quantum state system electron coher model reson coupl

Sample Cluster Record Titles

Bandgap mapping for III-V quantum well by electron spectroscopy imaging

Modeling of open quantum devices within the closed-system paradigm

Generation of squeezed states of nanomechanical resonators by reservoir engineering

Superconducting phase qubit coupled to a nanomechanical resonator: Beyond the rotating-wave approximation

Formation of a self-consistent double quantum well in a wide p-type quantum well

Quantum features in atomic nanofabrication using exactly resonant standing waves

Quantum mechanical hysteresis and the electron transfer problem

Subband decomposition approach for the simulation of quantum electron transport in nanostructures

Capture and release of photonic images in a quantum well

Cluster Metrics

Authors
long, gl 7
ruda, he 5
wang, c 4

spicka, v 4
qiao, b 4
deng, fg 4
zubairy, ms 3
zoller, p 3
zhang, yf 3
zhang, l 3
yakunin, mv 3
scully, mo 3
schuh, d 3
sariyanni, ze 3
rostovtsev, y 3

Sources

physical review b 49
physica e-low-dimensional systems & nanostructures 35
physical review letters 25
applied physics letters 11
physical review a 10
journal of applied physics 9
chinese physics letters 9
international journal of modern physics b 7
acta physica sinica 7
semiconductors 5
physics letters a 5
physica a-statistical mechanics and its applications 5
solid state communications 4
journal of physical chemistry b 4
ieee transactions on nanotechnology 4

Keywords

physics, condensed matter 105
physics, multidisciplinary 81
physics, applied 35
states 26
dots 20
physics, atomic, molecular & chemical 19
systems 19
optics 18
engineering, electrical & electronic 17
transport 16
physics, mathematical 14
dynamics 14
chemistry, physical 13
physics, condensed matter 12
materials science, multidisciplinary 11

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usa 96
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germany 42
russia 26
france 24
japan 21
italy 21
netherlands 18
england 15
canada 15
india 12
spain 9
austria 9
taiwan 8
czech republic 8

Institution
russian acad sci 16
tsing hua univ 14
chinese acad sci 14
princeton univ 9
univ calif santa barbara 7
acad sci czech republ 6
univ toronto 5
univ tokyo 5
univ cambridge 5
texas a&m univ 5
delft univ technol 5
zhejiang univ 4
univ london imperial coll sci technol & med 4
univ karlsruhe 4
univ arkansas 4

DataBase
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CATEGORY 3 - 508A2a ***(67 leaf clusters)***

Optics and Electronics (16432 REC)

THRUST

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- Fabrication and characterization of vertical-cavity surface-emitting lasers and detection using them (72 Records) Cluster 2
- Devices related to quantum wells, especially quantum cascade lasers and quantum well infrared photodetectors (115 Records) Cluster 119
- Lasers, focusing on diode lasers, waveguide lasers, and optically pumped lasers (275 Records) Cluster 152
- Applications of lasers, especially YAG laser irradiation and laser ablation to prepare materials (325 Records) Cluster 196
- Studies of femtosecond pulse lasers, especially enhancement of laser pulses, creation of 3d nanostructures, and ablation processes (243 Records) Cluster 144
- Photonic, especially two-photonic, effects: photon absorption and fluorescence, as well as detection (153 Records) Cluster 145
- Fabrication and structural/ optical properties of photonic crystals, especially photonic band gap features (238 Records) Cluster 76
- Optical waveguides, especially propagation of light through waveguides (139 Records) Cluster 79
- Design, fabrication, and characterization of gratings, such as Bragg gratings, or structures containing gratings, primarily for optical applications (103 Records) Cluster 40
- Optical properties of nanostructures/ nanomaterials, optical materials and devices, and optical microscopy studies (359 Records) Cluster 236
- Optical nonlinearities in nanostructures and investigation of second harmonic generation (105 Records) Cluster 128
- Plasmons: surface-plasmon resonance technology, surface dynamics, surface-plasmons in metallic structures, Raman scattering experiments, and studies of plasmons by finite difference time domain method (336 Records) Cluster 169

- Measurement and detection using optical instruments, with focus on the instrument parameters and features, especially mirrors and lenses (314 Records) Cluster 247
- Imaging using various forms of electron microscopy, including SEM, STEM, and TEM, as well as atomic force microscopy (178 Records) Cluster 189
- Machining, cutting, grinding, polishing of materials, especially surfaces, and characterization of the materials after these processes (86 Records) Cluster 109
- Modeling, design, and simulation of processes and systems at the nanoscale; measurement and minimization, control, and correction of errors (325 Records) Cluster 252
- Nanomechanical systems, including actuators, resonators, hard disk drives, sensors, and motors (211 Records) Cluster 213
- Applications of atomic force microscopy and similar methods of nanomanipulation, with focus on tips and cantilevers, namely their uses and responses to different influences (241 Records) Cluster 154
- Atomic force microscopy to measure, fabricate, and manipulate, with focus on rough surfaces (237 Records) Cluster 214
- Probing polymer/ molecular chain properties and surface interactions, especially by means of atomic force microscopy (AFM) (274 Records) Cluster 245
- Molecular dynamics simulations and models of physical and biological systems (241 Records) Cluster 234
- Models and simulations, especially Monte Carlo and molecular dynamics simulations, of systems and comparison to experiments or other models (578 Records) Cluster 254
- Phonon scattering, transport, and states; phonon-electron interactions; Raman scattering; related topics concerning vibrational modes and acoustics (176 Records) Cluster 167
- Electronic properties, structures, and states; energy transfer, levels, and loss; band gap properties; and spectroscopic studies (325 Records) Cluster 246
- Density functional theory, with focus on its use for condensed matter, atomic, molecular, and chemical physics calculations, especially to study nanoclusters (266 Records) Cluster 215
- Nanosized clusters, including their structures and properties, density functional theory calculations, molecular dynamics simulations, and

their interactions with compounds and each other (251 Records) Cluster 197

- Scanning tunneling microscopy studies (268 Records) Cluster 161
- Studies of individual molecules, especially on surfaces and in organic materials, with the aid of scanning tunneling microscopy (332 Records) Cluster 227
- Fluorescence/ luminescence properties, of dyes for instance, and their applications, especially to sensors (112 Records) Cluster 192
- Improvement of solar cells by dye-sensitized films (especially TiO2 films) or nanostructures (92 Records) Cluster 18
- Ring compounds, especially porphyrins, fullerenes, and their derivatives, with emphasis on reactions, synthesis, and structure of these compounds (332 Records) Cluster 250
- Chemical studies of bonding (especially hydrogen bonding), host-guest interactions, and other molecular interactions involved in structure and assembly, with focus on supramolecular structures and macrocycles (246 Records) Cluster 230
- Self-assembly, formation of supramolecular structures, aggregation, and block copolymers (694 Records) Cluster 210
- Self-assembled monolayers (SAMs), especially gold and alkanethiol SAMs, (294 Records) Cluster 50
- Self-assembled monolayers (SAMs), especially gold and alkanethiol SAMs, as well as Langmuir and Langmuir-Blodgett monolayers/ films (335 Records) Cluster 168
- Studies of surfaces (especially copper, gold, and silver-containing surfaces), focusing on the effects of cluster formation and deposition on surfaces and the use of scanning tunneling microscopy to characterize surfaces (STM) (220 Records) Cluster 244
- Layers, emphasizing properties of thickness and deposition, as well as interactions at the interfaces/ barriers (325 Records) Cluster 253
- Growth of layers/ films, especially InN and GaAs, by means of molecular beam epitaxy, chemical vapor deposition, and similar deposition techniques (264 Records) Cluster 205
- Growth of crystals and islands, emphasizing growth parameters and properties of the products (269 Records) Cluster 229
- Silicon carbide (SiC), emphasizing growth of desired structures by epitaxy or chemical vapor deposition (CVD) and issues concerning defects on the products (174 Records) Cluster 58

- Silicon-containing substances, emphasizing processes on and interactions with silicon surfaces and scanning tunneling microscopy to characterize the substances (228 Records) Cluster 131
- Silicon, silica, and silicide-containing substrates/ layers/ films: their properties and processes that occur on them (461 Records) Cluster 190
- Growth and characterization of silicon-germanium (SiGe) structures and their application to circuits, with focus on strained/ strain-relaxed SiGe layers (113 Records) Cluster 36
- Germanium-based substances, including germanium nanocrystals, islands, and substrates, as well as heterostructures containing silicon (176 Records) Cluster 42
- Ion implantation to modify or create materials, including nanocrystals, sometimes accompanied by or followed by annealing, thermal or laser (354 Records) Cluster 117
- Applications of ion/ electron beam/ irradiation techniques, including focused ion beam (FIB) technology, ion and electron-beam-induced deposition, and ion-beam milling (200 Records) Cluster 178
- Lithography and etching, including nanoimprint lithography and electron-beam lithography and focusing on nanopatterning (166 Records) Cluster 149
- Etching, especially plasma etching and reactive ion etching (282 Records) Cluster 113
- Hafnium dioxide (HfO2), hafnium-containing, and oxide films, compounds, and layers, with emphasis on dielectric properties, fabrication by atomic layer deposition (ALD), and use as gate dielectrics (195 Records) Cluster 111
- Gate dielectrics and metal-oxide semiconductor field-effect transistors (MOSFETs), emphasizing those made from silica (SiO2), hafnium dioxide (HfO2), silicon, and silicides (152 Records) Cluster 139
- Field transistors, single-electron transistors, electron mobility transistors, and similar electronic devices, with emphasis on design and properties of gates (243 Records) Cluster 122
- Metal-oxide semiconductor field-effect transistors (MOSFETs) and silicon-on-insulator (SOI) devices (128 Records) Cluster 60
- Electronic devices, circuits, and complementary metal-oxide semiconductor (CMOS) systems, emphasizing performance as measured by frequency, power, current, and voltage (331 Records) Cluster 224

- Modeling and design of electronic devices, including properties of those based on junctions (molecular junctions, metal junctions, Josephson junctions, and Schottky barriers), electron transport properties, current/ voltage characteristics, negative differential resistance (NDR) (407 Records) Cluster 243
- Properties and fabrication of magnetic tunnel junctions (MTJs) and investigation of magnetoresistance (121 Records) Cluster 53
- Field-emission properties of materials, especially carbon nanotubes (CNTs) and nanowires (180 Records) Cluster 95
- Upconversion emission/ luminescence properties and spectroscopic studies of rare earth ions (Er3+, Yb3+, and Tm3+), especially in doped crystals and glass ceramics (82 Records) Cluster 27
- Phosphorescence and luminescence of materials containing rare earth ions (especially Eu3+), with focus on synthesis by combustion method and from percursors (107 Records) Cluster 98
- Studies on optical activity (emission, luminescence, photoluminescence, and fluorescence), especially in nanocrystals and thin films, and factors that affect activity (326 Records) Cluster 219
- Light-emitting diodes (LEDs), including organic LEDs and emphasizing construction and optimization of LEDs (263 Records) Cluster 89
- Multiple quantum wells (MQWs), especially GaN, InGaN, and GaN/InGaN, and focusing on structural and photoluminescence properties (151 Records) Cluster 61
- Gallium nitride (GaN) films, layers, and structures, primarily grown by vapor-phase/ molecular-beam epitaxy and chemical vapor deposition, as well as gallium heterostructures, especially those containing sapphire (270 Records) Cluster 74
- Nitride (AlGaN, GaN, AlGaN/GaN, and AlN) structures grown and/or used for applications using ohmic contact, high-electron-mobility transistors (HEMTs), and heterojunction field-effect transistors (HFETs) (100 Records) Cluster 41
- Zinc oxide (ZnO) thin films, emphasizing fabrication by magnetron sputtering, deposition, and annealing; doped ZnO films; and optical properties of ZnO films (254 Records) Cluster 62
- Zinc oxide (ZnO) thin films, emphasizing growth by deposition, doped ZnO films, and emission/ magnetic/ optical/ electronic properties of ZnO films (70 Records) Cluster 7

- Zinc oxide (ZnO) nanowires and other nanostructures, focusing on growth, emission and pholuminescence properties, doped zinc nanostructures, and nanowire arrays (304 Records) Cluster 67
- Nanowires: growth by vapor deposition, nanowire arrays, silicon nanowires, single crystal nanowires (645 Records) Cluster 100

- # CLUSTER 2

  Fabrication and characterization of vertical-cavity surface-emitting lasers and detection using them (72 Records)

(USA leading; Taiwan, Germany follow. Two new institutions leading: Tampere University of Technology; National Chiao Tung University. American leaders include University of Illinois, Stanford University, University of Arizona.).

Cluster Syntax Features

Descriptive Terms
vcsel 11.7%, surface.emitting 8.0%, cavity.surface.emitting 7.4%, cavity.surface 7.3%, vertical.cavity 7.1%, caviti 6.8%, vertical.cavity.surface 6.4%, emit 4.8%, emitting.lasers 3.9%, vertic 3.7%, surface.emitting.lasers 3.4%, laser 3.3%, emitting.laser 1.4%, surface.emitting.laser 1.3%, output 0.9%

Discriminating Terms
vcsel 7.0%, surface.emitting 4.8%, cavity.surface.emitting 4.4%, cavity.surface 4.4%, vertical.cavity 4.2%, vertical.cavity.surface 3.8%, caviti 3.7%, emit 2.5%, emitting.lasers 2.3%, surface.emitting.lasers 2.0%, vertic 1.9%, film 1.7%, laser 0.9%, emitting.laser 0.8%, surface.emitting.laser 0.8%

Single Word Terms
laser 71, caviti 70, emit 69, surfac 68, vertic 67, vcsel 44, temperatur 37, high 34, oper 33, mode 33, optic 32, wavelength 32, power 30, devic 29, output 28

Double Word Terms
surface.emitting 68, cavity.surface 66, vertical.cavity 63, emitting.lasers 49, emitting.laser 28, lasers.vcsels 23, output.power 21, room.temperature 21, threshold.current 15, distributed.bragg 14, laser.vcsel 13, continuous.wave 13, single.mode 13, oxide.confined 13, transverse.mode 10

Triple Word Terms
cavity.surface.emitting 66, vertical.cavity.surface 61, surface.emitting.lasers 49, surface.emitting.laser 27, emitting.lasers.vcsels 22, emitting.laser.vcsel 13, distributed.bragg.reflectors 10, 850.vertical.cavity 9, distributed.bragg.reflector 5, external.cavity.surface 5, vertical.external.cavity 5, quantum.vertical.cavity 5, molecular.beam.epitaxy 5, continuous.wave.operation 5, single.transverse.mode 5

Term Cliques

77.78% vcsel surface.emitting cavity.surface.emitting cavity.surface vertical.cavity caviti vertical.cavity.surface emit vertic laser emitting.laser surface.emitting.laser output
86.00% vcsel surface.emitting cavity.surface.emitting cavity.surface vertical.cavity caviti vertical.cavity.surface emit emitting.lasers vertic surface.emitting.lasers laser

Sample Cluster Record Titles

High-power single-mode vertical-cavity surface-emitting lasers with triangular holey structure

Fabrication and characteristics of high-speed oxide-confined VCSELs using InGaAsP-InGaP strain-compensated MQWs

VCSEL based detection of water vapor near 940 nm

1.55-mu m InGaAs/InGaAlAs MQW vertical-cavity surface-emitting lasers with InGaAlAs/InP distributed Bragg reflectors

1.3-mu m GaInNAs surface-normal devices

1.5 mu m VCSEL structure optimization for high-power and high-temperature operation

Continuous optical pumping laser activity of a VCSEL at room temperature in an external cavity at 1.55 Im

Vertical-cavity surface-emitting lasers with monolithically integrated horizontal waveguides

High-frequency analog modulation of oxide confined 670-nm vertical-cavity surface-emitting lasers

Cluster Metrics

Authors

wang, sc 6
kuo, hc 6
lai, fi 5
chang, yh 5
chang, ya 5
ostermann, jm 4

michalzik, r 4
yan, cl 3
pessa, m 3
liu, y 3
kapon, e 3
hosea, tjc 3
debernardi, p 3
choquette, kd 3
zorn, m 2

Sources
ieee photonics technology letters 12
applied physics letters 10
journal of crystal growth 6
ieee journal of quantum electronics 6
physica status solidi a-applications and materials science 4
japanese journal of applied physics part 2-letters & express letters 3
iee proceedings-optoelectronics 3
journal of lightwave technology 2
applied optics 2
tm-technisches messen 1
spectrochimica acta part a-molecular and biomolecular spectroscopy 1
sensors and actuators b-chemical 1
semiconductors 1
physical review a 1
physica status solidi b-basic solid state physics 1

Keywords
engineering, electrical & electronic 30
physics, applied 21
optics 21
physics, applied 14
vcsels 14
surface-emitting lasers 8
mu-m 7
physics, condensed matter 6
optics 6
crystallography 6
surface-emitting lasers 6
semiconducting 6
laser diodes 6
semiconductor 5
gain 5

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2005 63

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Country

usa 15
taiwan 11
germany 11
france 7
switzerland 6
finland 6
peoples r china 5
sweden 4
spain 3
italy 3
england 3
south korea 2
russia 2
poland 2
japan 2

Institution

tampere univ technol 6
natl chiao tung univ 6
univ ulm 4
ecole polytech fed lausanne 4
univ marburg 3
univ illinois 3
stanford univ 3
royal inst technol 3
politecn turin 3
cnrs 3
chinese acad sci 3
univ surrey 2
univ montpellier 2 2
univ bayreuth 2
univ arizona 2

DataBase

science citation index 72

- # CLUSTER 119
  Devices related to quantum wells, especially quantum cascade lasers and quantum well infrared photodetectors (115 Records)

(USA leader, followed by Germany. Main institutions are CAS, RAS. Leading USA institutions: University of Wisconsin, Lehigh University.).

Cluster Syntax Features

Descriptive Terms
quantum 9.8%, laser 8.0%, quantum.cascade 5.4%, cascad 4.2%, threshold.current 2.7%, threshold 2.5%, gaa 2.3%, qwip 2.2%, inp 2.0%, quantum.cascade.lasers 1.9%, cascade.lasers 1.9%, wavelength 1.8%, current 1.7%, photodetector 1.4%, threshold.current.density 1.3%

Discriminating Terms
quantum 3.9%, quantum.cascade 3.8%, laser 3.6%, cascad 2.8%, film 2.0%, threshold.current 1.9%, qwip 1.5%, threshold 1.4%, quantum.cascade.lasers 1.4%, cascade.lasers 1.4%, inp 1.2%, gaa 1.0%, threshold.current.density 0.9%, photodetector 0.9%, quantum.infrared 0.9%

Single Word Terms
quantum 111, laser 75, temperatur 63, current 60, high 52, gaa 51, threshold 48, structur 47, wavelength 47, oper 41, densiti 41, grown 41, optic 36, emiss 33, epitaxi 31

Double Word Terms
threshold.current 41, room.temperature 31, quantum.cascade 31, current.density 29, molecular.beam 21, cascade.lasers 21, beam.epitaxy 20, quantum.wells 20, quantum.infrared 19, quantum.lasers 18, low.threshold 15, infrared.photodetectors 14, emission.wavelength 13, active.region 12, continuous.wave 11

Triple Word Terms
threshold.current.density 27, quantum.cascade.lasers 21, molecular.beam.epitaxy 20, quantum.infrared.photodetectors 13, quantum.cascade.laser 10, grown.molecular.beam 10, low.threshold.current 10, vapor.phase.epitaxy 8, in0.53ga0.47as 8, transmission.electron.microscopy 8, chemical.vapor.deposition 8, threshold.current.densities 8, continuous.wave.operation 7, metalorganic.chemical.vapor

5, vch.verlag.gmbh 5

Term Cliques
38.09% quantum qwip inp wavelength photodetector
50.26% quantum gaa wavelength current photodetector
41.74% quantum gaa qwip wavelength photodetector
35.51% quantum quantum.cascade cascad inp quantum.cascade.lasers cascade.lasers
50.00% quantum laser threshold.current threshold gaa wavelength current threshold.current.density
43.96% quantum laser threshold.current threshold gaa quantum.cascade.lasers cascade.lasers current threshold.current.density
40.52% quantum laser quantum.cascade cascad threshold.current threshold quantum.cascade.lasers cascade.lasers current threshold.current.density

Sample Cluster Record Titles

Temperature and pressure dependence of recombination processes in 1.5 mu m InGaAlAs/InP-based quantum well lasers

Carrier leakage suppression utilising short-period superlattices in 980 nm InGaAs/GaAs quantum well lasers

Peak response wavelengths of p- and n-type InxGa1-xAs-InP quantum well infrared photodetectors

High-performance distributed feedback quantum cascade lasers grown by metalorganic vapor phase epitaxy

Stabilization, injection and control of quantum cascade lasers, and their application to chemical sensing in the infrared

Theoretical comparison of the band alignment of conventionally strained and strain-compensated phosphorus- aluminum- and nitrogen-based 1.3 mu m QW lasers

Metalorganic vapor-phase epitaxy of room-temperature, low-threshold InGaAs/AlInAs quantum cascade lasers

Interdiffusion in highly strained InGaAs-QWs for high power laser diode applications

MOCVD growth of highly strained InGaAs : Sb-GaAs-GaAsP quantum well vertical cavity surface-emitting lasers with 1.27 mu m emission

Cluster Metrics

Authors

strasser, g 7
schrenk, w 6
pflugl, c 5
yeh, jy 4
tansu, n 4
roberts, js 4
reithmaier, jp 4
mawst, lj 4
liu, hc 4
golka, s 4
forchel, a 4
austerer, m 4
scarpa, g 3
marcadet, x 3
lu, w 3

Sources
applied physics letters 24
journal of crystal growth 16
infrared physics & technology 9
electronics letters 7
ieee photonics technology letters 6
journal of vacuum science & technology b 4
physical review b 3
physica status solidi a-applications and materials science 3
journal of applied physics 3
japanese journal of applied physics part 1-regular papers brief communications & review papers 3
ieee journal of quantum electronics 3
superlattices and microstructures 2
semiconductors 2
quantum electronics 2
physica status solidi b-basic research 2

Keywords
physics, applied 43
engineering, electrical & electronic 25
optics 19
physics, applied 18
crystallography 16
mu-m 16
physics, condensed matter 15
gaas 11
mu-m 9
instruments & instrumentation 9
operation 8

gainnas 8
laser diodes 7
wavelength 6
performance 6

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usa 22
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south korea 9
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austria 8
sweden 5
singapore 5
turkey 4
taiwan 4
spain 3

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chinese acad sci 8
russian acad sci 7
vienna tech univ 5
univ wisconsin 5
univ sheffield 5
thales res & technol 5
natl res council canada 5
lehigh univ 5
japan sci & technol agcy 5
univ wurzburg 4
nanyang technol univ 4
chalmers univ technol 4
tech univ munich 3
natl chiao tung univ 3
middle e tech univ 3

DataBase
science citation index 115

- # CLUSTER 152

  Lasers, focusing on diode lasers, waveguide lasers, and optically pumped lasers (275 Records)

(Countries: USA, Germany. Institutions: CAS, RAS. USA leaders: USAF, University of Central Florida, UCSB, Stanford.).

Cluster Syntax Features

Descriptive Terms
laser 29.8%, diod 4.6%, power 4.0%, mode 3.2%, pump 3.1%, output 2.1%, caviti 2.0%, wavelength 1.6%, oper 1.5%, optic 1.4%, threshold 1.2%, laser.diodes 1.1%, lock 1.1%, lase 1.0%, feedback 1.0%

Discriminating Terms
laser 17.6%, diod 2.9%, power 2.1%, film 2.0%, pump 2.0%, mode 1.5%, output 1.4%, caviti 1.2%, surfac 0.9%, laser.diodes 0.8%, wavelength 0.7%, lock 0.7%, oper 0.7%, lase 0.7%, feedback 0.7%

Single Word Terms
laser 263, optic 135, power 123, mode 120, diod 115, high 109, output 98, quantum 97, wavelength 91, oper 90, pump 83, caviti 82, threshold 77, structur 77, devic 76

Double Word Terms
output.power 55, laser.diodes 42, high.power 39, laser.diode 38, continuous.wave 35, threshold.current 34, single.mode 33, room.temperature 32, distributed.feedback 27, diode.laser 24, mode.locked 21, repetition.rate 21, semiconductor.lasers 18, current.density 17, average.output 17

Triple Word Terms
average.output.power 14, nd.yag.laser 14, threshold.current.density 13, continuous.wave.operation 10, passively.mode.locked 10, width.half.maximum 9, chemical.vapor.deposition 9, passive.mode.locking 9, solid.state.lasers 9, full.width.half 8, metal.organic.chemical 8, frequency.doubled.nd 8, continuous.wave.mode 7, temperature.continuous.wave 7, single.mode.laser 7

Term Cliques
44.73% laser pump wavelength optic lase
44.07% laser pump caviti optic lase
43.20% laser mode wavelength threshold lase
47.42% laser mode wavelength optic lase
37.56% laser mode wavelength oper threshold laser.diodes feedback
42.33% laser mode caviti threshold feedback
42.55% laser mode caviti threshold lase
46.55% laser mode caviti optic feedback
46.76% laser mode caviti optic lase
43.48% laser mode output wavelength oper optic feedback
43.64% laser power pump caviti optic lock
44.61% laser power pump output optic lock
48.06% laser power pump output wavelength optic
44.18% laser power mode wavelength oper laser.diodes
45.88% laser power mode caviti optic lock
46.85% laser power mode output optic lock
47.79% laser power mode output wavelength oper optic
42.69% laser diod oper threshold laser.diodes
46.04% laser diod power oper laser.diodes
49.94% laser diod power output oper optic
49.52% laser diod power pump output optic

Sample Cluster Record Titles

Carrier recombination processes in 1.3 mu m and 1.5 mu m InGaAs(P)-based lasers at cryogenic temperatures and high pressures

Continuous-wave operation of GaInNAsSb distributed feedback lasers at 1.5 mu m

High-power 1.3-mu m InGaAsN strain-compensated lasers fabricated with pulsed anodic oxidation

Free-standing, optically pumped, GaN/InGaN microdisk lasers fabricated by photoelectrochemical etching

Nonequilibrium gain in optically pumped GaInNAs laser structures

[Room-temperature "W" diode lasers emitting at lambda approximate to 4.0 mu m]

[DFB laser diodes in the wavelength range from 760 nm to 2.5 mu m]

[Tunable optically pumped lead-chalcogenide mid-infrared emitters on Si-substrates]

[Wavelength selection for the far-infrared p-Ge laser using etched silicon lamellar gratings]

Cluster Metrics

Authors

keller, u 9
forchel, a 7
paschotta, r 6
li, y 6
weyers, m 5
wang, yg 5
wang, j 5
ma, xy 5
kamp, m 5
yanagitani, t 4
yagi, h 4
wenzel, h 4
vurgaftman, i 4
ueda, k 4
takaichi, k 4

Sources

applied physics letters 34
ieee photonics technology letters 22
ieee journal of quantum electronics 22
optics letters 20
iee proceedings-optoelectronics 10
journal of crystal growth 9
applied physics b-lasers and optics 9
journal of applied physics 8
electronics letters 8
optics express 7
optics communications 6
ieee journal of selected topics in quantum electronics 6
chinese physics letters 6
applied optics 6
semiconductor science and technology 5

Keywords
engineering, electrical & electronic 93
physics, applied 63
optics 60
physics, applied 56
optics 52
quantum-well lasers 24
operation 22
mu-m 17
physics, multidisciplinary 14
emission 13
diodes 12
materials science, multidisciplinary 11
telecommunications 11
power 11
semiconductor-lasers 10

Publication Year
2005 240
2004 32
2006 3

Country
usa 57
germany 49
japan 31
peoples r china 30
russia 19
france 19
england 18
switzerland 14
taiwan 11
south korea 10
italy 9
sweden 7
canada 7
spain 6
denmark 6

Institution
chinese acad sci 18
russian acad sci 13
univ wurzburg 8
tech univ denmark 6
royal inst technol 6
usn 5

nanyang technol univ 5
eth honggerberg 5
eth 5
usaf 4
univ marburg 4
univ electrocommun 4
univ cent florida 4
univ calif santa barbara 4
stanford univ 4

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science citation index 275

- # CLUSTER 196
  Applications of lasers, especially YAG laser irradiation and laser ablation to prepare materials (325 Records)

(Country: USA dominant, Japan. Institution: CAS, RAS, Osaka University. Substantial representation of American institutions: University of Texas, LLNL, UCI, Washington State University, USN (NRL), Colorado State University.).

Cluster Syntax Features

Descriptive Terms
laser 52.5%, ablat 1.8%, irradi 1.8%, laser.induced 1.6%, puls 1.6%, beam 1.1%, induc 0.9%, radiat 0.8%, laser.beam 0.7%, optic 0.7%, yag 0.7%, wavelength 0.6%, nd 0.6%, light 0.5%, yag.laser 0.5%

Discriminating Terms
laser 37.4%, film 2.0%, ablat 1.3%, laser.induced 1.2%, irradi 0.9%, puls 0.7%, magnet 0.7%, layer 0.6%, structur 0.6%, carbon 0.6%, laser.beam 0.6%, nanotub 0.5%, deposit 0.5%, yag 0.5%, oxid 0.5%

Single Word Terms
laser 321, puls 118, optic 114, induc 107, surfac 100, high 98, irradi 92, materi 84, measur 83, beam 83, wavelength 83, two 78, electron 72, light 72, time 67

Double Word Terms
laser.induced 73, laser.beam 47, laser.irradiation 44, nd.yag 43, yag.laser 39,

laser.ablation 33, pulsed.laser 31, laser.radiation 30, laser.pulse 26, laser.light 23, electron.microscopy 23, scanning.electron 19, laser.wavelength 19, high.resolution 19, laser.power 18

Triple Word Terms
nd.yag.laser 35, scanning.electron.microscopy 14, laser.induced.breakdown 11, laser.induced.fluorescence 9, yag.laser.irradiation 7, yttrium.aluminum.garnet 7, induced.breakdown.spectroscopy 7, charge.coupled.device 7, atomic.force.microscope 7, pulsed.dye.laser 7, laser.induced.damage 6, laser.power.laser 6, krf.excimer.laser 6, electron.microscopy.sem 6, switched.nd.yag 6

Term Cliques
53.13% laser optic wavelength
30.41% laser beam laser.beam yag nd yag.laser
39.20% laser beam laser.beam optic light
32.72% laser irradi beam yag nd yag.laser
38.71% laser irradi beam radiat light
39.54% laser irradi puls induc radiat light
40.10% laser irradi puls induc radiat wavelength
32.00% laser irradi laser.induced puls induc yag wavelength nd yag.laser
34.15% laser ablat beam laser.beam nd
36.92% laser ablat irradi beam nd
34.54% laser ablat irradi laser.induced puls induc wavelength nd

Sample Cluster Record Titles

Ejection of clusters from liquid beam surface by IR laser irradiation

Laser-induced fluorescence detection in ultratrace analysis

Laser-assisted nanopatterning of aluminium using particle-induced near-field optical enhancement and nanoimprinting

GeO2-PbO-Bi2O3 glasses doped with Yb3+ for laser applications

Spatially selected crystallization in glass by YAG laser irradiation

Experimental studies and thermal modelling of 1064-and 532-nm Nd : YVO4 micro-laser ablation of polyimide

gamma-Fe2O3 nanoparticles prepared by laser ablation of a tiny wire

Calibration measurements in laser-induced breakdown spectroscopy using nanosecond and picosecond lasers

[Laser-induced micro-bubbles in cells]

Cluster Metrics

Authors
nelson, js 5
langford, sc 4
dickinson, jt 4
choi, b 4
zhang, hj 3
yeshchenko, oa 3
wen, lh 3
vaschenko, g 3
valdivia, ce 3
sones, cl 3
sato, r 3
rocca, jj 3
pikkula, bm 3
nwe, kh 3
niu, dm 3

Sources
applied physics letters 25
journal of applied physics 16
lasers in surgery and medicine 13
optics letters 9
applied surface science 9
applied physics a-materials science & processing 7
spectrochimica acta part b-atomic spectroscopy 6
review of scientific instruments 6
journal of physics d-applied physics 6
photomedicine and laser surgery 5
optics express 5
journal of physical chemistry a 5
technical physics letters 4
quantum electronics 4
physics of plasmas 4

Keywords
physics, applied 75
optics 33
chemistry, physical 28
spectroscopy 28
physics, applied 24

engineering, electrical & electronic 23
surgery 21
ablation 21
spectroscopy 19
pulses 17
optics 17
materials science, multidisciplinary 16
instruments & instrumentation 16
films 15
irradiation 13

Publication Year
2005 290
2004 31
2006 4

Country
usa 86
japan 46
peoples r china 30
germany 24
france 21
russia 20
south korea 17
england 14
canada 13
taiwan 9
italy 9
byelarus 8
brazil 8
ukraine 7
spain 7

Institution
chinese acad sci 11
russian acad sci 9
osaka univ 9
univ tokyo 7
univ texas 7
lawrence livermore natl lab 7
univ calif irvine 6
washington state univ 4
usn 4
univ bonn 4
natl inst adv ind sci & technol 4
nagaoka univ technol 4

colorado state univ 4
cea 4
yonsei univ 3

DataBase
science citation index 325

- # CLUSTER 144
  Studies of femtosecond pulse lasers, especially enhancement of laser pulses, creation of 3d nanostructures, and ablation processes (243 Records)

(Countries: USA, Germany. Institutions: RAS, CAS. American: University of Michigan.).

Cluster Syntax Features

Descriptive Terms
puls 24.2%, laser 17.5%, femtosecond 10.0%, femtosecond.laser 5.5%, laser.pulses 3.6%, ablat 1.5%, pump 1.4%, optic 1.1%, laser.pulse 0.7%, wavelength 0.7%, irradi 0.6%, fluenc 0.6%, intens 0.6%, time 0.5%, excit 0.5%

Discriminating Terms
puls 16.3%, laser 10.0%, femtosecond 7.3%, femtosecond.laser 4.1%, laser.pulses 2.7%, film 1.8%, ablat 1.0%, pump 0.9%, carbon 0.7%, magnet 0.6%, nanotub 0.6%, surfac 0.5%, structur 0.5%, laser.pulse 0.5%, layer 0.5%

Single Word Terms
puls 218, laser 211, femtosecond 128, optic 113, time 82, energi 74, wavelength 73, high 65, intens 65, pump 64, electron 64, gener 64, induc 63, surfac 60, crystal 58

Double Word Terms
laser.pulses 94, femtosecond.laser 88, laser.pulse 48, ti.sapphire 26, time.resolved 25, pump.probe 24, repetition.rate 23, pulse.energy 23, laser.induced 22, laser.ablation 19, laser.irradiation 18, sapphire.laser 18, atomic.force 15, harmonic.generation 15, femtosecond.pulses 15

Triple Word Terms
femtosecond.laser.pulses 30, ti.sapphire.laser 17, femtosecond.laser.pulse 13, atomic.force.microscopy 11, femtosecond.laser.ablation 9, femtosecond.laser.irradiation 9, second.harmonic.generation 8, ultrashort.laser.pulses 7, induced.femtosecond.laser 7, two.photon.absorption 7, short.laser.pulses 7, pump.probe.experiments 7, high.repetition.rate 6, nd.yag.laser 6, repetition.rate.khz 5

Term Cliques
36.42% laser femtosecond femtosecond.laser laser.pulses ablat optic laser.pulse irradi fluenc time
36.05% laser femtosecond femtosecond.laser laser.pulses ablat optic laser.pulse wavelength irradi fluenc
34.16% puls irradi fluenc intens time excit
39.42% puls pump intens time excit
43.37% puls pump optic time excit
42.63% puls pump optic wavelength excit
39.62% puls femtosecond optic irradi fluenc time excit
39.09% puls femtosecond optic wavelength irradi fluenc excit
41.20% puls laser laser.pulses laser.pulse irradi fluenc intens time
41.77% puls laser femtosecond laser.pulses ablat optic laser.pulse irradi fluenc time
41.40% puls laser femtosecond laser.pulses ablat optic laser.pulse wavelength irradi fluenc

Sample Cluster Record Titles

Laser-induced heating and melting of gold nanoparticles studied by time-resolved x-ray scattering

Nanohole-array size dependence of soft x-ray generation enhancement from femtosecond-laser-produced plasma

Anomalous exciton diffusion in the conjugated polymer MEH-PPV measured using a three-pulse pump-dump-probe anisotropy experiment

[Sub-30 nm lithography with near-field scanning optical microscope combined with femtosecond laser]

[Nanostructuring of surfaces by ultra-short laser pulses]

[Picosecond stimulated Raman scattering in crystals]

[Three-dimensional nanostructuring with femtosecond laser pulses]

[Optical limiting of semiconductor nanoparticles for nanosecond laser pulses]

[Femtosecond laser photoelectron projection microscopy of organic nanocomplexes]

Cluster Metrics

Authors
qiu, jr 8
hirao, k 6
zheltikov, am 4
wang, x 4
vitiello, m 4
shimotsuma, y 4
krausz, f 4
bonse, j 4
amoruso, s 4
zhu, cs 3
zhao, cj 3
wiggins, sm 3
teisset, cy 3
taylor, rs 3
song, yl 3

Sources
applied physics letters 19
applied physics a-materials science & processing 16
physical review b 10
journal of applied physics 10
applied physics b-lasers and optics 10
optics letters 9
applied surface science 8
optics express 7
physical review letters 6
quantum electronics 5
physical review a 5
optics communications 5

japanese journal of applied physics part 1-regular papers brief communications & review papers 5
physical review e 4
journal of experimental and theoretical physics 4

Keywords
physics, applied 54
optics 30
pulses 30
optics 29
physics, applied 28
materials science, multidisciplinary 27
physics, multidisciplinary 24
dynamics 21
ablation 21
spectroscopy 19
physics, condensed matter 16
engineering, electrical & electronic 15
chemistry, physical 15
generation 15
emission 13

Publication Year
2005 216
2004 23
2006 4

Country
usa 52
germany 46
japan 36
russia 28
france 19
italy 18
peoples r china 17
england 16
canada 13
south korea 11
spain 9
sweden 7
poland 7
scotland 6
switzerland 5

Institution
russian acad sci 16

chinese acad sci 15
moscow mv lomonosov state univ 8
kyoto univ 8
univ toronto 5
univ tokyo 5
univ munich 5
univ naples federico ii 4
univ michigan 4
polish acad sci 4
osaka univ 4
natl inst adv ind sci & technol 4
max planck inst quantum opt 4
japan sci & technol agcy 4
csic 4

DataBase
science citation index 243

- CLUSTER 145
  Photonic, especially two-photonic, effects: photon absorption and fluorescence, as well as detection (153 Records)

(All previous leading journals have been applied physics related. Present journal leaders: Journal of Physical Chemistry, Optics Letters. Countries: USA, followed by Germany, France, Japan. Institutions: University of Tokyo, University of Grenoble, UCB (only USA institution represented).

Cluster Syntax Features

Descriptive Terms
photon 47.2%, two.photon 8.9%, photon.absorption 2.3%, two.photon.absorption 1.9%, optic 1.7%, absorpt 1.6%, two 1.0%, excit 1.0%, single.photon 0.7%, detector 0.6%, singl 0.5%, nonlinear 0.5%, light 0.5%, energi 0.5%, tpa 0.4%

Discriminating Terms
photon 33.2%, two.photon 6.5%, photon.absorption 1.7%, film 1.6%, two.photon.absorption 1.4%, carbon 0.7%, surfac 0.7%, magnet 0.6%, particl 0.6%, nanotub 0.6%, absorpt 0.6%, nanoparticl 0.5%, single.photon 0.5%, temperatur 0.5%, oxid 0.4%

Single Word Terms
photon 153, optic 84, two 74, absorpt 56, excit 47, singl 42, structur 40, energi 40, electron 39, state 37, time 37, intens 37, high 37, laser 34, light 31

Double Word Terms
two.photon 56, photon.absorption 35, photon.energy 17, single.photon 16, room.temperature 13, one.photon 10, optical.properties 10, three.dimensional 9, band.gap 9, absorption.tpa 8, photon.induced 8, single.molecule 7, photon.flux 7, cross.section 7, time.resolved 7

Triple Word Terms
two.photon.absorption 32, two.photon.induced 8, photon.absorption.tpa 8, absorption.cross.section 5, photon.absorption.cross 5, photon.absorption.coefficients 4, two.photon.excitation 4, scanning.field.optical 4, chemical.vapor.deposition 4, field.optical.microscope 4, two.photon.transitions 4, harmonic.generation.shg 3, single.photon.source 3, large.two.photon 3, single.photon.detectors 3

Term Cliques
37.78% photon excit detector light energi
39.22% photon excit detector singl energi
36.08% photon excit single.photon detector singl
42.75% photon absorpt excit light energi
36.41% photon absorpt two excit nonlinear light tpa
52.12% photon optic singl energi
47.58% photon optic absorpt light energi
39.87% photon optic absorpt two nonlinear light tpa
35.00% photon two.photon photon.absorption two.photon.absorption absorpt two excit nonlinear tpa
37.69% photon two.photon photon.absorption two.photon.absorption optic absorpt two nonlinear tpa

Sample Cluster Record Titles

High-energy-photon dividing effects for increasing the efficiency of nano-sized TiO_2 solar cells

Collective and single-particle dynamics in time-resolved two-photon photoemission

Fine structure of coupled optical modes in photonic molecules

Single photon emission from a dendrimer containing eight perylene diimide chromophores

Two-photon-induced photoenhancement of densely packed CdSe/ZnSe/ZnS nanocrystal solids and its application to multilayer optical data storage

Two-photon absorption in diazobenzene compounds

Two-photon optical-beam-induced current solid-immersion imaging of a silicon flip chip with a resolution of 325 nm

Recurrence and photon statistics in fluorescence fluctuation spectroscopy

Two-photon absorption and fluorescence with quadrupolar and branched chromophores - effect of structure and branching

Cluster Metrics

Authors

yang, dy 3
park, sh 3
lim, tw 3
beermann, j 3
yu, wt 2
yang, pd 2
yang, h 2
yan, hq 2
xu, gb 2
watanabe, k 2
voronov, b 2
verevkin, a 2
torricelli, a 2
swartling, j 2
stasel'ko, di 2

Sources

journal of physical chemistry b 8
optics letters 7
surface science 5
physical review letters 5
applied physics letters 5
optics communications 4
optics and spectroscopy 4
optical materials 4
laser physics letters 4
journal of synchrotron radiation 4
journal of applied physics 4
ieee transactions on applied superconductivity 4
applied physics b-lasers and optics 4
thin solid films 3
solid state communications 3

Keywords

physics, applied 25
optics 25
optics 23
chemistry, physical 20
engineering, electrical & electronic 15
physics, applied 14
physics, multidisciplinary 13
physics, condensed matter 11
materials science, multidisciplinary 10
spectroscopy 10
instruments & instrumentation 9
chemistry, multidisciplinary 8
silver 7
films 7
excitation 7

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2004 16
2006 1

Country

usa 33
germany 28
france 24
japan 23
peoples r china 15
italy 12

russia 10
south korea 7
england 7
poland 6
netherlands 5
switzerland 4
sweden 4
singapore 4
ireland 4

Institution
univ tokyo 6
univ grenoble 5
univ calif berkeley 5
univ munich 4
russian acad sci 4
chinese acad sci 4
univ hamburg 3
univ aalborg 3
tsing hua univ 3
politecn milan 3
natl univ singapore 3
natl inst adv ind sci & technol 3
mit 3
korea adv inst sci & technol 3
japan sci & technol agcy 3

DataBase
science citation index 153

- # CLUSTER 76
  Fabrication and structural/ optical properties of photonic crystals, especially photonic band gap features (238 Records)

(Countries: USA, Japan. Institutions: CNRS, Technical University Denmark, Moscow Lomonosov State University, RAS. No USA representation among leaders.).

Cluster Syntax Features

Descriptive Terms
photon 33.5%, photonic.crystal 16.1%, crystal 6.0%, photonic.crystals 4.4%, waveguid 2.8%, dimensional.photonic 1.7%, photonic.band 1.6%, band 1.5%, dimension 1.2%, optic 1.1%, mode 1.1%, gap 0.9%, slab 0.9%, photonic.band.gap 0.7%, dimensional.photonic.crystal 0.6%

Discriminating Terms
photon 21.3%, photonic.crystal 10.9%, photonic.crystals 2.9%, crystal 1.7%, film 1.7%, waveguid 1.6%, dimensional.photonic 1.2%, photonic.band 1.1%, surfac 0.8%, particl 0.6%, nanoparticl 0.6%, carbon 0.6%, slab 0.6%, magnet 0.6%, temperatur 0.5%

Single Word Terms
photon 232, crystal 213, optic 131, structur 120, dimension 113, band 98, mode 89, two 88, waveguid 69, on 67, gap 65, fabric 65, wavelength 63, light 58, period 57

Double Word Terms
photonic.crystal 163, photonic.crystals 94, dimensional.photonic 67, two.dimensional 55, photonic.band 53, band.gap 50, three.dimensional 36, one.dimensional 33, refractive.index 27, time.domain 24, optical.properties 24, finite.difference 23, difference.time 22, crystal.waveguides 21, crystal.fiber 17

Triple Word Terms
dimensional.photonic.crystal 43, two.dimensional.photonic 38, photonic.band.gap 38, dimensional.photonic.crystals 24, difference.time.domain 22, finite.difference.time 22, photonic.crystal.waveguides 21, photonic.crystal.fiber 17, one.dimensional.photonic 16, three.dimensional.photonic 15, photonic.crystal.waveguide 14, photonic.crystal.slab 14, photonic.crystal.slabs 12, photonic.crystal.fibers 11, photonic.band.gaps 10

Term Cliques
45.56% photon photonic.band band dimension optic mode dimensional.photonic.crystal
41.86% photon dimensional.photonic photonic.band band dimension optic gap photonic.band.gap
44.54% photon waveguid photonic.band dimension optic photonic.band.gap
43.82% photon waveguid photonic.band dimension optic mode

dimensional.photonic.crystal
43.64% photon photonic.crystals dimensional.photonic photonic.band band dimension optic dimensional.photonic.crystal
44.80% photon photonic.crystals dimensional.photonic photonic.band band dimension optic gap
50.26% photon crystal band dimension optic mode slab dimensional.photonic.crystal
48.04% photon crystal photonic.crystals dimensional.photonic band dimension optic slab dimensional.photonic.crystal
52.52% photon photonic.crystal crystal dimensional.photonic dimension optic slab dimensional.photonic.crystal
50.93% photon photonic.crystal crystal waveguid dimension optic mode slab dimensional.photonic.crystal

Sample Cluster Record Titles

Mode-coexistent phase match condition for second harmonic generation in photonic crystal slabs consisting of centrosymmetric materials

Group delay of a coupled-defect waveguide in a photonic crystal

Fast nanopatterning of two-dimensional photonic crystals by electron beam lithography

All-optical modulation in dye-doped nematic liquid crystal photonic bandgap fibers

Broadband photonic crystal waveguide 60 degrees bend obtained utilizing topology optimization

Sol-gel photonic bandgap materials and structures

Distributed feedback regime of photonic crystal waveguide lasers at 1.5 mu m

Tailoring the ultrafast dephasing of quasiparticles in metallic photonic crystals

Vapor swellable colloidal photonic crystals with pressure tunability

Cluster Metrics

Authors
talneau, a 7
zheltikov, am 6
sakoda, k 6
ozbay, e 6
krauss, tf 6

raj, r 5
raineri, f 5
levenson, a 5
giessen, h 5
caglayan, h 5
bulu, i 5
vecchi, g 4
van hulst, nf 4
tanaka, y 4
seassal, c 4

Sources

applied physics letters 35
optics express 26
physical review b 19
optics letters 8
applied physics b-lasers and optics 8
physical review e 7
journal of applied physics 7
journal of optics a-pure and applied optics 6
physical review letters 5
physica e-low-dimensional systems & nanostructures 5
journal of lightwave technology 5
ieee photonics technology letters 5
optics communications 4
ieee journal on selected areas in communications 4
acta physica sinica 4

Keywords

physics, applied 62
optics 49
physics, condensed matter 31
optics 31
engineering, electrical & electronic 29
physics, multidisciplinary 18
light 18
laser 17
physics, applied 15
emission 13
crystals 13
photonic crystal 12
transmission 12
photonic crystal 12
chemistry, physical 11

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2004 23
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Country

usa 46
japan 37
france 27
peoples r china 26
germany 24
italy 22
russia 17
canada 15
denmark 11
england 9
spain 8
scotland 8
taiwan 7
sweden 7
turkey 6

Institution

cnrs 13
tech univ denmark 9
moscow mv lomonosov state univ 9
russian acad sci 8
univ twente 6
univ toronto 6
univ st andrews 6
univ lecce 6
univ bonn 6
bilkent univ 6
univ tokyo 5
univ pavia 5
natl inst mat sci 5
kyoto univ 5
hokkaido univ 5

DataBase

science citation index 238

- # CLUSTER 79
  Optical waveguides, especially propagation of light through waveguides (139 Records)

(Countries: USA, followed by Japan, France. Institutions: University Trent, Polytechnic Milan, CAS, CNR. No USA representation among leaders.).

Cluster Syntax Features

Descriptive Terms
waveguid 57.4%, optic 5.6%, mode 1.8%, loss 1.3%, propag 1.2%, optical.waveguide 1.1%, coupler 0.9%, devic 0.9%, index 0.8%, integr 0.7%, wavelength 0.7%, planar 0.7%, coupl 0.6%, silicon 0.5%, refract 0.4%

Discriminating Terms
waveguid 37.8%, optic 1.9%, film 1.6%, surfac 0.8%, optical.waveguide 0.8%, mode 0.7%, propag 0.6%, loss 0.6%, temperatur 0.6%, particl 0.6%, coupler 0.6%, carbon 0.6%, nanoparticl 0.6%, nanotub 0.5%, magnet 0.5%

Single Word Terms
waveguid 134, optic 112, mode 62, loss 47, high 45, fabric 44, devic 44, structur 42, coupl 41, low 40, propag 40, integr 39, two 37, wavelength 35, planar 34

Double Word Terms
optical.waveguide 23, single.mode 19, refractive.index 19, optical.waveguides 17, silicon.insulator 13, planar.waveguides 13, integrated.optical 11, planar.waveguide 10, low.loss 10, beam.propagation 9, spot.size 8, finite.difference 8, time.domain 8, two.dimensional 8, electric.field 8

Triple Word Terms
difference.time.domain 7, finite.difference.time 7, semiconductor.optical.amplifier 5, silicon.insulator.soi 5, field.scanning.optical 5, scanning.optical.microscopy 4, multiple.quantum.mqw 4, single.mode.optical 4, spot.size.converter 4,

low.refractive.index 3, optical.path.length 3, low.optical.loss 3, reactive.ion.etching 3, electric.field.distribution 3, dimensional.finite.difference 3

Term Cliques
30.58% optic coupler index wavelength planar refract
34.82% optic coupler index integr coupl
30.73% optic coupler index integr wavelength planar silicon
36.40% optic coupler devic integr coupl
35.54% optic coupler devic integr wavelength
42.75% waveguid optic index integr wavelength planar silicon
42.34% waveguid optic propag index wavelength planar refract
42.86% waveguid optic propag index wavelength planar silicon
44.09% waveguid optic loss index integr wavelength silicon
50.00% waveguid optic loss devic integr coupl
49.28% waveguid optic loss devic integr wavelength
43.68% waveguid optic loss propag index wavelength refract
44.19% waveguid optic loss propag index wavelength silicon
49.64% waveguid optic mode index integr planar
53.24% waveguid optic mode optical.waveguide integr
45.12% waveguid optic mode propag index planar refract
53.38% waveguid optic mode propag optical.waveguide
48.10% waveguid optic mode loss index integr coupl
46.45% waveguid optic mode loss propag index refract
48.20% waveguid optic mode loss propag index coupl

Sample Cluster Record Titles

Embedded polymer waveguides: design and fabrication approaches

A broadband waveguide for protein crystallography under intense microwave fields

Propagation in erbium and silicon codoped silica slab waveguides: analysis of gain

Pure-silica optical waveguides, fiber couplers, and high-aspect ratio submicrometer channels for electrokinetic separation devices

Stimulated emission and optical gain in LaF3 : Nd nanoparticle-doped polymer-based waveguides

Selective MOVPE growth of tilted arrayed waveguides from [011] direction

Optical waveguides with an aqueous core and a low-index nanoporous cladding

An integrated 2x2 SSFLC optical switch with channel ion-exchanged glass waveguides

Optical isolation in Cd1-xMnxTe magneto-optical waveguide grown on GaAs substrate

Cluster Metrics

Authors
pavesi, l 5
longhi, s 5
daldosso, n 4
zhu, hl 3
zhou, f 3
zayets, v 3
wang, w 3
wang, lf 3
van thourhout, d 3
shimotaya, s 3
shimomura, k 3
laporta, p 3
kawakita, y 3
hou, lp 3
bian, j 3

Sources
applied physics letters 15
ieee photonics technology letters 14
optics express 9
optics letters 7
journal of applied physics 7
optics communications 6
optical materials 4
optical engineering 4
ieee journal of selected topics in quantum electronics 4
physical review a 3
radio science 2
physical review letters 2
physical review b 2
physica status solidi a-applications and materials science 2
microwave and optical technology letters 2

Keywords
engineering, electrical & electronic 37
optics 34
optics 33
physics, applied 26
physics, applied 20
fabrication 12

physics, condensed matter 10
integrated optics 10
films 10
wave-guides 7
physics, multidisciplinary 7
materials science, multidisciplinary 7
light 7
wave-guide 6
instruments & instrumentation 6

Publication Year

2005 123
2004 14
2006 2

Country

usa 25
japan 18
france 16
italy 14
south korea 12
peoples r china 10
germany 9
england 8
spain 7
canada 7
czech republic 6
russia 5
australia 5
taiwan 4
singapore 3

Institution

univ trent 6
politecn milan 6
chinese acad sci 6
cnr 5
korea adv inst sci & technol 4
cnrs 4
australian natl univ 4
acad sci czech republ 4
univ southampton 3
state univ ghent 3
sophia univ 3
russian acad sci 3
natl inst adv ind sci & technol 3

nanyang technol univ 3
charles univ 3

DataBase
science citation index 139

- # CLUSTER 40
  Design, fabrication, and characterization of gratings, such as Bragg gratings, or structures containing gratings, primarily for optical applications (103 Records)

(Countries: USA prominent, followed by China, Japan, France, Korea. Institutions: Paul Scherrer Institute, MIT, Electronics and Telecommunications Research Institute. Other USA leaders are UCSB, University of Arizona.).

Cluster Syntax Features

Descriptive Terms
grate 69.3%, optic 1.5%, bragg 1.5%, wavelength 1.4%, period 0.8%, coupler 0.7%, fiber 0.5%, waveguid 0.5%, polar 0.5%, bragg.grating 0.4%, index 0.4%, bragg.gratings 0.4%, devic 0.4%, diffract 0.4%, holograph 0.3%

Discriminating Terms
grate 43.6%, film 1.7%, bragg 0.9%, surfac 0.6%, nanoparticl 0.6%, carbon 0.6%, magnet 0.5%, wavelength 0.5%, particl 0.5%, nanotub 0.5%, structur 0.5%, temperatur 0.4%, oxid 0.4%, deposit 0.4%, coupler 0.4%

Single Word Terms
grate 103, optic 62, wavelength 41, period 37, high 35, fabric 29, two 28, diffract 27, devic 25, effici 24, structur 23, beam 23, reflect 22, order 22, america 22

Double Word Terms
refractive.index 11, bragg.grating 9, two.dimensional 8, bragg.gratings 8, electron.beam 7, grating.period 6, fiber.bragg 6, single.mode 5, grating.structure 5, liquid.crystal 5, efficiency.grating 5, diffraction.efficiency 5, sub.wavelength 5, grating.fabricated 5, coupling.efficiency 5

Triple Word Terms
electron.beam.lithography 4, fiber.bragg.grating 4, high.aspect.ratio 3, wavelength.division.multiplexing 3, fiber.bragg.gratings 3, laser.interference.lithography 3, holographic.polymer.dispersed 2, distributed.bragg.reflector 2, one.two.dimensional 2, high.diffraction.efficiency 2, beam.lithography.reactive 2, low.insertion.loss 2, lithography.reactive.ion 2, scanning.electron.microscope 2, first.time.knowledge 2

Term Cliques
31.07% grate bragg wavelength bragg.grating bragg.gratings holograph
31.72% grate bragg wavelength fiber bragg.grating bragg.gratings
31.90% grate bragg wavelength fiber waveguid bragg.grating devic
51.21% grate optic polar diffract
55.58% grate optic period diffract
40.78% grate optic wavelength polar index holograph
38.70% grate optic wavelength fiber waveguid index devic
39.16% grate optic wavelength coupler index holograph
38.14% grate optic wavelength coupler waveguid index devic
42.72% grate optic wavelength period fiber bragg.gratings
41.47% grate optic wavelength period fiber index devic
39.64% grate optic bragg wavelength bragg.gratings holograph
40.29% grate optic bragg wavelength fiber bragg.gratings
39.25% grate optic bragg wavelength fiber waveguid devic

Sample Cluster Record Titles

Tunable dispersion compensator based on a fiber Bragg grating written in a tapered fiber

Normal-incidence polarized reflectometry for overlay metrology

Analog piezoelectric-driven tunable gratings with nanometer resolution

Holographic grating recording in azobenzene polymer films

Implementation of a distributed temperature sensor utilising a chirped Moire fibre Bragg grating

Precision laser diffractometry for grating period measurements

The complete analytical form and analysis on angular dispersion formula of two-dimensional grating

High contrast InP/InGaAsP grating MOCVD regrowth using TBA and TBP

Broad-band tunable all-fiber bandpass filter based on hollow optical fiber and long-period grating pair

Cluster Metrics

Authors
park, y 4
paek, mc 4
david, c 4
weitkamp, t 3
suh, d 3
longhi, s 3
lee, kd 3
diaz, a 3
ahn, sw 3
ziegler, e 2
yamaguchi, t 2
visnovsky, s 2
skogen, ej 2
ryu, hj 2
ryu, h 2

Sources
applied physics letters 11
optics letters 10
optics express 8
ieee photonics technology letters 6
optics communications 4
physical review e 3
optical materials 3
electronics letters 3
applied optics 3
review of scientific instruments 2
physical review letters 2
optical review 2
nanotechnology 2
microsystem technologies-micro-and nanosystems-information storage and processing systems 2
journal of the optical society of america b-optical physics 2

Keywords
optics 33
physics, applied 23
engineering, electrical & electronic 20
optics 18
physics, applied 12
physics, multidisciplinary 7

materials science, multidisciplinary 6
diffraction 6
instruments & instrumentation 5
optical 4
silicon 3
physics, fluids & plasmas 3
engineering, multidisciplinary 3
diffraction 3
spectroscopy 3

Publication Year
2005 92
2004 11

Country
usa 19
peoples r china 13
japan 12
france 12
south korea 11
italy 7
germany 7
switzerland 5
russia 5
taiwan 4
spain 4
sweden 3
england 3
czech republic 3
singapore 2

Institution
paul scherrer inst 4
mit 4
elect & telecommun res inst 4
univ shizuoka 3
politecn milan 3
lg elect inst technol 3
european synchrotron radiat facil 3
cnrs 3
chinese acad sci 3
univ tokyo 2
univ sannio 2
univ electrocommun 2
univ calif santa barbara 2
univ arizona 2

tohoku univ 2

DataBase
science citation index 103

- # CLUSTER 236
  Optical properties of nanostructures/ nanomaterials, optical materials and devices, and optical microscopy studies (359 Records)

(Countries: USA very dominant, followed by Japan, France, Germany. Institutions: CAS, Chalmers University Technology, CNRS. Leading USA institutions include University of Central Florida, University of Arizona, Northwestern University.).

Cluster Syntax Features

Descriptive Terms
optic 43.1%, field 2.1%, fiber 1.7%, modul 1.2%, field.optical 1.2%, wavelength 1.0%, snom 0.9%, polar 0.8%, light 0.7%, beam 0.7%, absorpt 0.7%, optical.properties 0.7%, switch 0.6%, scanning.field 0.6%, probe 0.5%

Discriminating Terms
optic 32.6%, film 2.0%, field.optical 1.0%, fiber 0.9%, carbon 0.9%, snom 0.8%, modul 0.8%, nanotub 0.8%, surfac 0.7%, magnet 0.7%, deposit 0.6%, nanoparticl 0.5%, oxid 0.5%, scanning.field 0.5%, field 0.5%

Single Word Terms
optic 357, field 115, high 106, structur 97, properti 92, wavelength 89, light 84, singl 74, two 69, surfac 68, system 66, scan 66, experiment 66, absorpt 63, depend 61

Double Word Terms

optical.properties 61, field.optical 47, optical.microscopy 39, scanning.field 32, refractive.index 25, optical.absorption 22, absorption.spectra 14, liquid.crystal 14, two.dimensional 14, microscopy.snom 14, atomic.force 14, room.temperature 14, optical.fiber 14, three.dimensional 13, band.gap 13

Triple Word Terms

scanning.field.optical 31, field.optical.microscopy 26, optical.microscopy.snom 13, field.scanning.optical 12, field.optical.microscope 11, scanning.optical.microscopy 11, optical.absorption.spectra 9, atomic.force.microscopy 9, semiconductor.optical.amplifier 9, apertureless.scanning.field 7, optical.microscopy.nsom 6, two.dimensional.optical 5, signal.noise.ratio 5, scanning.electron.microscopy 5, force.microscopy.afm 5

Term Cliques

43.27% optic absorpt probe
44.66% optic absorpt optical.properties
39.14% optic polar light optical.properties
33.82% optic polar light beam probe
47.26% optic wavelength absorpt
28.93% optic modul wavelength polar light beam switch
33.48% optic fiber light beam probe
31.24% optic fiber wavelength light beam switch
33.70% optic fiber wavelength snom light
26.32% optic field fiber field.optical snom light scanning.field probe

Sample Cluster Record Titles

Development of CMOS integrated optical receiver for short-range data communication

Advances in organic electro-optic materials and processing

Numerical modeling of the subwavelength phase-change recording using an apertureless scanning near-field optical microscope

Nanotechnology for smart polymer optical devices

Imaging optical near-fields of nanostructures

Light emission induced by tunneling electrons from surface nanostructures observed by novel conductive and transparent probes

Nanotechnology with atom optics

Modelling topographical artifacts in scanning near-field optical microscopy

Near-field optical transmittance of metal particle chain waveguides

Cluster Metrics

Authors

cacialli, f 5
park, yp 4
park, nc 4
latini, g 4
garbin, v 4
ferrari, e 4
fenwick, o 4
di fabrizio, e 4
cojoc, d 4
barchiesi, d 4
andrekson, pa 4
ambrosio, a 4
allegrini, m 4
zheludev, ni 3
yao, bl 3

Sources

optics express 30
applied physics letters 26
ieee photonics technology letters 20
physical review b 18
optics letters 13
journal of the korean physical society 11
journal of applied physics 11
microsystem technologies-micro-and nanosystems-information storage and processing systems 8
japanese journal of applied physics part 1-regular papers brief communications & review papers 8
applied optics 8
journal of lightwave technology 6
physical review letters 5
optics communications 5
journal of physics-condensed matter 5
ultramicroscopy 4

Keywords

optics 72
engineering, electrical & electronic 63
physics, applied 59
optics 43
physics, applied 37

physics, condensed matter 33
physics, multidisciplinary 24
materials science, multidisciplinary 20
light 20
spectroscopy 17
chemistry, physical 16
chemistry, multidisciplinary 16
photoluminescence 16
materials science, multidisciplinary 16
resolution 15

Publication Year
2005 323
2004 36

Country
usa 95
japan 36
france 33
germany 32
england 28
peoples r china 22
south korea 19
taiwan 18
italy 18
sweden 16
russia 12
spain 10
australia 10
switzerland 7
singapore 7

Institution
chinese acad sci 11
chalmers univ technol 9
cnrs 8
univ technol troyes 7
univ paris 06 7
yonsei univ 6
univ southampton 6
univ cent florida 6
univ cambridge 6
univ coll london 5
univ arizona 5
russian acad sci 5
northwestern univ 5

cnr 5
acreo ab 5

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science citation index 359

- # CLUSTER 128
  Optical nonlinearities in nanostructures and investigation of second harmonic generation (105 Records)

(Countries: USA, followed by a second tier of Japan and Russia, followed by a third tier of Germany, China, France. Institutions: RAS, CAS, Univerdsity Angers, Moscow Lomonosov State. USA leaders: University of Texas.).

Cluster Syntax Features

Descriptive Terms
nonlinear 24.9%, optic 7.8%, nonlinear.optical 5.1%, second.harmonic 3.8%, refract 3.8%, harmon 3.2%, second 2.2%, harmonic.generation 1.6%, shg 1.5%, second.harmonic.generation 1.4%, third.order 1.1%, gener 1.0%, wave 0.9%, third 0.9%, refractive.index 0.9%

Discriminating Terms
nonlinear 16.6%, nonlinear.optical 3.6%, optic 3.1%, second.harmonic 2.7%, refract 2.4%, harmon 2.1%, film 1.3%, second 1.2%, shg 1.1%, harmonic.generation 1.1%, second.harmonic.generation 1.0%, third.order 0.8%, particl 0.6%, surfac 0.6%, magnet

0.6%

Single Word Terms
optic 92, nonlinear 77, order 47, gener 38, second 38, harmon 32, properti 29, refract 29, field 26, phase 26, crystal 25, two 25, polar 25, puls 24, wavelength 24

Double Word Terms
nonlinear.optical 44, second.harmonic 32, harmonic.generation 25, third.order 20, refractive.index 19, order.nonlinear 19, optical.properties 16, optical.response 15, second.order 14, generation.shg 14, order.optical 11, nonlinear.refractive 8, nonlinear.refraction 8, optical.second 7, electric.field 7

Triple Word Terms
second.harmonic.generation 25, harmonic.generation.shg 14, third.order.nonlinear 12, nonlinear.optical.response 11, nonlinear.optical.properties 10, order.nonlinear.optical 8, nonlinear.refractive.index 8, linear.nonlinear.optical 6, second.order.optical 6, second.order.nonlinear 6, optical.second.harmonic 6, third.order.optical 5, four.wave.mixing 4, order.nonlinear.susceptibility 4, nonlinear.optical.spectroscopy 3

Term Cliques
47.62% optic gener wave
34.86% optic refract third.order wave third
41.19% optic nonlinear.optical shg third
36.08% optic nonlinear.optical second.harmonic harmon second harmonic.generation shg second.harmonic.generation gener
47.78% nonlinear optic nonlinear.optical second harmonic.generation second.harmonic.generation
49.71% nonlinear optic nonlinear.optical refract refractive.index
45.08% nonlinear optic nonlinear.optical refract third.order third

Sample Cluster Record Titles

Linear and nonlinear optical characterization of tellurium based chalcogenide glasses

Giant nonlinear optical response of nanoporous anatase layers

Second order optical non-linearity of transparent glass-ceramic materials induced by alternating field

Theory of ultrafast nonlinear refraction in semiconductor superlattices

Nonlinear ultrasonic phase-conjugate beams and their application in ultrasonic imaging

Optical poling of several halogen derivatives of pyrazoloquinoline

Resonant effects in optical second-harmonic generation from alkali covered Si(111)7 x 7

Optical phonon sidebands of electronic intersubband absorption in strongly polar semiconductor heterostructures

Single-beam and enhanced two-beam second-harmonic generation from silicon nanocrystals by use of spatially inhomogeneous femtosecond pulses

Cluster Metrics

Authors

kityk, iv 4
umar, aa 3
takahashi, y 3
ryasnyansky, ai 3
qian, sx 3
oyama, m 3
liu, y 3
komatsu, t 3
ganeev, ra 3
fujiwara, t 3
benino, y 3
timoshenko, vy 2
svelto, o 2
stepanov, al 2
stefanovich, sy 2

Sources

applied physics letters 10
physical review b 7
optics communications 7
optics express 6
journal of the optical society of america b-optical physics 5
ferroelectrics 4
optics letters 3
physics of the solid state 2
physical review letters 2
journal of the korean physical society 2
journal of physics-condensed matter 2
journal of optics a-pure and applied optics 2
journal of optical technology 2
journal of luminescence 2

journal of applied physics 2

Keywords
optics 30
physics, applied 17
physics, condensed matter 14
physics, multidisciplinary 11
absorption 8
thin-films 7
physics, condensed matter 6
optics 6
materials science, multidisciplinary 5
chemistry, physical 5
2nd-harmonic generation 5
spectroscopy 5
materials science, multidisciplinary 5
laser 5
index 5

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2005 92
2004 12
2006 1

Country
usa 24
japan 19
russia 18
germany 15
peoples r china 14
france 13
italy 8
poland 6
uzbekistan 4
ukraine 4
turkey 4
south korea 4
sweden 3
austria 3
singapore 2

Institution
russian acad sci 10
chinese acad sci 6
univ angers 4
moscow mv lomonosov state univ 4

univ texas 3
univ paris 06 3
tohoku univ 3
samarkand state univ 3
osaka univ 3
natl inst mat sci 3
nagaoka univ technol 3
max born inst nichtlineare opt & kurzzeitspektros 3
kyoto univ 3
japan sci & technol corp 3
fudan univ 3

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science citation index 105

- CLUSTER 169
  Plasmons: surface-plasmon resonance technology, surface dynamics, surface-plasmons in metallic structures, Raman scattering experiments, and studies of plasmons by finite difference time domain method (336 Records)

(Country: USA dominant, followed by France, Japan, Germany. Institutions: University Maryland, University Aalborg, RAS, Northwestern University. USA leaders also include UCB, Argonne National Lab.)

Cluster Syntax Features

Descriptive Terms
plasmon 24.4%, surface.plasmon 6.9%, reson 4.7%, polariton 3.7%, optic 2.8%, surfac 2.2%, metal 2.0%, scatter 1.8%, plasmon.resonance 1.5%, spr 1.5%, field 1.5%, mode 1.4%, wavelength 1.4%, excit 1.3%, light 1.3%

Discriminating Terms
plasmon 18.2%, surface.plasmon 5.0%, polariton 2.9%, reson 2.6%, film 1.2%, spr 1.0%, plasmon.resonance 1.0%, spp 0.9%, scatter 0.8%, optic 0.8%, carbon 0.7%, surface.plasmon.resonance 0.7%, wavelength 0.7%, electromagnet 0.7%, temperatur 0.7%

Single Word Terms
plasmon 252, surfac 242, optic 207, reson 180, metal 155, field 135, light 118, excit 115, wavelength 111, scatter 96, mode 94, structur 88, film 85, two 82, dielectr 77

Double Word Terms
surface.plasmon 179, plasmon.resonance 100, surface.plasmons 46, raman.scattering 40, plasmon.polaritons 38, resonance.spr 33, time.domain 33, finite.difference 33, difference.time 32, refractive.index 30, plasmon.polariton 29, field.optical 26, optical.properties 23, plasmon.resonances 22, metal.dielectric 20

Triple Word Terms
surface.plasmon.resonance 83, surface.plasmon.polaritons 35, plasmon.resonance.spr 33, difference.time.domain 32, finite.difference.time 32, surface.plasmon.polariton 23, field.optical.microscopy 14, surface.raman.scattering 14, scanning.field.optical 13, surface.plasmon.resonances 12, plasmon.polaritons.spps 11, localized.surface.plasmon 11, plasmon.polariton.spp 10, attenuated.total.reflection 10, excitation.surface.plasmon 8

Term Cliques
36.35% polariton optic scatter field wavelength excit light
35.33% polariton optic scatter field mode wavelength excit
41.02% reson optic scatter wavelength excit light
39.83% reson optic scatter mode wavelength excit
42.49% plasmon polariton optic metal field mode wavelength excit
47.36% plasmon reson optic metal mode wavelength excit
47.23% plasmon surface.plasmon polariton optic surfac metal field wavelength excit light
49.74% plasmon surface.plasmon reson optic surfac plasmon.resonance wavelength excit light
47.22% plasmon surface.plasmon reson optic surfac plasmon.resonance spr wavelength light
51.55% plasmon surface.plasmon reson optic surfac metal wavelength excit light

Sample Cluster Record Titles

Surface plasmon resonance: Theoretical evolutionary design optimization for a model analyte sensitive absorbing-layer system

Surface plasmon polariton based modulators and switches operating at telecom wavelengths

Evidence of multipolar excitations in surface enhanced Raman scattering

Resolution enhancement of a surface immersion microscope near the plasmon resonance

Coherent anti-Stokes Raman scattering as a local probe for nanocomposite materials: theoretical introduction into nanoCARS

Surface plasmon excitation on a single subwavelength hole in a metallic sheet

Plasmonic subwavelength waveguides: next to zero losses at sharp bends

Study of electromagnetic energy propagation on Au nanowires using finite-difference-time-domain method

Plasmonics - Towards subwavelength optical devices

Cluster Metrics

Authors

bozhevolnyi, si 12
smolyaninov, ii 7
leosson, k 7
zayats, av 6
schatz, gc 6
nikolajsen, t 6
leitner, a 6
krenn, jr 6
kim, j 6
hohenau, a 6
aussenegg, fr 6
van duyne, rp 5
ditlbacher, h 5
zhu, j 4
zheltikov, am 4

Sources

physical review b 40
optics express 26
optics letters 23
applied physics letters 23
nano letters 14
sensors and actuators b-chemical 13
physical review letters 13
journal of physical chemistry b 13
journal of applied physics 12
optics communications 11
journal of chemical physics 10
applied optics 9
journal of optics a-pure and applied optics 8
journal of the optical society of america b-optical physics 6
journal of the korean physical society 6

Keywords
optics 92
physics, condensed matter 51
physics, applied 48
nanoparticles 37
light 35
films 34
spectroscopy 31
scattering 28
physics, multidisciplinary 24
surface 24
optics 22
chemistry, physical 20
chemistry, analytical 20
microscopy 20
particles 19

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2005 303
2004 31
2006 2

Country
usa 101
france 43
japan 35
germany 29
russia 22
peoples r china 22
denmark 15

taiwan 14
south korea 14
england 14
canada 11
spain 10
netherlands 10
austria 9
india 7

Institution
univ maryland 12
univ aalborg 12
russian acad sci 10
northwestern univ 10
univ calif berkeley 8
karl franzens univ graz 8
cnrs 8
argonne natl lab 7
univ paris 06 6
seoul natl univ 6
queens univ belfast 6
osaka univ 6
micro managed photons as 6
leiden univ 6
indian inst technol 6

DataBase
science citation index 336

- ## CLUSTER 247
  Measurement and detection using optical instruments, with focus on

the instrument parameters and features, especially mirrors and lenses (314 Records)

(Countries: USA dominant, followed by Japan, Germany, China. Journals: mainly optics and instrumentation journals. Institutions: NASA, Tsing Hua University, RAS, CAS. Other leading USA institutions include US Army, University Colorado, Caltech, University of Central Florida, UCI, UCB, Northwestern University, University Washington, MIT.)

Cluster Syntax Features

Descriptive Terms

wavelength 8.7%, optic 5.5%, resolut 4.0%, spectral 3.8%, imag 3.1%, light 2.7%, detector 1.4%, reflect 1.3%, mirror 1.3%, measur 1.1%, mask 1.0%, instrument 0.9%, infrar 0.8%, solar 0.8%, scatter 0.8%

Discriminating Terms

wavelength 6.6%, spectral 2.8%, resolut 2.6%, optic 2.4%, film 2.2%, imag 1.6%, light 1.3%, detector 1.1%, mirror 1.0%, nanoparticl 0.8%, carbon 0.8%, nanotub 0.7%, mask 0.7%, reflect 0.7%, magnet 0.7%

Single Word Terms

optic 198, wavelength 158, resolut 124, light 115, high 107, measur 106, two 100, imag 92, structur 90, spectral 88, system 74, surfac 68, reflect 59, time 58, layer 56

Double Word Terms

high.resolution 38, spatial.resolution 24, spectral.resolution 22, photo.optical 18, two.dimensional 18, optical.coherence 18, coherence.tomography 17, numerical.aperture 15, light.source 14, visible.infrared 12, focal.plane 12, light.scattering 11, real.time 11, resolution.imaging 10, resolution.optical 10

Triple Word Terms

optical.coherence.tomography 17, extreme.ultraviolet.euv 6, quantum.infrared.photodetector 6, single.scattering.albedo 6, high.spectral.resolution 5, coupled.device.ccd 5, difference.time.domain 5, width.half.maximum 5, quantum.infrared.photodetectors 5, finite.difference.time 5, charge.coupled.device 5, tunable.filter.aotf 5, full.width.half 5, absorption.cross.section 5, wavelength.division.multiplexing 4

Term Cliques

26.11% light reflect measur scatter
25.00% imag light reflect scatter
24.20% spectral imag scatter

24.90% resolut spectral measur instrument solar
24.15% resolut spectral detector measur instrument infrar
25.10% resolut spectral imag detector infrar
37.18% optic light measur scatter
36.07% optic imag light scatter
29.99% optic resolut detector measur instrument infrar
37.20% optic resolut light detector measur
32.10% optic resolut imag detector infrar
35.22% optic resolut imag light mask
36.31% optic resolut imag light detector
29.54% wavelength reflect measur scatter
27.79% wavelength reflect mirror measur
25.11% wavelength spectral measur instrument solar scatter
25.96% wavelength spectral detector measur instrument infrar
40.34% wavelength optic mask
35.48% wavelength optic measur instrument scatter
31.79% wavelength optic detector measur instrument infrar
30.57% wavelength optic detector mirror measur instrument

Sample Cluster Record Titles

Process technology of aspherical mirrors manufacturing with magnetorheological finishing

Ethanol and H2S gas detection in air and in reducing and oxidising ambience: application of pattern recognition to analyse the output from temperature-modulated nanoparticulate WO3 gas sensors

Characterization of Asian dust and Siberian smoke with multiwavelength Raman lidar over Tokyo, Japan in spring 2003

Ultrasoft x-ray spectroscopy using multilayer mirrors on TCV

High quality light guide plates that can control the illumination angle based on microprism structures

Phase calibration of spatially nonuniform spatial light modulators

Blue integumentary structural colours in dragonflies (Odonata) are not produced by incoherent Tyndall scattering

Small-angle x-ray scattering with the new NanoSTAR-U principles & applications

A three-wavelength optical extinction cell for measuring aerosol light extinction and its application to determining light absorption coefficient

Cluster Metrics

Authors
woods, tn 5
yan, yb 4
stiebig, h 4
mcclintock, we 4
jin, gf 4
drexler, w 4
chen, zp 4
boreman, gd 4
van leeuwen, tg 3
tsui, dc 3
snow, m 3
sattmann, h 3
rafol, sb 3
povazay, b 3
platt, u 3

Sources
optics express 15
review of scientific instruments 12
applied optics 12
journal of vacuum science & technology b 11
geophysical research letters 9
optical engineering 8
applied physics letters 8
journal of biomedical optics 7
optics letters 6
journal of optics a-pure and applied optics 6
japanese journal of applied physics part 1-regular papers short notes & review papers 6
ieee photonics technology letters 6
journal of geophysical research-atmospheres 5
journal of applied physics 5
solar physics 4

Keywords
optics 63
engineering, electrical & electronic 46
physics, applied 44
optics 38
physics, applied 32
instruments & instrumentation 30
spectroscopy 15

astronomy & astrophysics 14
physics, multidisciplinary 13
meteorology & atmospheric sciences 10
tissue 10
absorption 10
geosciences, multidisciplinary 9
chemistry, physical 9
lithography 9

Publication Year

2005 281
2004 31
2006 2

Country

usa 123
japan 37
germany 32
peoples r china 27
france 19
russia 17
south korea 14
netherlands 13
switzerland 12
taiwan 9
italy 8
england 8
spain 7
canada 7
austria 6

Institution

nasa 9
tsing hua univ 7
russian acad sci 7
chinese acad sci 7
usa 6
univ colorado 6
caltech 6
univ cent florida 5
univ calif irvine 5
univ calif berkeley 5
paul scherrer inst 5
northwestern univ 5
univ washington 4
univ paris 06 4

mit 4

DataBase
science citation index 314

- # CLUSTER 189
  Imaging using various forms of electron microscopy, including SEM, STEM, and TEM, as well as atomic force microscopy (178 Records)

(Countries: USA dominant; Germany, Japan, next tier. Institutions: University Melbourne, UCB, ORNL, University Osaka. Other USA institutions include NIST, BNL, Northwestern University.)

Cluster Syntax Features

Descriptive Terms
imag 36.5%, resolut 9.6%, spatial 1.4%, electron 1.4%, spatial.resolution 1.4%, microscop 1.2%, aberr 1.2%, scan 1.0%, field 0.9%, high.resolution 0.7%, microscopi 0.7%, reconstruct 0.7%, contrast 0.7%, stem 0.6%, specimen 0.6%

Discriminating Terms
imag 25.5%, resolut 6.3%, film 2.0%, spatial.resolution 1.1%, aberr 0.9%, spatial 0.9%, carbon 0.7%, nanoparticl 0.7%, temperatur 0.6%, nanotub 0.6%, surfac 0.5%, layer 0.5%, oxid 0.5%, particl 0.5%, microscop 0.5%

Single Word Terms
imag 154, resolut 122, electron 91, microscopi 88, high 83, scan 71, microscop 62, field 57, structur 55, spatial 51, transmiss 51, measur 51, surfac 46, atom 44, two 44

Double Word Terms
electron.microscopy 51, high.resolution 46, transmission.electron 45, spatial.resolution 37, electron.microscope 27, scanning.transmission 22, scanning.electron 20, three.dimensional 16, energy.loss 13, resolution.electron 13, dark.field 12, resolution.transmission 12, electron.energy 11, secondary.electron 11, image.processing 11

Triple Word Terms
transmission.electron.microscopy 31, scanning.transmission.electron 20, transmission.electron.microscope 16, high.resolution.transmission 12, resolution.transmission.electron 12, electron.energy.loss 11, scanning.electron.microscope 9, scanning.electron.microscopy 9, annular.dark.field 9,

high.angle.annular 8, energy.loss.spectroscopy 8, angle.annular.dark 8, atomic.force.microscopy 7, high.resolution.electron 7, resolution.electron.microscopy 6

Term Cliques
36.24% resolut electron spatial.resolution scan field microscopi contrast stem
33.71% resolut electron spatial.resolution aberr scan microscopi contrast stem
38.12% resolut electron spatial.resolution microscop scan field contrast
35.23% resolut electron spatial.resolution microscop aberr scan contrast
37.36% resolut spatial electron spatial.resolution scan field microscopi stem
34.83% resolut spatial electron spatial.resolution aberr scan microscopi stem
39.41% resolut spatial electron spatial.resolution microscop scan field
36.52% resolut spatial electron spatial.resolution microscop aberr scan
39.89% imag resolut electron field high.resolution microscopi reconstruct contrast specimen
39.14% imag resolut electron field high.resolution microscopi reconstruct contrast stem
43.13% imag resolut electron scan field high.resolution microscopi contrast specimen
42.38% imag resolut electron scan field high.resolution microscopi contrast stem
37.64% imag resolut electron aberr high.resolution microscopi reconstruct contrast specimen
36.89% imag resolut electron aberr high.resolution microscopi reconstruct contrast stem
40.89% imag resolut electron aberr scan high.resolution microscopi contrast specimen
40.14% imag resolut electron aberr scan high.resolution microscopi contrast stem
43.47% imag resolut electron microscop scan field contrast specimen
40.94% imag resolut electron microscop aberr scan contrast specimen
46.42% imag resolut spatial electron scan field microscopi specimen
45.58% imag resolut spatial electron scan field microscopi stem
43.89% imag resolut spatial electron aberr scan microscopi specimen
43.05% imag resolut spatial electron aberr scan microscopi stem
44.59% imag resolut spatial electron microscop scan field specimen
42.06% imag resolut spatial electron microscop aberr scan specimen

Sample Cluster Record Titles

Charge contrast imaging of gibbsite using the variable pressure SEM

Separation of linear and non-linear imaging components in high-resolution transmission electron microscope images

Symmetries in BF and HAADF STEM image calculations

High-resolution heavy ion track structure imaging

Three-dimensional atomic imaging of Y and (B-12)(13) clusters in YB56 by HREM and crystallographic image processing

[Measurement of wear on asperity level using image-processing techniques]

[High-resolution transmission electron microscopy image simulation of screw dislocation core structures in body centered cubic metals]

[Application of image processing to the characterisation of nanostructures]

[Direct imaging of surface-enhanced Raman scattering in the near field]

Cluster Metrics

Authors
allen, lj 5
takai, y 4
pennycook, sj 4
oxley, mp 4
vladar, ae 3
schonhense, g 3
postek, mt 3
kimura, y 3
kawasaki, t 3
forster, f 3
findlay, sd 3
wu, y 2
weber, n 2
walther, t 2
villarrubia, js 2

Sources
ultramicroscopy 21
on the convergence of bio-information-, environmental-, energy-, space- and nano-technologies, pts 1 and 2 10
surface and interface analysis 7
journal of electron spectroscopy and related phenomena 6
journal of electron microscopy 6
applied physics letters 6
review of scientific instruments 5
physical review b 5
nanotechnology 5
journal of applied physics 4
scanning 3
microscopy and microanalysis 3
journal of vacuum science & technology b 3
surface science 2
small 2

Keywords

microscopy 37
physics, applied 25
resolution 18
microscopy 15
chemistry, physical 13
materials science, multidisciplinary 10
instruments & instrumentation 10
engineering, electrical & electronic 9
surface 9
materials science, multidisciplinary 9
spectroscopy 8
physics, condensed matter 7
transmission electron-microscopy 6
resolution 6
engineering, multidisciplinary 6

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2005 167
2004 11

Country

usa 66
germany 24
japan 23
south korea 14
france 14
england 12
netherlands 8
australia 8
peoples r china 7
taiwan 5
italy 5
brazil 4
switzerland 3
poland 3
israel 3

Institution

univ melbourne 6
univ calif berkeley 6
oak ridge natl lab 6
osaka univ 5
natl inst stand & technol 4
brookhaven natl lab 4

univ oxford 3
univ mainz 3
univ cambridge 3
univ antwerp 3
tohoku univ 3
northwestern univ 3
nagoya univ 3
delft univ technol 3
cnrs 3

DataBase

science citation index 178

- ## CLUSTER 109
  Machining, cutting, grinding, polishing of materials, especially surfaces, and characterization of the materials after these processes (86 Records)

(Countries: Japan, followed by USA, China tied for second. Very applied literature. Institutions: Harbin Institute of Technology, followed by Tohoku University and Singapore Institute of Manufacturing Technology tied for second. USA institutions far behind include Purdue University, Penn State University, ORNL.)

Cluster Syntax Features

Descriptive Terms
machin 17.0%, cut 12.1%, grind 8.9%, polish 3.8%, tool 3.5%, wheel 3.4%, micro 2.9%, diamond 2.3%, surfac 2.2%, rough 1.4%, mold 1.3%, speed 1.3%, edm 1.1%, materi 1.1%, surface.roughness 0.9%

Discriminating Terms
machin 11.1%, cut 7.8%, grind 5.8%, polish 2.4%, wheel 2.2%, tool 2.0%, film 1.8%, micro 1.5%, diamond 1.0%, mold 0.8%, speed 0.7%, edm 0.7%, nanoparticl 0.7%, rough 0.6%, carbon 0.6%

Single Word Terms
surfac 56, machin 53, materi 45, high 35, cut 34, mechan 32, rough 30, micro 29, tool 27, speed 27, forc 26, grind 25, diamond 25, electron 21, microscop 21

Double Word Terms
surface.roughness 22, atomic.force 12, scanning.electron 12, cutting.tool 9, electron.microscopy 9, material.removal 9, diamond.wheel 9, transmission.electron 8, brittle.materials 8, cutting.edge 7, high.speed 7, machined.surface 7, electron.microscope

7, discharge.machining 7, depth.cut 7

Triple Word Terms

atomic.force.microscope 6, scanning.electron.microscopy 6, scanning.electron.microscope 6, force.microscope.afm 5, electrical.discharge.machining 5, atomic.force.microscopy 5, transmission.electron.microscopy 4, discharge.machining.edm 4, force.microscopy.afm 4, surface.roughness.surface 3, material.removal.rate 3, metal.bonded.diamond 3, high.speed.cutting 3, single.crystal.diamond 3, grain.size.diamond 3

Term Cliques

19.77% mold speed
20.93% micro mold
36.88% wheel diamond surfac rough speed materi surface.roughness
18.60% grind mold
33.72% grind wheel surfac rough edm materi surface.roughness
36.54% grind wheel diamond surfac rough materi surface.roughness
32.75% grind polish wheel diamond surfac rough
43.49% cut diamond surfac speed materi
43.02% cut grind diamond surfac materi
40.03% machin tool surfac rough edm materi surface.roughness
43.19% machin tool surfac rough speed materi surface.roughness
39.70% machin grind surfac rough edm materi surface.roughness
41.86% machin grind polish surfac rough
43.22% machin cut tool surfac edm materi
46.90% machin cut tool surfac speed materi
37.98% machin cut tool micro edm materi
42.83% machin cut grind surfac edm materi

Sample Cluster Record Titles

Slip and coupling phenomena at the liquid-solid interface

Effect of polishing process on silica surface laser-induced damage threshold at 355 nm

3D and microstructural analysis of the chip formation during high speed cutting of C45E (AISI 1045)

Accurate estimation of surface roughness from texture features of the surface image using an adaptive neuro-fuzzy inference system

On the effect of crystallographic orientation on ductile material removal in silicon

Structure and properties of polyethylene prepared via low-frequency vibration-assisted injection molding

Grinding characteristics of conventional and ELID methods in difficult-to-cut and hardened brittle materials

Electric discharge machining of Al-10%SiCp as-cast metal matrix composites

Machining characteristics of Ce-ZrO2/CePO4 ceramics

Cluster Metrics

Authors

li, d 4
dong, s 4
zhang, fh 3
kuriyagawa, t 3
jackson, mj 3
huang, h 3
cheng, k 3
zong, wj 2
zhao, ql 2
yin, l 2
wang, hx 2
uematsu, t 2
tor, sb 2
togo, s 2
tay, by 2

Sources

advances in abrasive technology vi 11
precision engineering-journal of the international societies for precision engineering and nanotechnology 8
journal of materials processing technology 8
microsystem technologies-micro-and nanosystems-information storage and processing systems 6
wear 4
advances in abrasive technology viii 4
international journal of machine tools & manufacture 3
applied surface science 3
proceedings of the institution of mechanical engineers part b-journal of engineering manufacture 2
journal of micromechanics and microengineering 2
glass science and technology 2
zeitschrift fur metallkunde 1
ultramicroscopy 1
tribology letters 1

transactions of nonferrous metals society of china 1

Keywords
engineering, manufacturing 15
multidisciplinary 14
materials science, 14
materials science, multidisciplinary 10
engineering, industrial 9
engineering, manufacturing 9
& instrumentation 8
instruments 8
engineering, multidisciplinary 8
engineering, mechanical 7
engineering, electrical & electronic 7
physics, applied 7
engineering, mechanical 7
chemistry, physical 5
materials science, multidisciplinary 5

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2005 62
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Country
japan 21
usa 15
peoples r china 15
south korea 8
germany 7
taiwan 6
singapore 6
england 6
poland 2
malaysia 2
france 2
austria 2
syria 1
russia 1
mauritius 1

Institution
harbin inst technol 8
tohoku univ 5
singapore inst mfg technol 5
tohoku gakuin univ 3

nippon inst technol 3
univ tokyo 2
univ freiburg 2
tsing hua univ 2
toyama prefectural univ 2
pusan natl univ 2
purdue univ 2
penn state univ 2
oak ridge natl lab 2
natl inst adv ind sci & technol 2
nanyang technol univ 2

DataBase
science citation index 86

- CLUSTER 252
  Modeling, design, and simulation of processes and systems at the nanoscale; measurement and minimization, control, and correction of errors (325 Records)

(Countries: USA dominant; followed by Japan, followed by Korea and China. Institutions: Tohoku University, followed by Nanyang Technological University, MIT, Chalmers University Technology. Other leading USA institutions include Penn State University, George Washington University, University of Texas, University of Illinois.).

Cluster Syntax Features

Descriptive Terms
model 5.7%, error 4.9%, system 3.5%, measur 2.6%, design 2.1%, simul 1.8%, sensor 1.6%, paper 1.4%, accuraci 1.4%, machin 1.3%, micro 1.2%, scale 1.2%, precis 1.1%, element 1.0%, data 1.0%

Discriminating Terms

error 4.3%, model 2.8%, film 2.5%, system 1.4%, design 1.4%, accuraci 1.1%, machin 1.1%, measur 1.0%, sensor 0.9%, nanoparticl 0.9%, precis 0.9%, carbon 0.8%, simul 0.8%, nanotub 0.7%, paper 0.7%

Single Word Terms
model 139, system 128, paper 125, measur 107, two 102, high 86, experiment 86, simul 85, applic 78, surfac 74, data 73, design 73, structur 68, on 66, element 65

Double Word Terms
finite.element 46, three.dimensional 25, two.dimensional 17, scanning.electron 14, atomic.force 13, electron.microscopy 12, nano.scale 11, element.model 11, electron.beam 10, high.precision 9, microelectromechanical.systems 9, experimental.data 9, aspect.ratio 9, high.resolution 9, non.linear 8

Triple Word Terms
finite.element.model 11, scanning.electron.microscopy 11, three.dimensional.finite 7, dimensional.finite.element 7, microelectromechanical.systems.mems 7, electron.beam.lithography 5, force.microscope.afm 5, atomic.force.microscope 5, atomic.force.microscopy 5, finite.element.fem 5, scanning.electron.microscope 5, finite.element.fea 3, chemical.mechanical.polishing 3, finite.element.modeling 3, finite.element.simulation 3

Term Cliques
26.46% system paper accuraci scale element
25.69% system simul paper micro scale element
27.51% system design paper accuraci element
19.18% system design sensor machin micro precis
19.90% system design sensor accuraci machin precis
22.77% system design sensor paper machin micro
23.49% system design sensor paper accuraci machin
26.56% system design simul paper micro element
24.62% error measur data
30.62% error system simul paper
21.19% error system measur sensor accuraci machin precis
24.26% error system measur sensor paper accuraci machin
27.14% model paper accuraci scale element
28.92% model simul paper scale element
28.18% model design paper accuraci element
29.97% model design simul paper element
29.23% model error paper accuraci
27.46% model error simul data
31.46% model error simul paper

Sample Cluster Record Titles

Modeling and direct simulation of near-field granular flows

Investigation on influencing factors of AFM micro probe nanomachining

Reliability analysis and design for the fine-pitch flip chip BGA packaging

Modeling the nanoindentation of elastoplastic materials with nonlinear adaptive springs (NASs)

A dual-mode surface encoder for position measurement

Multiple orientation technique for the calibration of cylindrical workpieces on CMMs

Design of integrated eccentric mechanisms and exact constraint fixtures for micron-level repeatability and accuracy

Dynamic model of the grinding process

Motion error correction scheme using the spatial Doppler characteristics of the in-scene target in the SAR imaging system

Cluster Metrics

Authors

kiyono, s 7
gao, w 7
vallance, rr 4
shelton, jw 3
roy, s 3
parker, dh 3
marsh, er 3
lee, sj 3
zhao, yp 2
yokoyama, t 2
yokoyama, s 2
wu, rb 2
wozniak, a 2
welsch, h 2
wang, zy 2

Sources

precision engineering-journal of the international societies for precision engineering and nanotechnology 34
microsystem technologies-micro-and nanosystems-information storage and processing systems 20

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measurement technology and intelligent instruments vi 7
journal of vacuum science & technology b 6
japanese journal of applied physics part 1-regular papers brief communications & review papers 6
review of scientific instruments 5
physical review e 5
applied physics letters 5
sensors and actuators a-physical 4
journal of microelectromechanical systems 4
journal of materials processing technology 4
international journal of solids and structures 4
measurement science & technology 3
journal of micromechanics and microengineering 3

Keywords
engineering, electrical & electronic 71
engineering, manufacturing 39
engineering, multidisciplinary 39
physics, applied 38
& instrumentation 34
instruments 34
materials science, 32
multidisciplinary 31
instruments & instrumentation 24
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materials science, multidisciplinary 18
mechanics 16
design 12
engineering, multidisciplinary 10
engineering, manufacturing 10

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2005 274
2004 42
2006 9

Country
usa 101
japan 48
south korea 32
peoples r china 31
germany 24
taiwan 17
france 14

singapore 11
england 11
russia 10
italy 10
sweden 8
netherlands 8
poland 7
canada 6

Institution
tohoku univ 13
nanyang technol univ 7
mit 6
chalmers univ technol 6
tsing hua univ 5
tech univ denmark 5
seoul natl univ 5
penn state univ 5
osaka univ 5
george washington univ 5
chinese acad sci 5
univ tokyo 4
univ texas 4
univ illinois 4
phys tech bundesanstalt 4

DataBase
science citation index 325

- CLUSTER 213
  Nanomechanical systems, including actuators, resonators, hard disk drives, sensors, and motors (211 Records)

(Countries: USA dominant, followed by Japan and Korea. Institutions: Yonsei University, Ohio State University, Nanyang Technological University, Boston University. Other USA includes UCB, Goergia Institute of Technology.).

Cluster Syntax Features

Descriptive Terms
frequenc 8.8%, actuat 8.7%, reson 6.0%, drive 3.0%, disk 2.8%, motion 2.5%, track 1.9%, mode 1.8%, filter 1.8%, design 1.6%, slider 1.6%, servo 1.4%, vibrat 1.3%, motor 1.1%, system 1.0%

Discriminating Terms
actuat 6.5%, frequenc 5.4%, reson 3.3%, drive 2.1%, film 2.0%, disk 2.0%, motion 1.7%, track 1.4%, slider 1.2%, filter 1.2%, servo 1.1%, design 0.8%, nanoparticl 0.7%, mode 0.7%, vibrat 0.7%

Single Word Terms
frequenc 110, high 81, system 77, reson 73, paper 61, two 59, design 58, mode 57, experiment 56, actuat 53, drive 53, surfac 51, measur 51, mechan 47, structur 47

Double Word Terms
hard.disk 23, disk.drives 20, resonance.frequency 17, disk.drive 17, high.frequency 16, resonant.frequency 13, high.speed 11, resonance.frequencies 10, finite.element 9, single.crystal 8, flying.height 8, resonant.frequencies 8, aspect.ratio 7, optical.disk 7, bandpass.filter 7

Triple Word Terms
hard.disk.drives 15, hard.disk.drive 10, disk.drive.hdd 6, bandpass.filter.bpf 6, signal.noise.ratio 6, single.crystal.silicon 5, voice.coil.motor 5, high.track.density 5, disk.drives.paper 4, chemical.vapor.deposition 4, high.aspect.ratio 4, optical.disk.drive 4, van.der.waals 3, electron.beam.lithography 3, vapor.deposition.pcvd 3

Term Cliques
17.54% mode slider vibrat
10.43% track filter servo
17.06% drive disk track slider servo vibrat motor system
19.36% drive disk track design slider servo system
18.72% drive disk motion track servo vibrat motor system
25.12% reson motion mode vibrat
21.87% actuat drive disk track design servo system
19.61% actuat drive disk motion track servo motor system
26.86% actuat reson motion
39.81% frequenc design
32.94% frequenc reson mode vibrat
31.16% frequenc reson mode filter

Sample Cluster Record Titles

Nonlinear behavior for nanoscale electrostatic actuators with Casimir force

Testing a low-influence spindle drive motor

Macroscopic quantum effects in a strongly driven nanomechanical resonator

Surface properties and electromagnetic excitation of a piezoelectric gallium phosphate biosensor

Vibration response due to lateral tape motion and impulse force in a linear tape drive

Resonators with integrated CMOS circuitry for mass sensing applications, fabricated by electron beam lithography

Microtribodynamics of pseudo-contacting head-disk interfaces intended for 1 Tbit/in(2)

Immunoassay of prostate-specific antigen (PSA) using resonant frequency shift of piezoelectric nanomechanical microcantilever

An iterative learning approach to compensation for the servo track writing error in high track density disk drives

Cluster Metrics

Authors

weng, mh 6
roukes, ml 4
mohanty, p 4
jang, gh 4
du, hj 4
badzey, rl 4
zolfagharkhani, g 3
zendri, jp 3
wu, hw 3
talke, fe 3
taffarello, l 3
tada, h 3
prodi, ga 3
poggi, ma 3
pernegger, h 3

Sources

microsystem technologies-micro-and nanosystems-information storage and processing systems 54
applied physics letters 13

journal of micromechanics and microengineering 9
review of scientific instruments 6
precision engineering-journal of the international societies for precision engineering and nanotechnology 6
sensors and actuators a-physical 5
physical review letters 5
microwave and optical technology letters 5
ieee transactions on microwave theory and techniques 5
ieee transactions on magnetics 5
physical review b 4
nanotechnology 4
journal of applied physics 4
physical review e 3
on the convergence of bio-information-, environmental-, energy-, space- and nano-technologies, pts 1 and 2 3

Keywords
engineering, electrical & electronic 92
physics, applied 67
multidisciplinary 55
materials science, 55
physics, applied 29
instruments & instrumentation 27
materials science, multidisciplinary 18
design 15
physics, multidisciplinary 10
mechanics 9
atomic-force microscope 9
optics 9
physics, condensed matter 7
engineering, multidisciplinary 7
physics, fluids & plasmas 6

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2004 19
2006 1

Country
usa 73
japan 34
south korea 25
taiwan 14
singapore 13
germany 12
peoples r china 9

italy 8
sweden 7
france 6
switzerland 5
denmark 5
india 4
england 4
canada 4

Institution

yonsei univ 6
ohio state univ 6
nanyang technol univ 6
boston univ 6
univ calif berkeley 5
tech univ denmark 5
samsung adv inst technol 5
natl nano device labs 5
georgia inst technol 5
data storage inst 5
chalmers univ technol 5
tohoku univ 4
nagoya univ 4
ist nazl fis nucl 4
hitachi ltd 4

DataBase

science citation index 211

- # CLUSTER 154
  Applications of atomic force microscopy and similar methods of nanomanipulation, with focus on tips and cantilevers, namely their uses and responses to different influences (241 Records)

(Countries: USA dominant, with Germany and Japan the second tier. Institutions: UCB, Tel Aviv University, University Munster, Georgia Institute of Technology. Other USA include North Carolina State University, University of Illinois, Iowa State University, ORNL.)

Cluster Syntax Features

Descriptive Terms
tip 19.6%, forc 10.3%, cantilev 8.4%, probe 3.6%, atomic.force 3.0%, afm 2.5%, atom 2.5%, microscop 2.3%, imag 2.2%, force.microscope 1.9%, atomic.force.microscope 1.7%, tip.sample 1.5%, force.microscopy 1.4%, sampl 1.3%, microscopi 1.1%

Discriminating Terms
tip 13.8%, cantilev 6.2%, forc 5.8%, film 2.1%, probe 2.0%, atomic.force 1.6%, afm 1.3%, force.microscope 1.3%, atomic.force.microscope 1.2%, microscop 1.1%, tip.sample 1.1%, imag 0.9%, nanoparticl 0.7%, atom 0.7%, force.microscopy 0.7%

Single Word Terms
forc 189, atom 167, tip 152, microscopi 138, microscop 124, surfac 114, scan 108, imag 101, sampl 100, measur 94, cantilev 89, probe 85, afm 78, physic 74, resolut 64

Double Word Terms
atomic.force 148, force.microscopy 107, force.microscope 83, tip.sample 48, microscope.afm 33, scanning.probe 30, microscopy.afm 28, scanning.tunneling 27, probe.microscopy 21, tunneling.microscope 18, electric.field 18, sample.surface 18, tip.surface 16, ultrahigh.vacuum 14, afm.tip 14

Triple Word Terms
atomic.force.microscopy 81, atomic.force.microscope 78, force.microscope.afm 32, force.microscopy.afm 28, scanning.tunneling.microscope 18, scanning.probe.microscopy 17, microscopy.atomic.force 11, tip.sample.interaction 11, mode.atomic.force 10, scanning.tunneling.microscopy 10, tunneling.microscope.stm 9, force.microscope.tip 9, noncontact.atomic.force 7, frequency.modulation.atomic 7, modulation.atomic.force 7

Term Cliques
49.68% tip forc cantilev atomic.force afm atom imag tip.sample force.microscopy sampl microscopi
48.67% tip forc cantilev atomic.force afm atom microscop atomic.force.microscope

tip.sample sampl
50.12% tip forc cantilev atomic.force afm atom microscop force.microscope atomic.force.microscope sampl
49.94% tip forc cantilev probe atomic.force atom imag tip.sample force.microscopy sampl microscopi
50.81% tip forc cantilev probe atomic.force atom microscop tip.sample sampl
52.42% tip forc cantilev probe atomic.force atom microscop force.microscope sampl

Sample Cluster Record Titles

Micromachined fountain pen for atomic force microscope-based nanopatterning

Frequency response of atomic force microscope cantilever driven by fluid

Preparation and characterization of single-atom tips

Single-chip mechatronic microsystem for surface imaging and force response studies

Imaging using lateral bending modes of atomic force microscope cantilevers

Development of an atomic force microscope with capability of circumferential profiling

The advancement of SPM-based nanolithography

Kelvin probe microscopy of localized electric potentials induced in insulating materials by electron irradiation

Tip-enhanced near-field CARS microscopy

Cluster Metrics

Authors

salmeron, m 5
holscher, h 5
yamada, h 4
sebastian, a 4
matsushige, k 4
kobayashi, k 4
karapetian, e 4
kalinin, sv 4
kachanov, m 4
fukuma, t 4
chang, wj 4

yang, yc 3
wang, xf 3
schirmeisen, a 3
sader, je 3

Sources

applied physics letters 38
review of scientific instruments 20
nanotechnology 19
physical review b 14
journal of applied physics 9
physical review letters 8
journal of vacuum science & technology b 7
nano letters 6
ultramicroscopy 5
sensors and actuators a-physical 4
japanese journal of applied physics part 1-regular papers brief communications & review papers 4
measurement science & technology 3
langmuir 3
japanese journal of applied physics part 2-letters & express letters 3
applied surface science 3

Keywords

physics, applied 97
surface 33
instruments & instrumentation 30
materials science, multidisciplinary 27
engineering, multidisciplinary 23
tip 23
engineering, electrical & electronic 21
atomic-force microscopy 21
resolution 21
physics, condensed matter 19
microscopy 18
microscopy 17
physics, applied 15
afm 15
physics, multidisciplinary 14

Publication Year

2005 209
2004 30
2006 2

Country

usa 77
germany 39
japan 37
peoples r china 15
france 15
england 14
switzerland 11
taiwan 10
israel 8
australia 8
spain 7
canada 6
turkey 4
south korea 4
singapore 3

Institution
univ calif berkeley 8
tel aviv univ 8
univ munster 7
georgia inst technol 7
n carolina state univ 6
univ tokyo 5
univ illinois 5
iowa state univ 5
cnrs 5
univ melbourne 4
univ autonoma madrid 4
tufts univ 4
suffolk univ 4
osaka univ 4
oak ridge natl lab 4

DataBase
science citation index 241

- # CLUSTER 214
  Atomic force microscopy to measure, fabricate, and manipulate, with focus on rough surfaces (237 Records)

(Countries: USA dominant, followed by Japan, Germany, China. Institutions: CAS, University Tokyo, Osaka University, USAF, University Cambridge, Tsing Hua University, Max Plank Institute for Polymer Research. Other USA include University of Utah, University of South Carolina.).

Cluster Syntax Features

Descriptive Terms

forc 12.7%, atomic.force 6.4%, tip 6.2%, atom 6.1%, afm 5.9%, surfac 5.4%, force.microscopy 4.4%, atomic.force.microscopy 3.6%, rough 2.9%, microscopi 2.7%, contact 0.9%, microscop 0.9%, force.microscope 0.9%, imag 0.8%, atomic.force.microscope 0.8%

Discriminating Terms

forc 8.9%, tip 4.8%, atomic.force 4.8%, afm 4.3%, force.microscopy 3.2%, atom 3.2%, atomic.force.microscopy 2.6%, rough 2.1%, film 2.1%, surfac 1.2%, microscopi 1.0%, particl 0.7%, nanotub 0.7%, magnet 0.7%, carbon 0.7%

Single Word Terms

forc 191, atom 184, surfac 169, microscopi 161, afm 108, tip 72, scan 69, structur 68, microscop 67, electron 64, measur 62, layer 61, contact 58, substrat 57, imag 57

Double Word Terms

atomic.force 163, force.microscopy 138, microscopy.afm 59, force.microscope 47, electron.microscopy 30, surface.roughness 29, scanning.electron 23, microscope.afm 23, single.crystal 13, surfaces.atomic 11, microscopy.atomic 11, afm.tip 11, surface.energy 10, contact.mode 10, transmission.electron 10

Triple Word Terms

atomic.force.microscopy 126, force.microscopy.afm 58, atomic.force.microscope 44, force.microscope.afm 23, scanning.electron.microscopy 19, microscopy.atomic.force 10, surfaces.atomic.force 9, conducting.atomic.force 8, electron.microscopy.sem 7, van.der.waals 7, surface.atomic.force 6, transmission.electron.microscopy 6, ray.photoelectron.spectroscopy 6, focused.ion.beam 6, root.mean.square 6

Term Cliques
48.58% afm surfac force.microscopy atomic.force.microscopy rough microscopi contact
43.74% forc atomic.force tip atom afm microscop force.microscope imag atomic.force.microscope
53.32% forc atomic.force tip atom afm surfac microscop imag
57.76% forc atomic.force tip atom afm surfac force.microscopy atomic.force.microscopy microscopi imag
57.81% forc atomic.force tip atom afm surfac force.microscopy atomic.force.microscopy microscopi contact

Sample Cluster Record Titles

Influence of the atomic force microscope tip on the multifractal analysis of rough surfaces

A comparison of the surface chemistries of chromium electroplated finishes

Nanostructure and atomic structure of glass seen by atomic force microscopy

Determination of solid surface tension from particle-substrate pull-off forces measured with the atomic force microscope

Conducting probe atomic force microscopy investigation of anisotropic charge transport in solution cast PBD single crystals induced by an external field

Revealing contamination on AFM cantilevers by microdrops and microbubbles

Nanofabrication with atomic force microscopy

Spectroscopy in a sub-micrometer thick cell or how to probe the atom-surface interaction with a nanometric spatial resolution

Microdrops on atomic force microscope cantilevers: Evaporation of water and spring constant calibration

Cluster Metrics

Authors
hasegawa, y 4
sugimoto, y 3
reichling, m 3

namba, y 3
morita, s 3
kim, y 3
kim, j 3
heun, s 3
ercolani, d 3
eguchi, t 3
choi, i 3
akiyama, k 3
abe, m 3
zeng, hr 2
zabinski, js 2

Sources
nanotechnology 10
applied physics letters 10
journal of applied physics 8
applied surface science 8
surface science 6
nuclear instruments & methods in physics research section b-beam interactions with materials and atoms 6
tribology letters 5
physical review b 5
journal of physical chemistry b 5
ultramicroscopy 4
photonics spectra 4
nano letters 4
journal of vacuum science & technology b 4
journal de physique iv 4
surface and interface analysis 3

Keywords
physics, applied 37
chemistry, physical 29
surface 25
materials science, multidisciplinary 24
films 19
surfaces 17
silicon 17
materials science, multidisciplinary 16
chemistry, multidisciplinary 15
physics, condensed matter 14
engineering, electrical & electronic 14
physics, applied 14
physics, atomic, molecular & chemical 13
tip 13

physics, condensed matter 13

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2005 214
2004 21
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Country
usa 51
japan 33
germany 33
peoples r china 26
france 14
south korea 13
italy 12
england 11
russia 7
singapore 6
australia 5
taiwan 4
switzerland 4
sweden 4
poland 4

Institution
chinese acad sci 8
univ tokyo 5
osaka univ 5
usaf 4
univ cambridge 4
tsing hua univ 4
max planck inst polymer res 4
univ utah 3
univ twente 3
univ s carolina 3
univ osnabruck 3
univ modena 3
univ bonn 3
seoul natl univ 3
peking univ 3

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science citation index 237

- # CLUSTER 245
  Probing polymer/ molecular chain properties and surface interactions, especially by means of atomic force microscopy (AFM) (274 Records)

(Countries: USA dominant, followed by Japan, Germany, China. Institutions: CAS, Max Plank Institute of Polymer Research, Kyoto University. Other USA include Harvard University, University of Massachusetts, Columbia University, VPI, University of Utah.).

Cluster Syntax Features

Descriptive Terms
chain 14.6%, forc 10.2%, surfac 2.3%, polym 2.3%, afm 2.3%, atomic.force 1.8%, interact 1.7%, conform 1.6%, atom 1.4%, molecular 1.3%, water 1.3%, force.microscopy 1.3%, molecul 1.2%, atomic.force.microscopy 1.1%, interfac 1.1%

Discriminating Terms
chain 12.3%, forc 7.5%, film 1.7%, afm 1.5%, conform 1.3%, atomic.force 1.2%, magnet 0.8%, mica 0.8%, force.microscopy 0.8%, nanotub 0.7%, atomic.force.microscopy 0.7%, temperatur 0.7%, carbon 0.7%, nanoparticl 0.6%, polym 0.6%

Single Word Terms
surfac 159, forc 151, atom 135, chain 133, microscopi 119, structur 102, molecular 101, interact 97, molecul 89, polym 85, afm 81, water 77, two 73, solut 67, measur 66

Double Word Terms
atomic.force 116, force.microscopy 99, microscopy.afm 47, force.microscope 28, water.interface 24, chain.length 23, air.water 23, polymer.chains 21, molecular.weight 20, self.assembled 19, microscope.afm 16, two.dimensional 15, afm.tip 13, side.chains 13, aqueous.solution 12

Triple Word Terms
atomic.force.microscopy 94, force.microscopy.afm 47, atomic.force.microscope 26, air.water.interface 20, force.microscope.afm 16, van.der.waals 10, fourier.transform.infrared 9, measurements.atomic.force 7, transform.infrared.spectroscopy 7, mode.atomic.force 7, ray.photoelectron.spectroscopy 7, transmission.electron.microscopy 6, microscopy.atomic.force 6, langmuir.blodgett.films 6, tapping.mode.atomic 6

Term Cliques
27.81% conform molecular water molecul interfac
28.47% interact conform molecular interfac
28.39% polym conform molecular molecul interfac
32.48% polym afm molecular molecul
37.35% forc atomic.force atom molecular water force.microscopy molecul atomic.force.microscopy interfac
38.87% forc atomic.force interact atom molecular force.microscopy atomic.force.microscopy interfac
38.24% forc afm atomic.force atom molecular water force.microscopy molecul atomic.force.microscopy
39.87% forc afm atomic.force interact atom molecular force.microscopy atomic.force.microscopy
39.70% forc surfac atomic.force atom water force.microscopy molecul atomic.force.microscopy interfac
41.51% forc surfac atomic.force interact atom force.microscopy atomic.force.microscopy interfac
40.59% forc surfac afm atomic.force atom water force.microscopy molecul atomic.force.microscopy
42.52% forc surfac afm atomic.force interact atom force.microscopy atomic.force.microscopy
33.21% chain conform molecular water molecul
35.22% chain interact conform molecular
33.80% chain polym conform molecular molecul

Sample Cluster Record Titles

Tight-binding description of the STM image of molecular chains

Using wavelets to analyze AFM images of thin films: Surface micelles and supported lipid bilayers

Interactions between polymer brushes: Varying the number of end-attaching groups

Effect of nanosizing on some properties of one-dimensional polyacetylene chains

Alkyl chain length dependence of the field-effect carrier mobility in regioregular poly(3-alkylthiophene)s

SFM characterization of poly(isocyanodipeptide) single polymer chains in controlled environments: Effect of tip adhesion and chain swelling

Polymer melt near a solid surface: A molecular dynamics study of chain conformations and desorption dynamics

Force spectroscopy on dendronized poly(p-phenylene)s: Revealing the chain elasticity and the interfacial interaction

Atomic force microscopy studies on heat-induced gelation of Curdlan

Cluster Metrics

Authors
zhao, f 3
yang, p 3
shinto, h 3
pakula, t 3
li, xc 3
higashitani, k 3
egbe, dam 3
du, yk 3
cowman, mk 3
carbonnier, b 3
zhou, hl 2
zhang, x 2
yang, hs 2
xu, h 2
wei, g 2

Sources
langmuir 27
macromolecules 16
journal of physical chemistry b 15
journal of colloid and interface science 10
colloids and surfaces a-physicochemical and engineering aspects 7
carbohydrate research 7
journal of chemical physics 6
europhysics letters 6
physical review e 5
journal of the american chemical society 5
journal of adhesion science and technology 5

biophysical journal 5
biomacromolecules 5
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Keywords
chemistry, physical 84
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atomic-force microscopy 28
adsorption 26
chemistry, multidisciplinary 25
self-assembled monolayers 24
materials science, multidisciplinary 22
afm 19
physics, multidisciplinary 16
films 16
surface 15
biochemistry & molecular biology 15
microscopy 13
surfaces 13
monolayers 13

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usa 79
japan 34
germany 29
peoples r china 24
england 19
france 15
canada 13
sweden 10
netherlands 10
switzerland 8
australia 8
south korea 7
spain 6
russia 6
mexico 6

Institution
chinese acad sci 10

max planck inst polymer res 9
kyoto univ 8
tokyo inst technol 5
harvard univ 5
univ twente 4
univ massachusetts 4
univ alberta 4
royal inst technol 4
natl inst adv ind sci & technol 4
inst surface chem 4
columbia univ 4
virginia tech 3
univ wageningen & res ctr 3
univ utah 3

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- CLUSTER 234
  Molecular dynamics simulations and models of physical and biological systems (241 Records)

(Countries: USA predominant, followed by Germany and Japan. Institutions: National University of Singapore, University of Wisconsin, Northwestern University. Other USA include USAF, University of Washington, University of Illinois.).

Cluster Syntax Features

Descriptive Terms
dynam 9.4%, molecular 8.7%, simul 8.3%, molecular.dynamics 6.4%, water 3.8%, model 2.6%, diffus 2.0%, molecul 2.0%, dynamics.simulations 1.8%, molecular.dynamics.simulations 1.8%, cluster 1.1%, liquid 1.1%, surfac 1.1%, system 1.1%, fluid 0.9%

Discriminating Terms
dynam 6.7%, simul 5.9%, molecular.dynamics 5.6%, molecular 5.3%, film 2.4%, water

2.0%, dynamics.simulations 1.6%, molecular.dynamics.simulations 1.6%, diffus 1.1%, model 0.9%, magnet 0.8%, carbon 0.7%, nanoparticl 0.7%, molecul 0.7%, nanotub 0.7%

Single Word Terms

molecular 163, dynam 141, simul 140, model 101, structur 98, molecul 93, surfac 88, system 83, two 74, interact 71, function 70, water 63, experiment 62, properti 57, energi 57

Double Word Terms

molecular.dynamics 107, dynamics.simulations 65, dynamics.simulation 32, water.molecules 27, monte.carlo 22, density.functional 21, two.dimensional 14, functional.theory 14, experimental.data 12, van.der 11, der.waals 11, computer.simulations 10, self.assembly 9, lennard.jones 9, carlo.simulations 9

Triple Word Terms

molecular.dynamics.simulations 64, molecular.dynamics.simulation 30, density.functional.theory 14, van.der.waals 11, monte.carlo.simulations 9, dynamics.simulations.molecular 7, simulation.molecular.dynamics 5, functional.tight.binding 5, density.functional.tight 5, monte.carlo.simulation 5, simulations.molecular.dynamics 5, molecular.dynamics.computer 5, structural.dynamical.properties 4, equilibrium.molecular.dynamics 4, scale.molecular.dynamics 4

Term Cliques

40.72% dynam simul molecular.dynamics molecul cluster surfac system
35.31% dynam simul molecular.dynamics molecul dynamics.simulations molecular.dynamics.simulations liquid surfac system fluid
36.22% dynam simul molecular.dynamics model diffus molecul dynamics.simulations molecular.dynamics.simulations system fluid
36.72% dynam simul molecular.dynamics water molecul dynamics.simulations molecular.dynamics.simulations liquid surfac system
37.63% dynam simul molecular.dynamics water model diffus molecul dynamics.simulations molecular.dynamics.simulations system
45.47% dynam molecular simul molecular.dynamics molecul cluster surfac
38.63% dynam molecular simul molecular.dynamics molecul dynamics.simulations molecular.dynamics.simulations liquid surfac fluid
39.54% dynam molecular simul molecular.dynamics model diffus molecul dynamics.simulations molecular.dynamics.simulations fluid
40.04% dynam molecular simul molecular.dynamics water molecul dynamics.simulations molecular.dynamics.simulations liquid surfac
40.95% dynam molecular simul molecular.dynamics water model diffus molecul dynamics.simulations molecular.dynamics.simulations

Sample Cluster Record Titles

Melting of icosahedral gold nanoclusters from molecular dynamics simulations

Molecular dynamics study of nanoscale structure formation in droplet spreading on solid surfaces

Molecular dynamics simulations of phospholipid bilayers: Influence of artificial periodicity, system size, and simulation time

GDIS: a visualization program for molecular and periodic systems

Molecular simulation of loading-dependent diffusion in nanoporous materials using extended dynamically corrected transition state theory

Molecular dynamics studies of brittle fracture in vitreous silica: Review and recent progress

Modeling of the hysteresis phenomena in finite-sized slitlike nanopores. Revision of the recent results by rigorous numerical analysis

Molecular dynamics simulation of the structural and dynamical properties of crystalline BaO

Molecular dynamics simulation of room-temperature ionic liquid mixture of [bmim][BF4] and acetonitrile by a refined force field

Cluster Metrics

Authors

lim, tc 5
weiss, h 3
vasenkov, s 3
pal, s 3
muller-plathe, f 3
keller, h 3
jang, ss 3
goddard, wa 3
frauenheim, t 3
zhong, cl 2
zapol, p 2
wang, wc 2
wang, q 2
voth, ga 2
valiullin, r 2

Sources

journal of physical chemistry b 23
journal of chemical physics 23
physical review e 8
journal of the american chemical society 7
physical review letters 6
physical review b 6
molecular simulation 6
langmuir 6
biophysical journal 6
proceedings of the national academy of sciences of the united states of america 5
chemphyschem 5
chemical physics letters 5
physical chemistry chemical physics 4
physica a-statistical mechanics and its applications 4
journal of computational and theoretical nanoscience 4

Keywords

chemistry, physical 58
physics, atomic, molecular & chemical 38
water 23
chemistry, multidisciplinary 21
physics, multidisciplinary 20
adsorption 19
model 15
dynamics 15
diffusion 15
molecular dynamics 14
surfaces 13
surface 13
simulation 13
physics, fluids & plasmas 11
physics, condensed matter 11

Publication Year

2005 218
2004 20
2006 3

Country

usa 83
germany 24
japan 23
peoples r china 18
france 18
italy 16

england 10
netherlands 9
canada 9
australia 9
spain 8
russia 8
taiwan 7
singapore 6
poland 5

Institution
natl univ singapore 5
univ wisconsin 4
univ oxford 4
univ lyon 1 4
univ leipzig 4
univ helsinki 4
northwestern univ 4
nagoya univ 4
int univ bremen 4
chinese acad sci 4
zhejiang univ 3
usaf 3
univ washington 3
univ montpellier 2 3
univ illinois 3

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- CLUSTER 254
  Models and simulations, especially Monte Carlo and molecular dynamics simulations, of systems and comparison to experiments or other models (578 Records)

(Countries: USA dominant, followed by Germany, Japan, France. Institutions: RAS, CAS, University of Michigan, CNRS. Other USA include University of Illinois.).

Cluster Syntax Features

Descriptive Terms
model 4.3%, dynam 2.4%, simul 2.4%, equat 2.2%, wave 1.9%, system 1.8%, dimension 1.7%, field 1.5%, transport 1.4%, transit 1.1%, wire 1.1%, theori 1.1%, numer 1.0%, two 1.0%, diffus 1.0%

Discriminating Terms
film 3.2%, model 2.5%, equat 2.1%, wave 1.7%, simul 1.6%, dynam 1.6%, dimension 1.0%, carbon 1.0%, nanoparticl 1.0%, numer 0.9%, transport 0.9%, magnet 0.8%, deposit 0.8%, wire 0.8%, oxid 0.8%

Single Word Terms
model 235, two 217, system 209, electron 155, field 153, temperatur 153, simul 152, dynam 151, energi 146, structur 145, state 138, on 135, dimension 134, depend 133, time 130

Double Word Terms
two.dimensional 64, one.dimensional 53, monte.carlo 40, molecular.dynamics 34, time.dependent 33, ray.diffraction 29, phase.transition 29, three.dimensional 28, electric.field 24, experimental.data 22, numerical.simulations 22, temperature.dependence 21, low.temperature 19, carlo.simulations 19, power.law 18

Triple Word Terms
monte.carlo.simulations 19, molecular.dynamics.simulations 14, molecular.dynamics.simulation 13, monte.carlo.simulation 13, charge.density.wave 10, transmission.electron.microscopy 9, quasi.one.dimensional 8, mean.free.path 7, kinetic.monte.carlo 7, quasi.two.dimensional 6, dimensional.electron.gas 6, phys.rev.lett 5, phase.field.model 5, electron.electron.interactions 5, two.dimensional.electron 5

Term Cliques
19.72% transport wire numer two
21.54% dimension transport wire two
25.80% system dimension field transport transit theori two
19.46% wave wire numer two
21.28% wave dimension wire two
26.59% wave system dimension field theori two
25.46% equat system field transport transit theori two
22.79% simul dimension field transport transit theori two diffus
22.49% simul equat field transport transit theori two diffus
26.79% dynam equat system field transit theori two

23.66% dynam simul equat field transit theori two diffus
26.84% model equat system field transport theori numer two
26.71% model equat wave system field theori numer two
24.05% model simul equat field transport theori numer two diffus
28.01% model dynam equat system field theori numer two
25.09% model dynam simul equat field theori numer two diffus

Sample Cluster Record Titles

Theoretical modeling of photo-induced wave propagation in liquid-crystalline Langmuir monolayers

Use of stochastic web patterns to control electron transport in semiconductor superlattices

Simulation on nanoseale self-assembly of ternary-epilayers

Numerical local-potential-averaging method for quantum mechanical simulations

Molecular simulation for nanotechnologies: Application to industry

Molecular dynamics calculation of the J-integral fracture criterion for nano-sized crystals

Modeling of electron-electron scattering in Monte Carlo simulation of quantum cascade lasers

Model for the onset of transport in systems with distributed thresholds for conduction

Modeling of clusters in a strong 248-nm laser field by a three-dimensional relativistic molecular dynamic model

Cluster Metrics

Authors

lu, w 5
wang, j 4
reggiani, l 4
kim, d 4
yokoyama, h 3
toshima, t 3
todorov, tn 3
tanda, s 3
shukla, pk 3
sheng, p 3

rudan, m 3
reggiani, s 3
ratner, ma 3
li, y 3
guo, h 3

Sources
physical review b 103
physical review letters 32
physical review e 22
physica e-low-dimensional systems & nanostructures 18
journal of applied physics 14
journal of physics-condensed matter 13
journal of chemical physics 13
europhysics letters 11
journal of physical chemistry b 9
applied physics letters 8
journal of physics a-mathematical and general 7
journal of the physical society of japan 6
journal of non-crystalline solids 6
physics letters a 5
physica b-condensed matter 5

Keywords
physics, condensed matter 155
physics, multidisciplinary 85
physics, applied 44
transport 36
physics, atomic, molecular & chemical 35
systems 35
chemistry, physical 32
model 32
physics, fluids & plasmas 30
physics, mathematical 30
materials science, multidisciplinary 30
dynamics 30
materials science, multidisciplinary 27
engineering, electrical & electronic 24
growth 20

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2005 510
2004 62
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Country

usa 172
germany 73
japan 63
france 61
peoples r china 48
italy 45
russia 43
canada 26
spain 25
england 24
south korea 19
netherlands 17
israel 17
australia 13
sweden 12

Institution

russian acad sci 18
chinese acad sci 14
univ michigan 11
cnrs 11
univ tokyo 10
infm 9
univ illinois 8
univ cambridge 8
kyoto univ 8
csic 8
univ montpellier 2 7
osaka univ 7
univ sci & technol china 6
univ roma la sapienza 6
univ paris 11 6

DataBase

science citation index 578

- ## CLUSTER 167

  Phonon scattering, transport, and states; phonon-electron interactions; Raman scattering; related topics concerning vibrational modes and acoustics (176 Records)

(USA dominant, China, France next tier. Institutions: CAS, University Lyon, Pusan National University, MIT, CRNS. Other USA include University of Illinois, UCB, Ohio State University, University of Texas, UC Riverside, Penn State University.).

Cluster Syntax Features

Descriptive Terms

phonon 38.6%, mode 3.8%, frequenc 2.9%, scatter 2.8%, vibrat 2.3%, electron.phonon 1.9%, acoust 1.6%, conduct 1.4%, raman 1.2%, electron 0.9%, thermal 0.9%, transport 0.8%, temperatur 0.7%, thermal.conductivity 0.7%, superlattic 0.6%

Discriminating Terms

phonon 29.4%, film 2.1%, mode 2.0%, frequenc 1.5%, vibrat 1.5%, electron.phonon 1.5%, scatter 1.5%, acoust 1.2%, surfac 0.7%, magnet 0.6%, particl 0.6%, carbon 0.6%, deposit 0.6%, oxid 0.5%, layer 0.5%

Single Word Terms

phonon 134, frequenc 76, scatter 75, temperatur 73, electron 69, mode 67, low 63, energi 63, model 61, two 60, depend 57, structur 55, conduct 50, vibrat 47, calcul 44

Double Word Terms

electron.phonon 36, raman.scattering 21, low.frequency 21, thermal.conductivity 20, phonon.coupling 19, acoustic.phonon 15, phonon.modes 15, two.dimensional 15, temperature.dependence 15, phonon.interaction 14, optical.phonon 14, vibrational.modes 13, optical.phonons 13, low.temperatures 13, low.temperature 12

Triple Word Terms

electron.phonon.coupling 17, electron.phonon.interaction 10, low.frequency.raman 8, strong.electron.phonon 6, optical.phonon.modes 6, electron.phonon.interactions 6, inelastic.neutron.scattering 5, frequency.raman.scattering 5, electron.electron.electron 4, dielectric.continuum.model 4, electron.electron.phonon 4, electron.phonon.scattering 4, thermal.conductivity.silicon 4, thermoelectric.figure.merit 4, vch.verlag.gmbh 4

Term Cliques

24.72% acoust conduct thermal transport temperatur thermal.conductivity
28.41% electron.phonon transport temperatur
25.68% scatter conduct thermal transport thermal.conductivity

35.04% frequenc raman temperatur
33.52% frequenc acoust conduct temperatur
38.07% frequenc scatter conduct
23.86% mode vibrat superlattic
32.10% mode frequenc vibrat raman
32.24% mode frequenc vibrat acoust
36.08% mode frequenc scatter raman
30.91% phonon acoust thermal transport thermal.conductivity
39.77% phonon electron.phonon electron transport
31.93% phonon scatter thermal thermal.conductivity superlattic
35.23% phonon scatter thermal transport thermal.conductivity
45.31% phonon scatter electron transport
45.08% phonon mode acoust
40.91% phonon mode scatter superlattic
44.32% phonon mode scatter raman

Sample Cluster Record Titles

XPS spectra and electronic structure of the ErNi4B compound

Application of valence electron energy-loss spectroscopy and plasmon energy mapping for determining material properties at the moment

Effect of benzene derivatives bearing electron-releasing and/or electron-withdrawing groups on the fluorescence of CdS-Q clusters

Electronic structure of nanostructured ZnO from x-ray absorption and emission spectroscopy and the local density approximation

Anomalous luminescence dynamics of Eu3+ in BaFCl microcrystals

Electronic structure of regular bacterial surface layers

Resonance energy transfer dynamics in hydrogen-bonded oligo p-phenylenevinylene nanostructures

Electronic structure of [100]-oriented free-standing semiconductor nanowires

Electronic properties of deep defects in n-type GaN

Cluster Metrics

Authors

chen, kq 5
shuai, z 4
zou, bs 3
yang, ys 3
yang, rg 3
wang, ll 3
kim, sj 3
kim, je 3
huang, wq 3
choi, hw 3
chen, g 3
balandin, aa 3
amon, ch 3
zhang, l 2
yoshikawa, n 2

Sources
physical review b 44
journal of applied physics 13
physical review letters 10
applied physics letters 10
journal of the korean physical society 7
journal of heat transfer-transactions of the asme 6
journal of physics-condensed matter 5
surface science 3
physics letters a 3
physica status solidi b-basic solid state physics 3
journal of non-crystalline solids 3
solid state communications 2
semiconductor science and technology 2
physica status solidi a-applications and materials science 2
modern physics letters b 2

Keywords
physics, condensed matter 61
physics, applied 32
physics, multidisciplinary 26
scattering 23
transport 18
materials science, multidisciplinary 14
chemistry, physical 13
thin-films 13
physics, condensed matter 12
superlattices 9
crystals 9
spectroscopy 8

systems 8
semiconductors 8
phonons 8

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usa 67
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france 20
japan 14
india 13
germany 12
south korea 9
taiwan 6
russia 6
ukraine 5
sweden 5
israel 5
australia 5
spain 4
italy 4

Institution

chinese acad sci 11
univ lyon 1 6
pusan natl univ 5
mit 5
cnrs 5
univ illinois 4
univ calif berkeley 4
ohio state univ 4
indian assoc cultivat sci 4
hunan univ 4
univ texas 3
univ paris 06 3
univ mouloud mammeri 3
univ calif riverside 3
penn state univ 3

DataBase

science citation index 176

- ## CLUSTER 246

  Electronic properties, structures, and states; energy transfer, levels, and loss; band gap properties; and spectroscopic studies (325 Records)

(Countries: USA, followed by Germany, Japan. Institutions: Tsing Hua University, CNRS, RAS, CAS, UCB. Other USA include Cornell University).

Cluster Syntax Features

Descriptive Terms

state 11.2%, energi 7.3%, band 6.9%, electron 4.1%, excit 2.7%, charg 1.5%, valenc 1.5%, level 1.3%, calcul 1.0%, transfer 0.9%, spectra 0.9%, transit 0.9%, edg 0.9%, photoemiss 0.8%, orbit 0.8%

Discriminating Terms

state 7.9%, band 5.1%, energi 4.5%, film 2.3%, excit 1.8%, electron 1.4%, valenc 1.3%, magnet 0.8%, photoemiss 0.8%, nanoparticl 0.7%, deposit 0.7%, charg 0.7%, level 0.7%, particl 0.6%, orbit 0.6%

Single Word Terms

electron 230, state 209, energi 209, structur 140, band 131, spectroscopi 103, calcul 97, excit 94, experiment 86, level 85, two 83, spectra 83, function 79, transit 78, densiti 77

Double Word Terms

electronic.structure 45, conduction.band 37, valence.band 36, band.gap 35, electronic.states 30, ground.state 28, photoelectron.spectroscopy 28, band.structure 28, charge.transfer 27, excited.state 24, ray.photoelectron 21, energy.loss 21, electron.energy 21, excited.states 20, density.states 20

Triple Word Terms

ray.photoelectron.spectroscopy 20, electron.energy.loss 17, photoelectron.spectroscopy.xps 12, conduction.band.edge 11, energy.loss.spectroscopy 11, density.functional.theory 10, electron.paramagnetic.resonance 8, band.structure.calculations 8, ray.absorption.spectroscopy 8, angle.resolved.photoemission 7, deep.level.transient 6, vch.verlag.gmbh 6, edge.ray.absorption 6, level.transient.spectroscopy 6, valence.band.spectra 5

Term Cliques
33.57% state energi electron valenc level spectra transit edg photoemiss orbit
34.83% state energi electron valenc level calcul spectra transit photoemiss orbit
38.46% state energi electron excit transfer spectra transit photoemiss
35.82% state energi electron excit level calcul spectra transit photoemiss orbit
45.28% state energi electron excit charg transfer
46.36% state energi electron excit charg level
37.57% state energi band electron valenc transfer spectra transit photoemiss
36.18% state energi band electron valenc level spectra transit edg photoemiss
37.45% state energi band electron valenc level calcul spectra transit photoemiss
43.16% state energi band electron charg valenc transfer
40.73% state energi band electron charg valenc level edg

Sample Cluster Record Titles

Electronic structure of nanostructured ZnO from x-ray absorption and emission spectroscopy and the local density approximation

Resonance energy transfer dynamics in hydrogen-bonded oligo p-phenylenevinylene nanostructures

Electronic properties of deep defects in n-type GaN

Use of SiC band gap temperature dependence for absolute calibration of emissivity corrected pyrometers in III-nitride MOVPE

Gallium oxide and dioxide: Investigation of the ground and low-lying electronic states via anion photoelectron spectroscopy

Electronic structure of CuWO4: XPS, XES and NEXAFS studies

Two excited state structures of Donor-Acceptor substituted "proton sponge"

Tight binding modeling of band gaps and band offsets in heterostructures

Evidence of gap state formed by the charge transfer in Alq(3)/NaCl/Al interface studied by ultraviolet and x-ray photoelectron spectroscopy

Cluster Metrics

Authors
li, jm 4

chen, c 4
wenzel, w 3
wang, zw 3
timoshenko, vy 3
neumann, m 3
nahler, nh 3
mo, yx 3
matteucci, m 3
liu, rs 3
kuepper, k 3
hosono, h 3
cingolani, r 3
zhou, c 2
yu, my 2

Sources
physical review b 44
journal of physical chemistry b 22
journal of chemical physics 22
physical review letters 15
applied physics letters 10
journal of applied physics 9
journal of electron spectroscopy and related phenomena 8
physical review a 7
journal of physical chemistry a 7
molecular physics 6
journal of physics-condensed matter 6
chemical physics letters 6
synthetic metals 5
physica e-low-dimensional systems & nanostructures 5
surface science 4

Keywords
physics, condensed matter 77
physics, atomic, molecular & chemical 53
chemistry, physical 51
physics, multidisciplinary 32
physics, applied 27
spectroscopy 26
spectroscopy 23
films 19
materials science, multidisciplinary 18
states 17
energy 17
spectra 15
chemistry, multidisciplinary 13

semiconductors 13
optics 13

Publication Year
2005 281
2004 42
2006 2

Country
usa 87
germany 55
japan 50
peoples r china 37
russia 31
england 26
france 25
italy 20
sweden 14
canada 14
india 12
taiwan 9
south korea 9
poland 8
spain 7

Institution
tsing hua univ 13
cnrs 12
russian acad sci 11
chinese acad sci 10
univ calif berkeley 9
tohoku univ 8
univ oxford 6
univ cambridge 6
lund univ 6
kyoto univ 6
cornell univ 6
univ paris 11 5
infm 5
univ tokyo 4
univ british columbia 4

DataBase
science citation index 325

- # CLUSTER 215
  Density functional theory, with focus on its use for condensed matter, atomic, molecular, and chemical physics calculations, especially to study nanoclusters (266 Records)

(Countries: USA dominant, followed by Germany, China, Japan. Institutions: Forschungszentrum Karlsruhe, Tsing Hua University, University Oslo, Osaka University. USA includes UCB.)

Cluster Syntax Features

Descriptive Terms
calcul 6.5%, cluster 6.4%, density.functional 4.4%, densiti 4.3%, function 2.8%, energi 2.8%, theori 2.6%, electron 2.5%, functional.theory 2.5%, density.functional.theory 2.5%, atom 2.4%, structur 1.4%, orbit 1.3%, electronic.structure 1.3%, principl 1.2%

Discriminating Terms
calcul 4.5%, cluster 4.1%, density.functional 3.6%, film 2.5%, densiti 2.2%, functional.theory 2.0%, density.functional.theory 2.0%, theori 1.7%, function 1.1%, electronic.structure 1.0%, orbit 1.0%, first.principles 0.9%, energi 0.9%, principl 0.9%, initio 0.8%

Single Word Terms
electron 182, calcul 174, densiti 172, function 167, structur 158, energi 151, theori 126, atom 119, state 93, experiment 84, properti 81, first 75, molecular 73, local 72, model 70

Double Word Terms
density.functional 136, functional.theory 102, electronic.structure 61, first.principles 54, ground.state 30, local.density 23, hartree.fock 23, principles.calculations 21, band.gap 21, time.dependent 21, density.states 19, dependent.density 19, basis.sets 19, theory.dft 19, structure.calculations 19

Triple Word Terms
density.functional.theory 102, first.principles.calculations 21, functional.theory.dft 19, time.dependent.density 19, dependent.density.functional 19, density.functional.calculations 17, local.density.approximation 16, functional.theory.calculations 14, calculations.density.functional 11, electronic.structure.calculations 10, density.approximation.lda 8, augmented.plane.wave 8, principles.density.functional 7, first.principles.density 7, initio.density.functional 7

Term Cliques
46.43% cluster function energi theori electron orbit
52.15% cluster function energi theori electron atom structur
49.00% calcul density.functional densiti function theori electron functional.theory density.functional.theory atom structur electronic.structure principl
51.09% calcul density.functional densiti function energi theori electron functional.theory density.functional.theory orbit
54.31% calcul density.functional densiti function energi theori electron functional.theory density.functional.theory atom structur

Sample Cluster Record Titles

A DFT study of the vibrational frequencies of alpha-[XMo12O40](n-) heteropolyanions

Theoretical studies of multiple-scattering-cluster theory of local structure of N2O multilayer

Density-functional band-structure calculations for La-, Y-, and Sc-filled CoP3-based skutterudite structures

Blue luminescence of Au nanoclusters embedded in silica matrix

First-principles calculation of transport properties of single-row aluminium nanowires suspended between semi-infinite crystalline electrodes

Ab initio calculations of the structural and electronic properties of HgmTen clusters

Band structure calculations on the monoclinic bulk and nano-SrAl2O4 crystals

Coupled-cluster theory with simplified linear-r(12) corrections: The CCSD(R12) model

DFT vibrational calculations of Rhodamine 6G adsorbed on silver: Analysis of tip-enhanced Raman spectroscopy

Cluster Metrics

Authors

zhang, sf 7
su, gl 7
ren, xg 7
ning, cg 7
deng, jk 7
li, gq 6
hirose, k 6
hattig, c 6
ono, t 5
li, b 5
klopper, w 5
huang, f 5
zhou, h 4
ohno, t 4
jorgensen, p 4

Sources

physical review b 68
journal of chemical physics 31
physical review letters 12
journal of physical chemistry b 11
international journal of quantum chemistry 10
chemical physics letters 8
nanotechnology 7
molecular physics 7
journal of physics-condensed matter 5
journal of applied physics 4
surface science 3
physical chemistry chemical physics 3
journal of the american chemical society 3
journal of solid state chemistry 3
journal of physical chemistry a 3

Keywords

physics, condensed matter 81
physics, atomic, molecular & chemical 68
chemistry, physical 40
physics, multidisciplinary 25
physics, applied 15
density 15
density-functional theory 14
growth 14
systems 13
electronic-structure 13
ab-initio 13

materials science, multidisciplinary 12
pseudopotentials 12
conductance 12
transport 11

Publication Year
2005 231
2004 35

Country
usa 69
germany 34
peoples r china 31
japan 29
italy 21
england 18
france 16
brazil 12
india 10
canada 10
sweden 9
spain 8
russia 8
norway 8
israel 8

Institution
forschungszentrum karlsruhe 12
tsing hua univ 11
univ oslo 8
osaka univ 8
univ trieste 5
univ tokyo 5
univ karlsruhe 5
natl inst mat sci 5
cnrs 5
cnr 5
chinese acad sci 5
weizmann inst sci 4
univ sao paulo 4
univ cambridge 4
univ calif berkeley 4

DataBase
science citation index 266

- CLUSTER 197

  Nanosized clusters, including their structures and properties, density functional theory calculations, molecular dynamics simulations, and their interactions with compounds and each other (251 Records)

(Countries: USA dominant, followed by second tier China, Japan, Germany. Institutions: CAS, CNRS, University Karlsruhe, Forschungszentrym Karlsruhe. USA include Georgia Institute of Technology, VCU.).

Cluster Syntax Features

Descriptive Terms

cluster 47.4%, atom 1.9%, density.functional 1.4%, bond 1.4%, calcul 1.4%, structur 0.9%, isom 0.9%, energi 0.9%, molecul 0.8%, cu 0.8%, dft 0.8%, density.functional.theory 0.7%, functional.theory 0.7%, theori 0.7%, hydrogen 0.7%

Discriminating Terms

cluster 34.5%, film 2.3%, density.functional 1.0%, nanoparticl 0.7%, particl 0.7%, isom 0.7%, magnet 0.7%, layer 0.6%, nanotub 0.6%, calcul 0.6%, dft 0.5%, carbon 0.5%, deposit 0.5%, crystal 0.5%, functional.theory 0.5%

Single Word Terms

cluster 176, structur 152, atom 113, calcul 104, function 103, energi 93, densiti 87, bond

82, molecular 82, theori 78, molecul 77, electron 73, two 68, form 67, surfac 62

Double Word Terms

density.functional 80, functional.theory 58, molecular.dynamics 31, theory.dft 23, ray.diffraction 21, dft.calculations 18, electronic.structure 16, photoelectron.spectroscopy 14, room.temperature 14, dynamics.simulations 13, binding.energies 13, molecular.orbital 13, theory.calculations 13, dynamics.simulation 12, mass.spectrometry 12

Triple Word Terms

density.functional.theory 58, functional.theory.dft 23, molecular.dynamics.simulations 13, functional.theory.calculations 13, molecular.dynamics.simulation 12, density.functional.calculations 8, theory.dft.calculations 8, ray.photoelectron.spectroscopy 8, electronic.structure.calculations 7, scanning.tunneling.microscopy 6, absorption.fine.structure 6, ray.absorption.fine 6, time.flight.mass 6, clusters.density.functional 6, initio.density.functional 5

Term Cliques

30.56% density.functional calcul structur isom energi molecul dft density.functional.theory functional.theory theori
31.29% density.functional bond calcul structur energi molecul dft density.functional.theory functional.theory theori hydrogen
36.18% atom bond structur molecul cu
34.16% atom density.functional calcul structur isom energi molecul dft
34.66% atom density.functional bond calcul structur energi molecul dft hydrogen
44.54% cluster atom structur isom energi

Sample Cluster Record Titles

Potential energy surfaces of SimOn cluster formation and isomerization

Density functional theory study of triangular molybdenum sulfide nanocluster and CO adsorption on it

XAFS spectral analysis of the cadmium coordination geometry in cadmium thiolate clusters in metallothionein

Lanthanide clusters with internal Ln: Fragmentation and the formation of dimers with bridging Se2- and Se-2(2-) ligands

Magic clusters Na-57(-) and Na-59(+)

Thermodynamic properties of AuyAgx bimetallic clusters through the evolutive ensemble

Structure and energetics of nickel, copper, and gold clusters

Molecular dynamics study of the surface melting of iron clusters

Structures and reactions of hydrated biomolecular cluster ions

Cluster Metrics

Authors
wu, hs 5
jiao, hj 4
springborg, m 3
neyman, km 3
navarrete, jtl 3
liu, rs 3
li, jy 3
hernandez, v 3
dong, kj 3
delgado, mcr 3
cui, xy 3
casado, j 3
zheng, cx 2
zhao, mw 2
zhang, z 2

Sources
journal of physical chemistry b 27
journal of chemical physics 22
journal of the american chemical society 14
physical review b 11
journal of physical chemistry a 11
chemical physics letters 9
inorganic chemistry 8
surface science 6
european physical journal d 6
journal of molecular structure-theochem 5
european journal of inorganic chemistry 5
chemical physics 5
dalton transactions 4
science and technology of advanced materials 3
physics and chemistry of glasses 3

Keywords
chemistry, physical 72
physics, atomic, molecular & chemical 53
chemistry, multidisciplinary 38

chemistry, inorganic & nuclear 31
complexes 21
adsorption 20
surface 19
nanoparticles 19
density 19
clusters 17
ab-initio 15
chemistry 14
density-functional theory 13
physics, condensed matter 12
nanoclusters 11

Publication Year

2005 231
2004 20

Country

usa 71
peoples r china 36
japan 35
germany 35
france 18
spain 14
italy 12
england 12
russia 10
canada 10
south korea 7
australia 7
india 6
mexico 5
belgium 5

Institution

chinese acad sci 8
cnrs 7
univ karlsruhe 6
forschungszentrum karlsruhe 6
shanxi normal univ 5
russian acad sci 5
natl inst adv ind sci & technol 5
univ valladolid 4
tohoku univ 4
korea adv inst sci & technol 4
inst mol sci 4

hunan univ 4
georgia inst technol 4
virginia commonwealth univ 3
univ waterloo 3

DataBase
science citation index 251

- # CLUSTER 161
  Scanning tunneling microscopy studies (268 Records)

(Countries: USA, closely followed by Japan, then by Germany. Institutions: University of Tokyo, UCI, RAS, Free University of Berlin, CNRS. Other USA include Northwestern University and UCB.)

Cluster Syntax Features

Descriptive Terms

tunnel 25.0%, stm 8.3%, scanning.tunneling 7.4%, tunneling.microscopy 2.9%, scanning.tunneling.microscopy 2.9%, scan 2.1%, molecul 1.7%, electron 1.6%, state 1.6%, surfac 1.2%, scanning.tunneling.microscope 1.1%, tunneling.microscope 1.1%, 111 1.0%, tunneling.spectroscopy 1.0%, imag 0.8%

Discriminating Terms

tunnel 18.2%, stm 6.2%, scanning.tunneling 5.6%, tunneling.microscopy 2.2%, scanning.tunneling.microscopy 2.1%, film 2.0%, scanning.tunneling.microscope 0.8%, tunneling.microscope 0.8%, scan 0.8%, tunneling.spectroscopy 0.8%, nanoparticl 0.7%, particl 0.7%, magnet 0.7%, carbon 0.7%, nanotub 0.6%

Single Word Terms

tunnel 258, scan 209, electron 173, surfac 156, microscopi 135, stm 123, state 116, structur 111, spectroscopi 103, energi 92, atom 88, imag 80, molecul 79, temperatur 78, two 78

Double Word Terms

scanning.tunneling 186, tunneling.microscopy 118, microscopy.stm 58, tunneling.microscope 56, tunneling.spectroscopy 51, low.temperature 41, stm.images 34, electronic.structure 33, temperature.scanning 30, microscope.stm 27, electronic.states 26, electron.tunneling 25, microscopy.spectroscopy 25, density.states 24, one.dimensional 24

Triple Word Terms

scanning.tunneling.microscopy 117, scanning.tunneling.microscope 56, tunneling.microscopy.stm 53, scanning.tunneling.spectroscopy 29, low.temperature.scanning 27, temperature.scanning.tunneling 26, tunneling.microscope.stm 23, tunneling.microscopy.spectroscopy 22, density.functional.theory 18, surface.scanning.tunneling 15, local.density.states 14, scanning.tunnelling.microscopy 12, angle.resolved.photoemission 9, phys.rev.lett 8, stm.scanning.tunneling 8

Term Cliques

53.57% tunnel scanning.tunneling tunneling.microscopy scanning.tunneling.microscopy scan electron state 111 tunneling.spectroscopy
56.76% tunnel stm scanning.tunneling scan electron surfac scanning.tunneling.microscope tunneling.microscope
53.17% tunnel stm scanning.tunneling scan molecul electron scanning.tunneling.microscope tunneling.microscope
53.40% tunnel stm scanning.tunneling scan molecul electron state 111 imag
54.27% tunnel stm scanning.tunneling tunneling.microscopy scanning.tunneling.microscopy scan electron state surfac 111 imag

Sample Cluster Record Titles

STM images of molecules on a metallic surface: a fast calculation based on a self-consistent semiempirical molecular orbital method

Quantization of electronic states in individual oxide-supported silver particles

Scanning tunneling microscopy/spectroscopy observation of intrinsic hydrogenated amorphous silicon surface under light irradiation

[Fermi surface investigation in the scanning tunneling microscopy of Bi2Sr2CaCu2O8]

[Unequal-sphere packing model for the structural arrangement of the well-ordered adsorbate-substrate system]

[Structural features of Ga-rich GaAs(001) surfaces: Scanning tunneling microscopy study]

[Size-dependent tunneling differential conductance spectra of crystalline Pd nanoparticles]

[In situ Video-STM study of the potential-induced (1 x 1) -> "hex" transition on Au(100) electrode surfaces in Cl- containing solution]

[2x1 reconstructed Si(111) surface: STM experiments versus ab initio calculations]

Cluster Metrics

Authors
ho, w 10
rieder, kh 6
yeom, hw 4
nilius, n 4
nazin, gv 4
morgenstern, k 4
maeda, k 4
joachim, c 4
gourdon, a 4
ahn, jr 4
wenderoth, m 3
veuillen, jy 3
ulbrich, rg 3
trifonov, as 3
ratner, ma 3

Sources
physical review b 62
physical review letters 34
surface science 23
applied physics letters 12
nano letters 8
journal of physical chemistry b 8
journal of chemical physics 8
applied surface science 7
japanese journal of applied physics part 1-regular papers brief communications & review papers 5

russian journal of electrochemistry 4
journal of the physical society of japan 4
physica e-low-dimensional systems & nanostructures 3
physica c-superconductivity and its applications 3
physica b-condensed matter 3
jetp letters 3

Keywords
physics, condensed matter 73
physics, multidisciplinary 49
chemistry, physical 46
surface 41
scanning-tunneling-microscopy 39
spectroscopy 32
physics, applied 30
states 22
stm 21
scanning tunneling microscope 20
silicon 19
physics, condensed matter 18
physics, atomic, molecular & chemical 16
scanning tunneling microscopy 15
transport 15

Publication Year
2005 240
2004 28

Country
usa 69
japan 59
germany 41
france 24
england 17
peoples r china 16
russia 15
south korea 12
switzerland 11
italy 11
canada 10
netherlands 8
israel 8
india 6
taiwan 4

Institution

univ tokyo 16
univ calif irvine 10
russian acad sci 9
free univ berlin 9
cnrs 9
tokyo inst technol 8
northwestern univ 8
natl inst mat sci 7
yonsei univ 6
univ calif berkeley 6
tohoku univ 6
univ kiel 5
univ karlsruhe 5
osaka univ 5
natl inst adv ind sci & technol 5

DataBase
science citation index 268

- CLUSTER 227
  Studies of individual molecules, especially on surfaces and in organic materials, with the aid of scanning tunneling microscopy (332 Records)

(Countries: USA dominant, followed by Japan and Germany. Institutions: CAS, CNRS, University of Texas, Kyoto University. Other USA include UCB, Princeton University, Arizona State University, University of Pittsburgh.)

Cluster Syntax Features

Descriptive Terms
molecul 38.1%, single.molecule 5.1%, molecular 5.1%, singl 2.0%, stm 1.5%, conjug 1.2%, surfac 1.1%, adsorb 1.0%, tunnel 1.0%, adsorpt 0.9%, organ 0.8%, scanning.tunneling 0.7%, fulleren 0.6%, function 0.5%, interact 0.5%

Discriminating Terms
molecul 29.6%, single.molecule 4.5%, molecular 2.6%, film 2.1%, stm 1.1%, conjug 0.8%, particl 0.7%, nanotub 0.7%, magnet 0.7%, carbon 0.6%, temperatur 0.6%, deposit 0.6%, crystal 0.6%, adsorb 0.5%, singl 0.5%

Single Word Terms
molecul 289, molecular 179, surfac 149, structur 121, singl 121, two 102, electron 95, function 89, interact 87, scan 86, tunnel 80, microscopi 80, atom 72, assembl 72, adsorb 70

Double Word Terms
single.molecule 75, scanning.tunneling 66, tunneling.microscopy 52, microscopy.stm 32, self.assembled 27, density.functional 27, single.molecules 25, functional.theory 22, charge.transfer 21, atomic.force 18, surface.raman 17, self.assembly 17, organic.molecules 16, electron.transfer 16, raman.scattering 15

Triple Word Terms
scanning.tunneling.microscopy 52, tunneling.microscopy.stm 28, density.functional.theory 22, atomic.force.microscopy 11, surface.raman.scattering 10, scanning.tunneling.microscope 10, functional.theory.dft 10, self.assembled.monolayers 8, single.molecule.spectroscopy 7, oriented.pyrolytic.graphite 7, tunneling.microscope.stm 7, metal.molecule.metal 7, ray.photoelectron.spectroscopy 7, single.molecule.level 7, situ.scanning.tunneling 7

Term Cliques
30.06% molecular surfac organ fulleren interact
27.65% molecular conjug organ function interact
23.43% molecular conjug organ fulleren interact
27.17% molecular conjug tunnel scanning.tunneling interact
31.55% molecular singl conjug tunnel
23.72% single.molecule singl conjug tunnel
39.54% molecul molecular surfac adsorpt organ function interact
36.94% molecul molecular stm surfac adsorb adsorpt function interact
34.74% molecul molecular stm surfac adsorb tunnel adsorpt scanning.tunneling interact
49.28% molecul molecular singl surfac tunnel
43.01% molecul single.molecule singl surfac tunnel

Sample Cluster Record Titles

Molecular molds

Halogen-substituted thiophenol molecules on Cu(111)

Reducing a polymer to its subunits as an aid to molecular mapping

Atomic structure and tip-induced reconstruction of bromide covered Cu(110) electrodes

Along the way from molecules to devices - The role of supramolecular interactions

Towards individual molecules as electronic components

Scanning transmission X-ray microscopy as a speciation tool for natural organic molecules

Using single-molecule fluorescence spectroscopy to study electron transfer

Pushing around electrons: towards 2-D and 3-D molecular switches

Cluster Metrics

Authors
wan, lj 8
barbara, pf 6
yang, zy 4
stoddart, jf 4
morita, t 4
moresco, f 4
maruyama, y 4
liu, hy 4
lee, yj 4
kitagawa, k 4
kimura, s 4
gourdon, a 4
futamata, m 4
feringa, bl 4
bai, cl 4

Sources
journal of physical chemistry b 30
physical review b 16
langmuir 15

journal of the american chemical society 15
nano letters 11
chemphyschem 11
angewandte chemie-international edition 10
journal of raman spectroscopy 9
proceedings of the national academy of sciences of the united states of america 8
journal of chemical physics 8
physical review letters 7
surface science 6
chemical physics letters 6
chemical physics 5
biophysical journal 5

Keywords
chemistry, physical 100
chemistry, multidisciplinary 66
adsorption 34
surface 29
scanning-tunneling-microscopy 28
spectroscopy 28
materials science, multidisciplinary 26
spectroscopy 24
self-assembled monolayers 22
physics, atomic, molecular & chemical 22
monolayers 19
physics, condensed matter 18
fluorescence 17
dynamics 17
surfaces 16

Publication Year
2005 302
2004 27
2006 3

Country
usa 101
japan 50
germany 42
france 25
peoples r china 23
italy 22
england 19
netherlands 13
denmark 11
switzerland 10

spain 10
israel 9
belgium 9
south korea 7
russia 7

Institution
chinese acad sci 12
cnrs 11
univ texas 8
kyoto univ 8
weizmann inst sci 6
tohoku univ 6
free univ berlin 6
univ tokyo 5
univ munich 5
univ calif berkeley 5
tech univ denmark 5
russian acad sci 5
princeton univ 5
arizona state univ 5
univ pittsburgh 4

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science citation index 332

- ## CLUSTER 192
  Fluorescence/ luminescence properties, of dyes for instance, and their applications, especially to sensors (112 Records)

(Countries: USA, followed by China and Germany. Institutions: MIT, followed closely by CAS and Anhui Normal University. Other USA include UCSB, UCLA, University of Massachusetts, University of Maryland.).

Cluster Syntax Features

Descriptive Terms

fluoresc 31.3%, dye 9.7%, aggreg 2.4%, conjug 1.4%, transfer 1.2%, polym 1.2%, sensor 1.1%, energy.transfer 1.0%, quench 0.9%, molecul 0.8%, chemosensor 0.8%, detect 0.6%, molecular 0.6%, emiss 0.6%, solut 0.6%

Discriminating Terms

fluoresc 22.0%, dye 6.8%, film 1.5%, aggreg 1.3%, conjug 0.8%, magnet 0.7%, energy.transfer 0.7%, carbon 0.6%, nanotub 0.6%, temperatur 0.6%, crystal 0.6%, chemosensor 0.6%, quench 0.6%, particl 0.5%, deposit 0.5%

Single Word Terms

fluoresc 78, molecul 38, solut 37, molecular 34, two 33, dye 32, state 29, emiss 29, spectroscopi 29, transfer 29, electron 29, system 28, detect 28, structur 27, concentr 27

Double Word Terms

energy.transfer 16, fluorescence.quenching 13, fluorescence.spectra 12, time.resolved 12, dye.molecules 11, electron.transfer 10, water.soluble 10, excited.state 9, fluorescence.lifetime 8, conjugated.polymer 8, fluorescence.emission 8, fluorescence.intensity 7, metal.ions 7, conjugated.polymers 7, red.shift 6

Triple Word Terms

poly.phenylene.ethynylene 5, fluorescence.correlation.spectroscopy 4, resonance.energy.transfer 4, photoinduced.electron.transfer 4, energy.transfer.fret 4, time.resolved.fluorescence 4, fluorescence.quantum.yield 3, fluorescence.resonance.energy 3, transient.absorption.spectroscopy 3, interfacial.electron.transfer 3, correlation.spectroscopy.fcs 3, steady.state.time 3, state.time.resolved 3, electron.energy.transfer 3, atomic.force.microscopy 3

Term Cliques

28.13% transfer polym molecul solut
23.44% transfer polym energy.transfer molecul
20.68% transfer polym sensor energy.transfer quench emiss
23.51% conjug transfer polym quench emiss solut
20.39% conjug transfer polym energy.transfer quench emiss
28.35% aggreg transfer molecul solut
22.62% dye chemosensor molecular
19.05% dye quench chemosensor
25.67% dye transfer energy.transfer molecul

22.10% dye transfer energy.transfer quench
28.35% dye aggreg molecul molecular
27.23% dye aggreg transfer molecul
44.64% fluoresc molecul molecular
30.36% fluoresc quench chemosensor detect emiss solut
30.71% fluoresc sensor chemosensor molecular emiss
27.98% fluoresc sensor quench chemosensor detect emiss
36.25% fluoresc polym molecul detect solut
32.14% fluoresc polym quench detect emiss solut
34.38% fluoresc polym energy.transfer molecul
29.76% fluoresc polym sensor quench detect emiss
27.98% fluoresc polym sensor energy.transfer quench emiss
30.80% fluoresc conjug polym quench emiss solut
27.68% fluoresc conjug polym energy.transfer quench emiss

Sample Cluster Record Titles

Comparison of photophysical and colloidal properties of biocompatible semiconductor nanocrystals using fluorescence correlation spectroscopy

Biosensors based on binding-modulated donor-acceptor distances

Vibrational modes of merocyanine dyes softened upon J-aggregation of the dyes in their Langmuir-Blodgett films

Fluorescence lifetime fluctuations of single molecules probe local density fluctuations in disordered media: A bulk approach

Reactant concentrations from fluorescence correlation spectroscopy with tailored fluorescent probes. An example of local calibration-free pH measurement

Femtosecond fluorescence studies of self-assembled helical aggregates in solution

Interaction of thiacarbocyanine polymethine dyes with the surface of silver bromide sols

Turning fluorescent dyes into Cu(II) nanosensors

Fluorescence resonant energy transfer biosensor based on upconversion-luminescent nanoparticles

Cluster Metrics

Authors

swager, tm 6
zhu, cq 2
zhang, y 2
yoon, j 2
wang, l 2
van hulst, nf 2
tonellato, u 2
tecilla, p 2
shavel, a 2
rampazzo, e 2
prodi, l 2
panigrahi, s 2
pal, t 2
nath, s 2
martinez-manez, r 2

Sources
journal of the american chemical society 12
journal of physical chemistry b 9
journal of materials chemistry 5
macromolecules 4
angewandte chemie-international edition 4
langmuir 3
lab on a chip 3
analytical chemistry 3
analytica chimica acta 3
tetrahedron letters 2
spectroscopy and spectral analysis 2
spectrochimica acta part a-molecular and biomolecular spectroscopy 2
organic letters 2
new journal of chemistry 2
journal of separation science 2

Keywords
chemistry, multidisciplinary 35
chemistry, physical 27
fluorescence 13
chemistry, analytical 12
energy-transfer 11
films 9
spectroscopy 8
chemistry, organic 8
nanoparticles 8
polymer science 7
fluorescence 7
water 7

photoluminescence 7
materials science, multidisciplinary 7
conjugated polymers 7

Publication Year
2005 100
2004 11
2006 1

Country
usa 29
peoples r china 19
germany 13
japan 9
india 8
south korea 7
italy 7
spain 6
netherlands 5
taiwan 3
england 3
canada 3
ukraine 2
switzerland 2
russia 2

Institution
mit 7
chinese acad sci 5
anhui normal univ 4
univ trieste 3
univ padua 3
univ calif santa barbara 3
univ calif los angeles 3
tsing hua univ 3
cnr 3
univ twente 2
univ politecn valencia 2
univ massachusetts 2
univ maryland 2
univ hamburg 2
technion israel inst technol 2

DataBase
science citation index 112

- # CLUSTER 18
  Improvement of solar cells by dye-sensitized films (especially TiO2 films) or nanostructures (92 Records)

(Countries: Japan dominant, followed by China, USA, Switzerland, Germany. Sri Lanka next, but far behind. Institutions: Swiss Federal Institute of Technology, CAS, National Institute of Advanced Industrial Science and Technology, Osaka University. USA includes NREL, UCB.).

Cluster Syntax Features

Descriptive Terms
dye 17.0%, solar 15.0%, cell 8.0%, solar.cells 7.5%, dye.sensitized 5.6%, sensit 5.2%, tio2 3.4%, sensitized.solar 3.3%, dye.sensitized.solar 3.0%, effici 2.0%, sensitized.solar.cells 1.7%, solar.cell 1.5%, convers 0.9%, dssc 0.8%, conversion.efficiency 0.8%

Discriminating Terms
dye 10.1%, solar 9.0%, solar.cells 4.6%, dye.sensitized 3.5%, cell 3.0%, sensit 2.5%, sensitized.solar 2.1%, dye.sensitized.solar 1.9%, film 1.3%, tio2 1.2%, sensitized.solar.cells 1.1%, solar.cell 0.9%, surfac 0.7%, effici 0.7%, structur 0.6%

Single Word Terms
cell 89, solar 82, dye 70, sensit 68, effici 62, tio2 54, convers 47, electron 38, film 33, light 32, current 30, nanocrystallin 30, photocurr 29, energi 28, electrolyt 27

Double Word Terms
solar.cells 70, dye.sensitized 54, sensitized.solar 47, solar.cell 34, conversion.efficiency 34, open.circuit 22, nanocrystalline.tio2 21, short.circuit 19, tio2.solar 16, energy.conversion 16, power.conversion 13, sensitized.tio2 12, incident.photon 12, circuit.voltage 12, solid.state 12

Triple Word Terms
dye.sensitized.solar 45, sensitized.solar.cells 36, sensitized.solar.cell 18, open.circuit.voltage 12, short.circuit.photocurrent 11, energy.conversion.efficiency 11, incident.photon.current 10, tio2.solar.cells 10, solar.cells.dsscs 9, photon.current.conversion 9, dye.sensitized.tio2 9, sensitized.nanocrystalline.tio2 8, short.circuit.current 8, power.conversion.efficiency 8, sensitized.tio2.solar 8

Term Cliques
62.14% dye solar cell dye.sensitized sensit tio2 sensitized.solar dye.sensitized.solar effici solar.cell convers conversion.efficiency
59.78% dye solar cell solar.cells dye.sensitized sensit tio2 sensitized.solar dye.sensitized.solar effici sensitized.solar.cells convers dssc conversion.efficiency

Sample Cluster Record Titles

Influence of electrolyte on the photovoltaic performance of a dye-sensitized TiO2 solar cell based on a Ru(II) terpyridyl complex photosensitizer

The use of xylenol orange in a dye-sensitized solar cell

The application of inverse titania opals in nanostructured solar cells

Dye-sensitized SnO2 electrodes with iodide and pseudohalide redox mediators

Single- and double-layered mesoporous TiO2/P25 TiO2 electrode for dye-sensitized solar cell

Efficiency improvement in solid-state-dye-sensitized photovoltaics with an amphiphilic Ruthenium-dye

Ionic liquid crystal as a hole transport layer of dye-sensitized solar cells

Novel conjugated organic dyes for efficient dye-sensitized solar cells

Photophysical and (photo)electrochemical properties of a coutnarin dye

Cluster Metrics

Authors
gratzel, m 10
arakawa, h 6
zakeeruddin, sm 5
yanagida, s 5
nazeeruddin, mk 5
zhang, bw 4
wang, xs 4
sugihara, h 4
schmidt-mende, l 4
li, c 4
kitamura, t 4
ito, s 4
humphry-baker, r 4

hara, k 4
zeng, zh 3

Sources
journal of physical chemistry b 15
solar energy materials and solar cells 13
journal of materials chemistry 6
applied physics letters 4
thin solid films 3
journal of the american chemical society 3
journal of photochemistry and photobiology a-chemistry 3
chemistry letters 3
nature materials 2
langmuir 2
journal of materials processing technology 2
journal of electroanalytical chemistry 2
chemphyschem 2
chemical physics letters 2
chemical communications 2

Keywords
chemistry, physical 32
materials science, multidisciplinary 21
films 19
conversion 14
chemistry, multidisciplinary 13
energy & fuels 13
efficiency 12
materials science, multidisciplinary 11
light 10
dye-sensitized solar cell 9
transport 9
physics, 8
solar-cells 7
physics, applied 7
tio2 films 7

Publication Year
2005 82
2004 7
2006 3

Country
japan 24
peoples r china 12
usa 11

switzerland 11
germany 10
sri lanka 4
sweden 3
new zealand 3
netherlands 3
england 3
austria 3
italy 2
israel 2
india 2
greece 2

Institution
swiss fed inst technol 9
chinese acad sci 8
natl inst adv ind sci & technol 7
osaka univ 6
natl renewable energy lab 4
kyoto univ 4
inst fundamental studies 4
johannes kepler univ 3
weizmann inst sci 2
uppsala univ 2
univ london imperial coll sci technol & med 2
univ jena 2
univ calif berkeley 2
riso natl lab 2
peking univ 2

DataBase
science citation index 92

- # CLUSTER 250
  Ring compounds, especially porphyrins, fullerenes, and their derivatives, with emphasis on reactions, synthesis, and structure of these compounds (332 Records)

(Countries: Japan and USA essentially tied. Well behind are China, Germany, Russia. Institutions: RAS, CAS, Tokyo Institute of Technology, Tohoku University, Gunma University. USA includes University of Massachusetts, UCR.).

Cluster Syntax Features

Descriptive Terms
porphyrin 7.1%, reaction 4.1%, deriv 2.7%, fulleren 2.4%, ring 2.2%, compound 2.0%, synthesi 1.8%, radic 1.8%, substitut 1.6%, bi 1.6%, nmr 1.6%, molecular 1.5%, phenyl 1.3%, ci 1.1%, unit 1.0%

Discriminating Terms
porphyrin 5.7%, film 2.2%, reaction 1.8%, fulleren 1.7%, deriv 1.6%, ring 1.4%, radic 1.2%, substitut 1.0%, phenyl 1.0%, bi 0.9%, nmr 0.9%, surfac 0.9%, compound 0.9%, ci 0.9%, particl 0.8%

Single Word Terms
structur 172, reaction 146, synthesi 128, molecular 107, rai 103, compound 96, two 93, deriv 91, electron 90, diffract 78, on 76, synthes 75, nmr 73, new 72, ring 71

Double Word Terms
ray.diffraction 48, vch.verlag 27, verlag.gmbh 27, gmbh.co 27, co.kgaa 26, electron.transfer 24, kgaa.69451 24, 69451.weinheim 23, nmr.spectroscopy 22, nmr.spectra 16, mass.spectrometry 16, solid.state 15, donor.acceptor 13, coupling.reaction 13, charge.transfer 12

Triple Word Terms

vch.verlag.gmbh 27, verlag.gmbh.co 26, gmbh.co.kgaa 26, co.kgaa.69451 24, kgaa.69451.weinheim 23, density.functional.theory 10, cross.coupling.reaction 6, differential.scanning.calorimetry 6, ray.diffraction.data 6, maldi.tof.mass 5, tof.mass.spectrometry 5, nmr.spectroscopy.ray 5, functional.theory.dft 5, five.membered.ring 5, single.crystal.ray 5

Term Cliques

12.95% radic bi
22.23% compound synthesi bi phenyl unit
23.19% compound synthesi bi nmr phenyl
19.64% ring substitut molecular ci unit
18.31% ring radic substitut molecular ci
21.69% ring synthesi substitut phenyl unit
25.90% ring synthesi substitut molecular unit
21.39% ring compound molecular ci unit
23.43% ring compound synthesi phenyl unit
27.65% ring compound synthesi molecular unit
20.84% deriv substitut molecular ci unit
22.89% deriv synthesi substitut phenyl unit
27.11% deriv synthesi substitut molecular unit
22.59% deriv compound molecular ci unit
23.55% deriv compound nmr molecular ci
24.64% deriv compound synthesi phenyl unit
28.86% deriv compound synthesi molecular unit
23.34% deriv fulleren synthesi unit
25.66% reaction ring radic substitut molecular
27.05% reaction ring synthesi substitut phenyl
31.27% reaction ring synthesi substitut molecular
28.80% reaction ring compound synthesi phenyl
33.01% reaction ring compound synthesi molecular
21.59% reaction fulleren radic
28.25% reaction deriv synthesi substitut phenyl
32.47% reaction deriv synthesi substitut molecular
28.66% reaction deriv compound synthesi nmr phenyl
32.18% reaction deriv compound synthesi nmr molecular
28.43% reaction deriv fulleren synthesi nmr
14.46% porphyrin bi unit
20.36% porphyrin ring substitut molecular unit
12.75% porphyrin fulleren unit

Sample Cluster Record Titles

STM and XPS studies of the oxidation of aniline at Cu(110) surfaces

C-1 C60F16O: A fluorofullerene ether having exceptionally long chromatographic retention

Synthesis of novel 3,4-dihydro-2H-pyrrolo[60]fullerene derivatives bearing an alkylsulfanyl substituent

Synthesis and photophysical properties of C-60-diphenylaminofluorene dyad and multiads

Mimicking photosynthesis: covalent [60]fullerene-based donor-acceptor ensembles

A porphyrin nanochannel: formation of cationic channels by a protonated saddle-distorted porphyrin and its inclusion behavior

Porphyrin-substituted dinucleotides: Synthesis and spectroscopy

Synthesis of ferrocenylpyrazole derivatives

Porphyrins with fused exocyclic rings

Cluster Metrics

Authors

liu, y 5
guldi, dm 5
nishimura, j 4
nakamura, y 4
edwards, d 4
davies, pr 4
zhang, w 3
yin, jj 3
watterson, ac 3
wang, jj 3
unno, m 3
ter wiel, mkj 3
tejedor, jl 3
tamaoki, n 3
starikova, za 3

Sources

journal of organic chemistry 23
european journal of organic chemistry 21
journal of the american chemical society 16
chemistry-a european journal 12
tetrahedron 11

russian chemical bulletin 8
chemical communications 8
tetrahedron letters 7
journal of physical chemistry b 7
journal of organometallic chemistry 7
fullerenes nanotubes and carbon nanostructures 7
organic letters 6
organic & biomolecular chemistry 6
macromolecules 6
journal of porphyrins and phthalocyanines 6

Keywords
chemistry, organic 98
chemistry, multidisciplinary 91
chemistry, physical 38
chemistry, inorganic & nuclear 32
complexes 29
derivatives 27
chemistry, organic 18
chemistry 18
polymers 15
materials science, multidisciplinary 15
polymer science 14
molecular wires 13
spectra 12
c-60 12
self-assembled monolayers 11

Publication Year
2005 291
2004 40
2006 1

Country
japan 63
usa 62
peoples r china 38
germany 33
russia 28
france 21
spain 17
italy 15
canada 14
england 12
south korea 10
india 10

mexico 7
hungary 7
switzerland 6

Institution
russian acad sci 23
chinese acad sci 12
tokyo inst technol 7
tohoku univ 7
gunma univ 7
univ tokyo 6
max planck inst polymer res 6
kyushu univ 6
univ massachusetts 5
univ erlangen nurnberg 5
cnrs 5
univ complutense madrid 4
univ calif riverside 4
univ bologna 4
univ autonoma madrid 4

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science citation index 332

- # CLUSTER 230

  Chemical studies of bonding (especially hydrogen bonding), host-guest interactions, and other molecular interactions involved in structure and assembly, with focus on supramolecular structures and macrocycles (246 Records)

(Countries: USA, well ahead of China, Japan, Germany. Institutions: CAS, UCLA, University Twente. Other USA includes UCB, University of Utah.).

Cluster Syntax Features

Descriptive Terms

bond 10.7%, supramolecular 7.7%, hydrogen 5.0%, macrocycl 2.9%, chiral 2.6%, hydrogen.bonding 2.3%, guest 2.2%, aren 2.2%, assembl 2.1%, complex 1.6%, molecular 1.5%, molecul 1.5%, nmr 1.5%, self 1.4%, calix 1.3%

Discriminating Terms

bond 6.8%, supramolecular 6.0%, hydrogen 2.6%, macrocycl 2.3%, film 2.1%, chiral 1.9%, hydrogen.bonding 1.8%, aren 1.7%, guest 1.7%, calix 1.1%, hydrogen.bonded 1.0%, rotaxan 1.0%, surfac 0.9%, nmr 0.9%, nanoparticl 0.8%

Single Word Terms

bond 128, structur 120, complex 93, hydrogen 91, assembl 88, self 88, molecul 84, interact 84, form 82, molecular 81, two 74, supramolecular 73, nmr 62, on 62, format 58

Double Word Terms

self.assembly 56, hydrogen.bonding 47, hydrogen.bonded 32, ray.diffraction 29, hydrogen.bonds 29, nmr.spectroscopy 27, solid.state 27, hydrogen.bond 18, self.assembled 17, calix.arene 16, bonding.interactions 15, metal.ions 14, crystal.structure 11, guest.molecules 10, co.kgaa 10

Triple Word Terms

hydrogen.bonding.interactions 12, vch.verlag.gmbh 10, gmbh.co.kgaa 10, kgaa.69451.weinheim 10, co.kgaa.69451 10, verlag.gmbh.co 10, solid.state.nmr 6, fourier.transform.infrared 6, formed.self.assembly 6, hydrogen.bonded.supramolecular 5, supramolecular.self.assembly 5, van.der.waals 5, nuclear.magnetic.resonance 4, magnetic.resonance.nmr 4, hydrogen.bonding.interaction 4

Term Cliques

25.55% guest aren assembl complex molecul self calix
27.64% guest aren assembl complex molecular nmr self
28.92% guest aren assembl complex molecular molecul self
28.98% chiral guest assembl complex molecular molecul self
30.28% macrocycl assembl complex molecular nmr self
28.18% macrocycl chiral assembl complex molecular self
28.51% supramolecular chiral guest assembl complex molecul self
27.64% supramolecular macrocycl chiral assembl complex self
34.44% bond chiral assembl complex molecular molecul self
35.57% bond hydrogen hydrogen.bonding assembl complex molecular molecul self
33.97% bond supramolecular chiral assembl complex molecul self
35.16% bond supramolecular hydrogen hydrogen.bonding assembl complex molecul self

Sample Cluster Record Titles

An STM study on the growth process of vapor-deposited hydroquinone adlayers on Rh(111) and Pt(111)

Hydrophobic chemistry in aqueous solution: Stabilization and stereoselective encapsulation of phosphonium guests in a supramolecular host

An oriented ID coordination/organometallic dimetallic molecular wire with Ag-Pd metal-metal bonds

Synthesis and self assembly of hydrogen-bonded supramolecular polymers

Halogen bonds in biological molecules

A new imidazolium cavitand for the recognition of dicarboxylates

Novel pi-expanded radialene macrocycles with inner cavity

Nanoencapsulation of [60]fullerene with the cavitand cucurbit[7]uril

Encapsulation and stabilization of reactive aromatic diazonium ions and the tropylium ion within a supramolecular host

Cluster Metrics

Authors

stoddart, jf 11
reinhoudt, dn 7
liu, y 5
cantrill, sj 5
vignon, sa 4
verboom, w 4
van leeuwen, fwb 4
kim, sk 4
kim, k 4
crego-calama, m 4
zhou, qf 3
yoon, yj 3
yoon, j 3
tan, yb 3
stang, pj 3

Sources

journal of the american chemical society 16
chemical communications 16
journal of physical chemistry b 11
chemistry-a european journal 11
angewandte chemie-international edition 9
organic letters 7
tetrahedron letters 6
new journal of chemistry 6
macromolecules 6
langmuir 6
journal of organic chemistry 6
journal of materials chemistry 5
european journal of organic chemistry 5
european journal of inorganic chemistry 5
tetrahedron 4

Keywords
chemistry, multidisciplinary 87
chemistry, organic 43
chemistry, physical 39
complexes 30
chemistry 23
self-assembly 20
chemistry, inorganic & nuclear 18
materials science, multidisciplinary 17
design 17
recognition 15
derivatives 14
complexation 14
complexes 13
polymer science 12
molecular recognition 12

Publication Year
2005 212
2004 34

Country
usa 60
peoples r china 33
japan 30
germany 28
france 20
south korea 17
canada 13
netherlands 12
india 12
italy 10
spain 7
england 7
russia 6
finland 5
taiwan 4

Institution
chinese acad sci 12
univ calif los angeles 11
univ twente 8
univ calif berkeley 5
univ strasbourg 1 4
univ halle wittenberg 4
tohoku univ 4

pohang univ sci & technol 4
osaka univ 4
kyoto univ 4
ewha womans univ 4
cnrs 4
yonsei univ 3
wuhan univ 3
univ utah 3

DataBase
science citation index 246

- # CLUSTER 210
  Self-assembly, formation of supramolecular structures, aggregation, and block copolymers (694 Records)

(Countries: USA dominant, China, Japan, Germany. Institutions: CAS dominant, Northwestern University. Other USA include University of Michigan, Georgia Institute of Technology, University of Massachusetts, UCLA.).

Cluster Syntax Features

Descriptive Terms
assembl 32.9%, self 19.1%, self.assembly 12.3%, self.assembled 2.0%, supramolecular 2.0%, aggreg 0.8%, molecular 0.7%, molecul 0.7%, peptid 0.7%, amphiphil 0.5%, structur 0.4%, self.assembling 0.4%, form 0.4%, block 0.3%, copolym 0.3%

Discriminating Terms
assembl 23.3%, self 12.7%, self.assembly 9.5%, film 1.6%, supramolecular 1.4%, self.assembled 1.2%, carbon 0.7%, nanotub 0.6%, temperatur 0.6%, magnet 0.6%, quantum 0.5%, oxid 0.5%, surfac 0.5%, si 0.4%, particl 0.4%

Single Word Terms
assembl 666, self 624, structur 302, form 217, molecular 179, surfac 179, molecul 170, two 169, format 162, interact 155, solut 152, system 138, function 131, microscopi 131, properti 131

Double Word Terms
self.assembly 433, self.assembled 232, self.assembling 65, self.assemble 62, electron.microscopy 52, atomic.force 49, force.microscopy 47, two.dimensional 46, hydrogen.bonding 42, layer.layer 35, three.dimensional 34, transmission.electron 34, aqueous.solution 28, building.blocks 26, one.dimensional 26

Triple Word Terms
atomic.force.microscopy 43, transmission.electron.microscopy 32, self.assembled.structures 21, angle.ray.scattering 18, synthesis.self.assembly 18, small.angle.ray 17, self.assembly.amphiphilic 16, force.microscopy.afm 16, scanning.tunneling.microscopy 15, electrostatic.self.assembly 14, layer.layer.self 14, dynamic.light.scattering 14, formed.self.assembly 14, scanning.electron.microscopy 13, layer.self.assembly 12

Term Cliques
34.15% assembl self peptid amphiphil structur self.assembling form block copolym
34.69% assembl self aggreg peptid amphiphil structur self.assembling form copolym
33.38% assembl self supramolecular molecular molecul peptid amphiphil structur self.assembling form block
33.82% assembl self supramolecular aggreg molecular molecul peptid amphiphil structur self.assembling form
36.82% assembl self self.assembled peptid amphiphil structur form block copolym
37.36% assembl self self.assembled molecular molecul peptid amphiphil structur form block
37.37% assembl self self.assembled aggreg peptid amphiphil structur form copolym
37.85% assembl self self.assembled aggreg molecular molecul peptid amphiphil structur form
40.04% assembl self self.assembly peptid amphiphil structur form block copolym
40.59% assembl self self.assembly aggreg peptid amphiphil structur form copolym
38.20% assembl self self.assembly supramolecular molecular molecul peptid amphiphil structur form block
38.64% assembl self self.assembly supramolecular aggreg molecular molecul peptid amphiphil structur form

Sample Cluster Record Titles

Nanostructures of n-type organic semiconductor in a p-type matrix via self-assembly of block copolymers

Self-assembly of cetyl linear polyethylenimine to give micelles, vesicles, and dense nanoparticles

Two-component dendritic gel: Effect of stereochemistry on the supramolecular chiral assembly

Self-assembly of folic acid derivatives: Induction of supramolecular chirality by hierarchical chiral structures

Self-assembled germanium nano-clusters on silver(110)

Self-assembly and properties of phthalocyanine and polyelectrolytes onto melamine resin particles

Self-assembly of organic molecules on montmorillonite

Supramolecular crystalline sheets with ordered nanopore arrays from self-assembly of rigid-rod building blocks

Bifunctional, conjugated oligomers for orthogonal self-assembly: Selectivity varies from planar substrates to nanoparticles

Cluster Metrics

Authors

lee, m 10
stupp, si 9
reinhoudt, dn 7
nolte, rjm 7
wang, l 6
tang, hl 6
smith, dk 6
shinkai, s 6
schenning, aphj 6
rowan, ae 6
pan, m 6
meijer, ew 6
zhu, db 5
zhang, x 5
liu, y 5

Sources

langmuir 49
journal of the american chemical society 46

chemical communications 34
macromolecules 30
angewandte chemie-international edition 30
advanced materials 25
chemistry-a european journal 23
journal of physical chemistry b 20
nano letters 12
chemistry of materials 12
colloids and surfaces a-physicochemical and engineering aspects 11
biomacromolecules 11
proceedings of the national academy of sciences of the united states of america 10
journal of materials chemistry 10
journal of colloid and interface science 8

Keywords
chemistry, multidisciplinary 206
chemistry, physical 150
self-assembly 95
polymer science 61
materials science, multidisciplinary 59
materials science, multidisciplinary 51
nanostructures 47
films 41
monolayers 38
chemistry, organic 37
water 36
polymers 35
nanoparticles 34
thin-films 32
molecules 30

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2005 630
2004 58
2006 5
2003 1

Country
usa 244
peoples r china 117
japan 90
germany 73
england 40
netherlands 39
france 39
south korea 28

canada 21
switzerland 20
italy 19
india 14
spain 12
israel 12
singapore 11

Institution
chinese acad sci 39
northwestern univ 18
kyushu univ 13
eindhoven univ technol 13
univ michigan 11
georgia inst technol 11
radboud univ nijmegen 10
max planck inst colloids & interfaces 10
yonsei univ 9
univ tokyo 9
univ massachusetts 9
univ calif los angeles 9
nanjing univ 9
ecole polytech fed lausanne 9
univ strasbourg 1 8

DataBase
science citation index 694

- CLUSTER 50
  Self-assembled monolayers (SAMs), especially gold and alkanethiol SAMs, (294 Records)

(Countries: USA dominant, followed by Japan, Germany, South korea, China. Institutions: University of Heidelberg, Korea Advanced Institute S&T, University of Washington, Kyoto University. Other USA include Penn State, Clemson University, University of Houston).

Cluster Syntax Features

Descriptive Terms

sam 44.0%, monolay 7.1%, self.assembled 5.1%, self.assembled.monolayers 4.6%, assembled.monolayers 4.6%, assembl 3.9%, self 3.0%, monolayers.sams 1.9%, assembled.monolayers.sams 1.8%, surfac 1.5%, gold 1.4%, alkanethiol 0.9%, self.assembled.monolayer 0.8%, assembled.monolayer 0.8%, termin 0.7%

Discriminating Terms

sam 30.4%, monolay 4.0%, self.assembled.monolayers 3.1%, assembled.monolayers 3.1%, self.assembled 2.9%, film 1.5%, assembl 1.4%, monolayers.sams 1.3%, assembled.monolayers.sams 1.3%, self 1.0%, particl 0.6%, magnet 0.6%, alkanethiol 0.6%, carbon 0.6%, nanoparticl 0.6%

Single Word Terms

sam 293, self 289, assembl 289, monolay 286, surfac 226, gold 128, spectroscopi 113, structur 100, form 99, molecular 95, molecul 93, solut 90, substrat 85, termin 85, function 80

Double Word Terms

self.assembled 284, assembled.monolayers 214, monolayers.sams 180, assembled.monolayer 92, monolayer.sam 74, photoelectron.spectroscopy 50, ray.photoelectron 50, force.microscopy 37, contact.angle 35, atomic.force 35, cyclic.voltammetry 29, spectroscopy.xps 25, reflection.absorption 24, scanning.tunneling 23, surface.plasmon 23

Triple Word Terms

self.assembled.monolayers 214, assembled.monolayers.sams 177, self.assembled.monolayer 92, assembled.monolayer.sam 74, ray.photoelectron.spectroscopy 50, atomic.force.microscopy 29, photoelectron.spectroscopy.xps 23, scanning.tunneling.microscopy 22, surface.plasmon.resonance 21, force.microscopy.afm 19, contact.angle.measurements 16, infrared.reflection.absorption 15, tunneling.microscopy.stm 14, terminated.self.assembled 14, reflection.absorption.spectroscopy 14

Term Cliques

74.79% sam monolay self.assembled assembl self surfac gold self.assembled.monolayer assembled.monolayer

71.56% sam monolay self.assembled assembled.monolayers self.assembled.monolayers assembl self monolayers.sams assembled.monolayers.sams surfac gold alkanethiol termin

Sample Cluster Record Titles

Oriented crystal growth of 4-Iodo-4'-nitrobiphenyl on polar self-assembled monolayer templates: A case for "Chemical epitaxy"

Highly efficient photocurrent generation from a self-assembled monolayer film of a novel C-60-tethered 2,5-dithienylpyrrole triad

Self-assembled monolayers of bis(salicylaldiminato)nickel(II) Schiff-base complexes: synthesis and structure

Influence of alkyl chain length of biotin terminated n-alkanethiolate SAMs on a molecular recognition between streptavidin and biotin

Determination of ethamsylate in the presence of catecholamines using 4-amino-2-mercaptopyrimidine self-assembled monolayer gold electrode

Elastic and inelastic electron tunneling in alkane self-assembled monolayers

A thermal stability study of alkane and aromatic thiolate self-assembled monolayers on copper surfaces

Loosely packed self-assembled monolayer of N-hexadecyl-3,6-di(p-mercaptophenylacetylene)carbazole on gold and its application in biomimetic membrane research

X-ray photoelectron spectroscopy and near-edge X-ray absorption fine structure study of water adsorption on pyridine-terminated thiolate self-assembled monolayers

Cluster Metrics

Authors

zharnikov, m 8
shaporenko, a 8
grunze, m 8
zhang, s 5
reinhoudt, dn 5
liedberg, b 5
kakiuchi, t 5
huskens, j 5
terfort, a 4
li, ly 4
lee, tr 4
knoll, w 4
kitano, h 4
jiang, sy 4

himmelhaus, m 4

Sources
langmuir 53
journal of physical chemistry b 30
journal of the american chemical society 15
surface science 10
applied surface science 10
chemistry of materials 8
biomaterials 6
analytical chemistry 6
journal of chemical physics 5
japanese journal of applied physics part 1-regular papers brief communications & review papers 5
electrochimica acta 5
chemistry-a european journal 5
thin solid films 4
journal of materials chemistry 4
journal of electroanalytical chemistry 4

Keywords
chemistry, physical 132
gold 92
self-assembled monolayers 79
films 54
adsorption 40
chemistry, multidisciplinary 36
surfaces 26
au(111) 26
surface 25
self-assembled monolayers 24
monolayers 23
materials science, multidisciplinary 22
spectroscopy 20
scanning-tunneling-microscopy 19
chemistry, analytical 19

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2006 5

Country
usa 92
japan 36
germany 35

south korea 30
peoples r china 28
england 16
italy 12
netherlands 10
taiwan 9
spain 9
canada 9
sweden 7
portugal 7
switzerland 6
france 6

Institution

univ heidelberg 16
korea adv inst sci & technol 10
univ washington 9
kyoto univ 9
chinese acad sci 8
univ twente 7
penn state univ 7
clemson univ 7
univ houston 5
tokyo inst technol 5
nagoya univ 5
max planck inst polymer res 5
linkoping univ 5
hokkaido univ 5
cnr 5

DataBase

science citation index 294

- # CLUSTER 168

  Self-assembled monolayers (SAMs), especially gold and alkanethiol SAMs, as well as Langmuir-Blodgett monolayers/ films (335 Records)

(Countries: USA dominant, followed by Japan, Germany, China. Institutions: CAS, UCLA, University of Alberta, National Institute of Advanced Industrial S&T. Other USA include Pacific Northwest National Lab, Northwestern University).

Cluster Syntax Features

Descriptive Terms
monolay 45.4%, self.assembled 5.2%, assembl 4.2%, self.assembled.monolayers 3.2%, assembled.monolayers 3.2%, self 3.2%, surfac 2.3%, langmuir 0.8%, molecul 0.7%, self.assembled.monolayer 0.6%, assembled.monolayer 0.6%, gold 0.5%, acid 0.5%, molecular 0.4%, alkanethiol 0.4%

Discriminating Terms
monolay 33.9%, self.assembled 3.4%, self.assembled.monolayers 2.4%, assembled.monolayers 2.4%, assembl 1.8%, self 1.2%, film 1.2%, particl 0.7%, nanoparticl 0.7%, magnet 0.7%, nanotub 0.7%, temperatur 0.6%, carbon 0.6%, langmuir 0.5%, crystal 0.5%

Single Word Terms
monolay 328, surfac 246, assembl 210, self 195, molecul 121, structur 111, form 107, microscopi 107, measur 102, molecular 94, spectroscopi 91, two 86, film 82, function 81, atom 81

Double Word Terms
self.assembled 183, assembled.monolayers 118, force.microscopy 62, atomic.force 61, assembled.monolayer 57, water.interface 36, ray.photoelectron 34, surface.pressure 33, air.water 33, contact.angle 31, photoelectron.spectroscopy 30, microscopy.afm 29, langmuir.blodgett 28, electron.transfer 26, scanning.tunneling 24

Triple Word Terms
self.assembled.monolayers 118, self.assembled.monolayer 57, atomic.force.microscopy 57, air.water.interface 31, ray.photoelectron.spectroscopy 29, force.microscopy.afm 29, scanning.tunneling.microscopy 20, fourier.transform.infrared 18, surface.pressure.area 15, contact.angle.measurements 15, tunneling.microscopy.stm 14, assembled.monolayers.sams 13, photoelectron.spectroscopy.xps 13, langmuir.blodgett.films 13, grazing.incidence.ray 12

Term Cliques
45.92% monolay surfac langmuir molecul acid molecular
40.13% monolay self.assembled assembl self self.assembled.monolayer assembled.monolayer gold acid alkanethiol
46.03% monolay self.assembled assembl self surfac molecul self.assembled.monolayer assembled.monolayer gold acid
44.18% monolay self.assembled assembl self.assembled.monolayers assembled.monolayers self gold acid alkanethiol
51.18% monolay self.assembled assembl self.assembled.monolayers assembled.monolayers self surfac gold acid

Sample Cluster Record Titles

Use of self-assembled monolayers, metal ions and smectic liquid crystals to detect organophosphonates

Growth kinetics and morphology of self-assembled monolayers formed by contact printing 7-octenyltrichlorosilane and octadecyltrichlorosilane on Si(100) wafers

Study of mixed Langmuir-Blodgett films of immunoglobulin G/amphiphile and their application for immunosensor engineering

Self-assembled monolayers of optically active Co(III) complexes: a new promoter electrode recognizing the electron transfer site in cytochrome c

Vapor-phase self-assembled monolayer for improved mold release in nanoimprint lithography

Self-assembled silane monolayers: Fabrication with nanoscale uniformity

Properties of two-component Langmuir monolayer of single chain perfluorinated carboxylic acids with dipalmitoylphosphatidylcholine (DPPC)

Tribological behavior of self-assembled double layer measured by a pin-on-plate method

Electrochemical properties of thiol monolayers prepared by constant- potential assembly

Cluster Metrics

Authors
gooding, jj 5
wiegart, l 4
vollhardt, d 4

struth, b 4
reinhoudt, dn 4
kim, k 4
zhang, xt 3
zhang, ly 3
zhang, jd 3
xu, zh 3
whitesides, gm 3
ulstrup, j 3
tanaka, k 3
stoddart, jf 3
sek, s 3

Sources

langmuir 66
journal of physical chemistry b 33
journal of the american chemical society 12
surface science 10
colloids and surfaces b-biointerfaces 9
chemical communications 9
journal of electroanalytical chemistry 8
thin solid films 7
applied surface science 7
colloids and surfaces a-physicochemical and engineering aspects 6
small 5
journal of colloid and interface science 5
angewandte chemie-international edition 5
sensors and actuators b-chemical 4
physical chemistry chemical physics 4

Keywords

chemistry, physical 142
self-assembled monolayers 75
chemistry, multidisciplinary 56
gold 50
films 44
surfaces 37
monolayers 33
adsorption 29
monolayers 25
chemistry, analytical 22
scanning-tunneling-microscopy 21
self-assembled monolayers 21
electrochemistry 21
au(111) 20
materials science, multidisciplinary 19

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Country

usa 105
japan 42
germany 37
peoples r china 32
france 24
south korea 23
england 19
canada 16
italy 14
poland 12
india 12
netherlands 9
israel 9
denmark 9
spain 8

Institution

chinese acad sci 8
univ calif los angeles 7
univ alberta 7
natl inst adv ind sci & technol 7
nanjing univ 6
nagoya univ 6
kyushu univ 6
jilin univ 6
warsaw univ 5
univ warsaw 5
univ new s wales 5
tsing hua univ 5
pohang univ sci & technol 5
pacific nw natl lab 5
northwestern univ 5

DataBase

science citation index 335

- CLUSTER 244
  Studies of surfaces (especially copper, gold, and silver-containing surfaces), focusing on the effects of cluster formation and deposition on surfaces and the use of scanning tunneling microscopy to characterize surfaces (STM) (220 Records)

(Countries: USA, Japan, Germany. Institutions: National Institute of Materials Science, University of Tokyo, CAS. Other USA include University of Pittsburgh, UCSB).

Cluster Syntax Features

Descriptive Terms

surfac 8.0%, cu 3.8%, stm 2.5%, cluster 2.3%, 111 2.2%, atom 2.0%, 110 1.7%, electron 1.6%, deposit 1.4%, scanning.tunneling 1.3%, oxygen 1.2%, 001 1.2%, ag 1.2%, tunnel 1.2%, oxid 1.2%

Discriminating Terms

surfac 3.1%, cu 2.6%, stm 2.4%, film 1.9%, 111 1.8%, 110 1.5%, cluster 1.4%, scanning.tunneling 1.2%, 001 0.9%, scanning.tunneling.microscopy 0.9%, nanotub 0.9%, tunneling.microscopy 0.9%, carbon 0.9%, particl 0.8%, island 0.7%

Single Word Terms

surfac 161, electron 129, structur 117, microscopi 116, atom 101, scan 90, temperatur 88, energi 88, high 87, deposit 78, substrat 68, layer 66, tunnel 65, low 62, spectroscopi 60

Double Word Terms

scanning.tunneling 60, tunneling.microscopy 53, electron.microscopy 52, transmission.electron 50, electron.diffraction 37, microscopy.stm 34, energy.electron 34, room.temperature 33, high.resolution 33, low.energy 32, photoelectron.spectroscopy 28, electron.microscope 25, ultrahigh.vacuum 22, ray.photoelectron 22, scanning.electron 20

Triple Word Terms

scanning.tunneling.microscopy 53, transmission.electron.microscopy 39, tunneling.microscopy.stm 31, energy.electron.diffraction 31, low.energy.electron 27, ray.photoelectron.spectroscopy 21, transmission.electron.microscope 17, resolution.transmission.electron 16, high.resolution.transmission 15, scanning.electron.microscopy 12, electron.diffraction.leed 11, ultra.high.vacuum 11, atomic.force.microscopy 10, density.functional.theory 10, electron.energy.loss 10

Term Cliques
29.68% surfac 110 scanning.tunneling oxygen 001 tunnel oxid
34.92% surfac 110 electron oxygen 001 oxid
37.42% surfac atom deposit scanning.tunneling 001 tunnel
32.53% surfac atom 110 scanning.tunneling oxygen 001 tunnel
29.89% surfac stm 111 110 scanning.tunneling oxygen tunnel oxid
33.47% surfac stm 111 atom deposit scanning.tunneling ag tunnel
31.31% surfac stm 111 atom 110 scanning.tunneling ag tunnel
32.39% surfac stm 111 atom 110 scanning.tunneling oxygen tunnel
32.67% surfac stm cluster atom deposit scanning.tunneling ag tunnel
37.64% surfac cu atom deposit 001
35.71% surfac cu atom 110 electron oxygen 001
34.77% surfac cu 111 atom deposit ag
31.89% surfac cu 111 atom 110 ag
33.33% surfac cu 111 atom 110 oxygen
33.71% surfac cu cluster atom deposit ag

Sample Cluster Record Titles

Nano-patterned silicon surfaces for the self-organised growth of metallic nanostructures

Chemical reactions and interdiffusion at the Fe/NiO(001) interface

Ag and Au thin layers on Ta(211) face

Self-assembled growth of CeO2 nanostructures on sapphire

Multiscale modeling of surface sputtering in a scanning transmission electron microscope

Size distribution of cobalt nanoclusters in an amorphous carbon matrix

In situ STM study of nanosized Ru and Os islands spontaneously deposited on Pt(111) and Au(111) electrodes

STM investigations on a tetralactam macrocycle adsorbed on Au(111) and Cu(111) surfaces

Effect of external stress on the patterning of nanostructures: a kinetic Monte Carlo simulation of Ta deposited on anistropically compressed Ta(100) surfaces

Cluster Metrics

Authors
yang, jc 4
zhou, gw 3
zhang, y 3
yoshitake, m 3
yamamoto, t 3
xue, qk 3
tong, x 3
tanaka, s 3
spiecker, e 3
shvets, iv 3
sharma, hr 3
sasaki, t 3
murphy, s 3
mizoguchi, t 3
metiu, h 3

Sources
surface science 24
physical review b 23
journal of physical chemistry b 8
applied surface science 7
thin solid films 6
review of scientific instruments 6
physical review letters 6
journal of materials research 6
langmuir 5
journal of applied physics 5
applied physics letters 5
nuclear instruments & methods in physics research section b-beam interactions with materials and atoms 4
japanese journal of applied physics part 1-regular papers brief communications & review papers 4
acta physica sinica 4
journal of the american chemical society 3

Keywords
chemistry, physical 53
physics, condensed matter 30
growth 30
physics, applied 28
scanning-tunneling-microscopy 26
materials science, multidisciplinary 23
surface 22

films 18
physics, multidisciplinary 17
physics, applied 17
adsorption 17
surfaces 16
thin-films 15
physics, condensed matter 14
physics, 14

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2005 195
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2003 2

Country
usa 51
japan 38
germany 35
peoples r china 15
france 15
england 14
russia 11
italy 9
spain 8
south korea 8
poland 6
taiwan 4
ireland 4
hungary 4
belgium 4

Institution
natl inst mat sci 9
univ tokyo 7
chinese acad sci 7
russian acad sci 6
natl inst adv ind sci & technol 6
univ pittsburgh 5
univ kiel 5
tohoku univ 5
univ warwick 4
univ munich 4
max planck inst met res 4
infm 4
cnrs 4
univ york 3

univ calif santa barbara 3

DataBase
science citation index 220

- # CLUSTER 253
  Layers, emphasizing properties of thickness and deposition, as well as interactions at the interfaces/ barriers (325 Records)

(Countries: USA, Japan, Germany, China. Institutions: CAS, National Chiao Tung University, RAS. Other USA include University of Illinois, UCSD, Georgia Institute of Technology, University of Wisconsin).

Cluster Syntax Features

Descriptive Terms
layer 22.6%, oxid 3.1%, thick 3.0%, deposit 2.8%, cu 1.8%, plasma 1.5%, surfac 1.4%, multilay 1.2%, contact 1.1%, substrat 0.9%, barrier 0.8%, silicon 0.8%, interfac 0.8%, metal 0.7%, dielectr 0.7%

Discriminating Terms
layer 20.0%, film 2.1%, thick 2.0%, oxid 1.1%, cu 1.1%, multilay 1.0%, nanotub 1.0%, deposit 0.9%, carbon 0.9%, nanoparticl 0.9%, plasma 0.8%, quantum 0.8%, particl 0.8%, contact 0.7%, layer.thickness 0.6%

Single Word Terms
layer 244, structur 153, surfac 136, thick 132, electron 131, deposit 130, rai 100, microscopi 99, high 98, oxid 98, substrat 92, temperatur 86, film 83, form 77, properti 77

Double Word Terms
electron.microscopy 78, scanning.electron 45, transmission.electron 44, ray.diffraction 43, layer.thickness 41, atomic.force 31, ray.photoelectron 31, force.microscopy 29, photoelectron.spectroscopy 29, vapor.deposition 23, current.density 20, chemical.vapor 20, high.resolution 18, room.temperature 17, layer.deposition 16

Triple Word Terms

transmission.electron.microscopy 43, scanning.electron.microscopy 38, ray.photoelectron.spectroscopy 29, atomic.force.microscopy 27, chemical.vapor.deposition 17, photoelectron.spectroscopy.xps 15, electron.microscopy.sem 13, electron.microscopy.tem 12, ray.diffraction.xrd 11, atomic.layer.deposition 9, high.resolution.transmission 9, resolution.transmission.electron 9, force.microscopy.afm 9, plasma.chemical.vapor 8, magnetic.tunnel.junctions 7

Term Cliques
12.82% plasma barrier dielectr
14.92% cu barrier metal dielectr
24.22% deposit cu surfac contact barrier interfac metal
26.33% deposit cu surfac contact substrat interfac metal
21.33% thick barrier dielectr
26.55% oxid deposit surfac contact barrier interfac metal
28.66% oxid deposit surfac contact substrat interfac metal
29.28% oxid deposit surfac contact substrat silicon
27.08% oxid deposit plasma surfac contact silicon
26.21% oxid deposit plasma surfac contact barrier
30.59% layer deposit cu multilay substrat interfac metal
32.57% layer deposit cu surfac barrier interfac metal
34.68% layer deposit cu surfac substrat interfac metal
35.69% layer thick multilay substrat interfac
34.90% layer oxid deposit surfac barrier interfac metal
37.01% layer oxid deposit surfac substrat interfac metal
39.03% layer oxid deposit surfac substrat silicon
36.82% layer oxid deposit plasma surfac silicon
35.95% layer oxid deposit plasma surfac barrier
36.12% layer oxid thick barrier interfac
39.08% layer oxid thick substrat interfac
38.58% layer oxid thick substrat silicon

Sample Cluster Record Titles

Exchange bias in NiFe/FeMn/NiFe trilayers

Thermal effect on the oxides on Nb(100) studied by synchrotron-radiation x-ray photoelectron spectroscopy

Effects of wetting ability of plating electrolyte on Cu seed layer for electroplated copper film

Formation of an ordered passivated-nanogold multilayer by the Langmuir-Blodgett method

Effects of O-2- and N-2-plasma treatments on copper surface

[Electroless gold deposition on silicon(100) wafer based on a seed layer of silver]

[Formation of preferentially oriented Cu[111] layer on Nb[110] barrier on SiO2]

[Effect of H-2 sputter gas on interfacial mixing in spin valves]

[Formation and characterization of nanometer scale metal-oxide-semiconductor structures on GaAs using low-temperature atomic layer deposition]

Cluster Metrics

Authors
yang, y 5
park, sj 4
yamaguchi, n 3
wada, k 3
toguchi, m 3
ohno, r 3
mccreery, rl 3
matsubara, h 3
maehama, t 3
kumar, r 3
kim, sh 3
higa, a 3
eden, jg 3
zhu, jg 2
zhang, z 2

Sources
journal of applied physics 27
applied surface science 14
applied physics letters 14
thin solid films 13
japanese journal of applied physics part 1-regular papers short notes & review papers 9
nanotechnology 7
journal of the electrochemical society 7
langmuir 6
electrochemical and solid state letters 6
surface and interface analysis 5
physical review b 5
journal of vacuum science & technology b 5
journal of magnetism and magnetic materials 5
advanced functional materials 5
surface & coatings technology 4

Keywords
physics, applied 67
materials science, multidisciplinary 49
physics, applied 45
chemistry, physical 44
films 44
physics, 37
engineering, electrical & electronic 34
physics, condensed matter 33
materials science, multidisciplinary 21
applied 20
growth 20
thin-films 19
electrochemistry 19
condensed matter 17
materials science, coatings & films 16

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Country
usa 79
japan 46
germany 34
peoples r china 29
south korea 22
taiwan 20
france 20
spain 12
england 12
russia 11
singapore 9
italy 8
india 7
belgium 6
sweden 5

Institution
chinese acad sci 10
natl chiao tung univ 7
russian acad sci 6
univ illinois 5
tohoku univ 5

natl univ singapore 5
natl tsing hua univ 5
csic 5
univ calif san diego 4
inst phys 4
inst microelect 4
georgia inst technol 4
univ wisconsin 3
univ ulm 3
univ ryukyus 3

DataBase
science citation index 325

- # CLUSTER 205
  Growth of layers/ films, especially InN and GaAs, by means of molecular beam epitaxy, chemical vapor deposition, and similar deposition techniques (264 Records)

(Countries: USA, Japan, Germany. Institutions: RAS, CNRS, CAS. Other USA include Arizona State University, University of Houston).

Cluster Syntax Features

Descriptive Terms
epitaxi 11.6%, layer 5.9%, growth 5.6%, grown 3.9%, molecular.beam 3.4%, beam.epitaxy 3.4%, molecular.beam.epitaxy 3.2%, inn 2.4%, substrat 2.2%, beam 2.2%, disloc 2.1%, gaa 2.1%, buffer 1.7%, 001 1.7%, epilay 1.3%

Discriminating Terms
epitaxi 9.0%, molecular.beam 2.8%, beam.epitaxy 2.8%, molecular.beam.epitaxy 2.7%, growth 2.6%, grown 2.3%, inn 2.0%, layer 2.0%, disloc 1.5%, film 1.5%, buffer 1.2%, gaa 1.2%, beam 1.2%, 001 1.1%, epilay 1.1%

Single Word Terms
epitaxi 211, grown 179, layer 176, growth 172, substrat 159, beam 128, molecular 122, structur 121, surfac 120, high 114, temperatur 114, rai 112, electron 111, diffract 106, microscopi 104

Double Word Terms

molecular.beam 117, beam.epitaxy 115, ray.diffraction 89, electron.microscopy 74, transmission.electron 69, layers.grown 48, high.resolution 39, atomic.force 38, force.microscopy 38, phase.epitaxy 35, growth.temperature 34, buffer.layer 31, chemical.vapor 25, vapor.deposition 25, buffer.layers 25

Triple Word Terms

molecular.beam.epitaxy 114, transmission.electron.microscopy 64, atomic.force.microscopy 36, beam.epitaxy.mbe 24, grown.molecular.beam 23, chemical.vapor.deposition 23, vapor.phase.epitaxy 22, high.resolution.ray 18, resolution.ray.diffraction 17, energy.electron.diffraction 16, electron.microscopy.tem 15, high.energy.electron 15, plasma.molecular.beam 15, reflection.high.energy 14, metalorganic.vapor.phase 12

Term Cliques

44.59% layer growth grown substrat disloc buffer epilay
47.16% layer growth grown molecular.beam beam.epitaxy molecular.beam.epitaxy substrat beam buffer epilay
46.63% layer growth grown molecular.beam beam.epitaxy molecular.beam.epitaxy inn substrat beam buffer
44.98% epitaxi layer growth substrat disloc gaa 001 epilay
47.21% epitaxi layer growth molecular.beam beam.epitaxy molecular.beam.epitaxy substrat beam gaa 001 epilay
49.95% epitaxi layer growth grown substrat disloc 001 epilay
50.83% epitaxi layer growth grown molecular.beam beam.epitaxy molecular.beam.epitaxy substrat beam 001 epilay
52.65% epitaxi layer growth grown molecular.beam beam.epitaxy molecular.beam.epitaxy inn substrat beam

Sample Cluster Record Titles

Nano-patterning surfaces by the self-organized growth of ordered and strained epitaxial layers

Growth and characterization of InAs epitaxial layer on GaAs(111)B

InN epitaxial growths on Yttria stabilized zirconia (111) step substrates

Ordered growth of germanium hut islands on Si (001) molecular bonded substrates

InAsSb single crystals with cutoff wavelength longer than 10 mu m grown by melt epitaxy

High uniformity of InGaAsP layers grown by multi-wafer MOVPE system

[Molecular-beam epitaxy of (Zn,Mn)Se on Si(100)]

[Metal/semiconductor phase transition in chromium nitride(001) grown by rf-plasma-assisted molecular-beam epitaxy]

[InN layers grown on silicon substrates: effect of substrate temperature and buffer layers]

Cluster Metrics

Authors
ploog, kh 6
suzuki, t 5
kaganer, vm 5
jenichen, b 5
braun, w 5
williams, rs 4
neave, jh 4
liu, r 4
zhou, jm 3
zhang, j 3
yao, t 3
wu, tb 3
wu, sd 3
wang, h 3
tuomi, t 3

Sources
journal of crystal growth 46
applied physics letters 36
journal of applied physics 31
journal of vacuum science & technology b 12
physical review b 11
thin solid films 9
surface science 6
superlattices and microstructures 5
crystal research and technology 5
chinese physics letters 5
applied surface science 5
semiconductors 4
physical review letters 4
journal of physics-condensed matter 4
journal of electronic materials 4

Keywords
physics, applied 79

crystallography 52
growth 46
molecular-beam epitaxy 37
physics, applied 37
physics, condensed matter 31
gaas 31
engineering, electrical & electronic 30
films 28
materials science, multidisciplinary 20
thin-films 19
molecular beam epitaxy 19
layers 19
surface 18
physics, multidisciplinary 17

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Country

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russia 18
taiwan 14
south korea 14
england 14
italy 10
poland 6
canada 6
ireland 5
spain 4
india 4

Institution

russian acad sci 13
cnrs 13
chinese acad sci 12
univ london imperial coll sci technol & med 6
paul drude inst festkorperelekt 6
natl tsing hua univ 6
univ shizuoka 5
tokyo inst technol 5

cnr 5
arizona state univ 5
univ houston 4
polish acad sci 4
natl synchrotron radiat res ctr 4
natl inst mat sci 4
natl inst adv ind sci & technol 4

DataBase
science citation index 264

- # CLUSTER 229
  Growth of crystals and islands, emphasizing growth parameters and properties of the products (269 Records)

(Countries: USA, China, Japan, Germany, France. Institutions: Shandong University, CAS, CNRS. USA includes Sandia National Laboratories).

Cluster Syntax Features

Descriptive Terms
growth 37.4%, crystal 6.9%, island 1.9%, grown 1.5%, step 1.4%, rate 1.1%, growth.rate 1.1%, epitaxi 1.0%, single.crystals 1.0%, layer 0.9%, nucleat 0.9%, temperatur 0.7%, crystal.growth 0.6%, surfac 0.6%, vapor 0.5%

Discriminating Terms
growth 29.6%, crystal 3.0%, film 1.7%, island 1.4%, growth.rate 1.0%, nanoparticl 0.9%, particl 0.8%, single.crystals 0.8%, step 0.7%, magnet 0.7%, grown 0.7%, epitaxi 0.5%,

crystal.growth 0.5%, quantum 0.5%, polym 0.5%

Single Word Terms
growth 248, temperatur 125, crystal 122, surfac 115, grown 99, high 96, structur 89, rate 85, layer 79, substrat 75, deposit 75, microscopi 71, epitaxi 69, singl 66, rai 62

Double Word Terms
growth.rate 46, ray.diffraction 41, single.crystals 36, atomic.force 33, vapor.deposition 33, chemical.vapor 33, crystal.growth 31, growth.temperature 29, epitaxial.growth 28, force.microscopy 27, single.crystal 25, crystals.grown 22, two.dimensional 22, growth.rates 21, electron.microscopy 20

Triple Word Terms
chemical.vapor.deposition 30, atomic.force.microscopy 27, scanning.tunneling.microscopy 19, force.microscopy.afm 13, transmission.electron.microscopy 12, vapor.phase.epitaxy 10, vapor.deposition.cvd 9, single.crystals.grown 9, scanning.electron.microscopy 9, high.resolution.ray 8, situ.atomic.force 8, energy.dispersive.ray 8, width.half.maximum 8, full.width.half 8, ray.photoelectron.spectroscopy 7

Term Cliques
36.35% growth step rate growth.rate epitaxi layer temperatur surfac vapor
32.96% growth step rate growth.rate epitaxi layer nucleat surfac vapor
49.26% growth grown temperatur vapor
38.71% growth island step epitaxi layer temperatur surfac
34.36% growth island step epitaxi layer nucleat surfac
34.62% growth crystal step rate growth.rate nucleat crystal.growth surfac
40.66% growth crystal step rate growth.rate layer temperatur surfac
36.85% growth crystal step rate growth.rate layer nucleat surfac
39.85% growth crystal grown single.crystals crystal.growth
46.84% growth crystal grown single.crystals temperature

Sample Cluster Record Titles

Fabrication of complex crystals using kinetic control, chemical additives, and epitaxial growth

Growth of atomically flat Ag on mica

Island growth as a growth mode in atomic layer deposition: A phenomenological model

Growth, structural and high pressure studies on MoS2 single crystal

[Growth dynamics and optimization of Ga(In)AsN/GaAs towards 1.3 mu m and 1.55 mu m]

[Growth of Sr3Fe2O7-x single crystals by the floating zone method]

[Atomic force microscopy studies on growth mechanisms of LAP crystals grown in solution containing excessive amount of L-arginine]

[The influence of ammonia on the growth mode in InGaN/GaN heteroepitaxy]

[In situ and real-time characterization of metal-organic chemical vapor deposition growth by high resolution x-ray diffraction]

Cluster Metrics

Authors
zhang, gh 6
xu, d 6
wang, xq 6
geng, yl 6
wang, ty 5
du, w 5
zhang, hj 4
vaidya, r 4
sun, dl 4
silly, f 4
patel, sg 4
liu, hy 4
castell, mr 4
xu, xg 3
wei, l 3

Sources
journal of crystal growth 53
surface science 16
physical review b 13
applied physics letters 12
physical review letters 8
journal of applied physics 4
japanese journal of applied physics part 1-regular papers short notes & review papers 4
geochimica et cosmochimica acta 4
crystal research and technology 4
applied surface science 4
solid state communications 3
physica status solidi b-basic solid state physics 3

materials science and engineering b-solid state materials for advanced technology 3
materials chemistry and physics 3
journal of the american chemical society 3

Keywords
crystallography 60
chemistry, physical 33
growth 33
materials science, multidisciplinary 32
physics, applied 31
chemical-vapor-deposition 27
films 24
physics, condensed matter 23
physics, condensed matter 17
epitaxy 17
physics, multidisciplinary 16
physics, applied 15
temperature 12
surface 12
materials science, multidisciplinary 12

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2005 229
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Country
usa 57
peoples r china 44
japan 34
germany 32
france 26
india 17
england 13
russia 9
spain 7
italy 7
south korea 6
taiwan 5
canada 5
singapore 4
poland 4

Institution
shandong univ 12
chinese acad sci 12

cnrs 8
univ oxford 6
natl inst mat sci 6
tohoku univ 5
shanghai jiao tong univ 5
univ paris 06 4
univ cambridge 4
sardar patel univ 4
sandia natl labs 4
max planck inst met res 4
anna univ 4
univ tokyo 3
univ munster 3

DataBase
science citation index 269

- # CLUSTER 58
  Silicon carbide (SiC), emphasizing growth of desired structures by epitaxy or chemical vapor deposition (CVD) and issues concerning defects on the products (174 Records)

(Countries: Japan, USA, Germany. Institutions: Kyoto University, Linkoping University, Technical University Ilmenau. Other USA include University of South Carolina, Rensselaer Polytechnic Institute, US Navy.).

Cluster Syntax Features

Descriptive Terms
sic 66.8%, growth 1.8%, epitaxi 1.3%, layer 1.0%, silicon.carbide 0.9%, cvd 0.8%, carbid 0.7%, grown 0.7%, si 0.7%, silicon 0.6%, defect 0.5%, epilay 0.5%, substrat 0.5%, fault 0.4%, dope 0.4%

Discriminating Terms
sic 44.9%, film 1.4%, nanoparticl 0.7%, particl 0.6%, magnet 0.6%, silicon.carbide 0.6%, nanotub 0.6%, epitaxi 0.6%, structur 0.4%, surfac 0.4%, carbid 0.4%, quantum 0.4%, oxid 0.4%, cvd 0.3%, polym 0.3%

Single Word Terms
sic 170, layer 88, growth 82, deposit 80, high 75, temperatur 72, chemic 71, grown 71, si 69, electron 69, substrat 66, epitaxi 66, surfac 65, structur 65, silicon 65

Double Word Terms
chemical.vapor 52, vapor.deposition 47, silicon.carbide 47, electron.microscopy 37, transmission.electron 33, epitaxial.growth 27, growth.sic 25, sic.epitaxial 20, sic.0001 19, ray.diffraction 18, high.temperature 18, atomic.force 16, sic.layers 16, hot.wall 16, deposition.cvd 16

Triple Word Terms
chemical.vapor.deposition 47, transmission.electron.microscopy 28, silicon.carbide.sic 15, vapor.deposition.cvd 14, atomic.force.microscopy 12, sic.epitaxial.layers 11, grown.chemical.vapor 11, epitaxial.growth.sic 10, resolution.transmission.electron 8, high.resolution.transmission 8, epitaxial.layers.grown 8, layers.grown.chemical 8, scanning.electron.microscopy 8, hot.wall.cvd 7, sic.epitaxial.growth 7

Term Cliques
41.52% sic layer cvd grown si silicon defect dope
39.46% sic layer silicon.carbide carbid defect fault
38.29% sic layer silicon.carbide cvd carbid silicon defect dope
42.69% sic epitaxi layer grown defect substrat fault
41.59% sic epitaxi layer cvd grown si defect dope
44.25% sic epitaxi layer cvd grown si defect substrat
41.09% sic growth cvd grown si silicon defect dope
38.89% sic growth silicon.carbide carbid defect fault
37.86% sic growth silicon.carbide cvd carbid silicon defect dope
38.72% sic growth epitaxi grown defect epilay substrat fault
38.00% sic growth epitaxi cvd grown defect epilay dope
40.66% sic growth epitaxi cvd grown defect epilay substrat
41.16% sic growth epitaxi cvd grown si defect dope
43.82% sic growth epitaxi cvd grown si defect substrat

Sample Cluster Record Titles

The microstructure of polymer-derived amorphous silicon carbide layers

Ab initio study of structural and electronic properties of planar defects in Si and SiC

Determination of densities and energy levels of donors in free-standing undoped 3C-SiC epilayers with thicknesses of 80 mu m

Coating of SiC surface by thin carbon films using the carbide-derived carbon process

Application of Raman microscopy to the analysis of silicon carbide monofilaments

Wafer bonding characteristics for 3C-SiC-on-insulator structures using PECVD oxide

Helical nanocables with SiC core and SiO2 shell

Strong influence of boron doping on nanocrystalline silicon-carbide formation by using photo-CVD technique

Experimental evidence for the quantum confinement effect in 3C-SiC nanocrystallites

Cluster Metrics

Authors

kimoto, t 8
ambacher, o 8
pezoldt, j 7
nishino, s 6
matsunami, h 6
ohshima, s 5
janzen, e 5
cimalla, v 5
yakimova, r 4
syvajarvi, m 4
sudarshan, ts 4
monteil, y 4
henry, a 4
chow, tp 4
tojo, t 3

Sources

silicon carbide and related materials 2004 49

journal of applied physics 13
applied physics letters 8
journal of electronic materials 6
journal of crystal growth 6
physical review b 4
physica status solidi a-applications and materials science 4
journal of materials science 4
journal of the european ceramic society 3
japanese journal of applied physics part 1-regular papers short notes & review papers 3
japanese journal of applied physics part 1-regular papers brief communications & review papers 3
high-performance ceramics iii, pts 1 and 2 3
advanced si-based ceramics and composites 3
thin solid films 2
surface science 2

Keywords
physics, applied 27
silicon-carbide 20
materials science, multidisciplinary 19
silicon-carbide 17
physics, applied 15
growth 15
silicon carbide 14
physics, condensed matter 14
engineering, electrical & electronic 14
chemical-vapor-deposition 14
sic 11
cvd 11
crystallography 10
4h-sic 10
sic 10

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2005 163
2004 9
2003 2

Country
japan 45
usa 42
germany 28
peoples r china 16
france 16
sweden 15
russia 11

south korea 9
italy 9
england 6
norway 5
greece 4
mexico 3
australia 3
ukraine 2

Institution

kyoto univ 12
linkoping univ 9
tech univ ilmenau 8
kyoto inst technol 6
cnrs 6
univ s carolina 5
univ oslo 5
chinese acad sci 5
yonsei univ 4
tohoku univ 4
royal inst technol 4
rensselaer polytech inst 4
carnegie mellon univ 4
aristotle univ thessaloniki 4
usn 3

DataBase

science citation index 174

- # CLUSTER 131
  Silicon-containing substances, emphasizing processes on and

interactions with silicon surfaces and scanning tunneling microscopy (STM) to characterize the substances (228 Records)

(Countries: Japan, USA, Germany. Institutions: Tohoku University, Osaka University University, University oif Illinois, CAS. Other USA include Arizona State University, University of Wisconsin.).

Cluster Syntax Features

Descriptive Terms

si 27.7%, si.111 10.1%, 111 6.9%, surfac 3.3%, si.100 1.5%, scanning.tunneling 1.4%, atom 1.4%, stm 1.4%, si.001 1.3%, tunnel 1.1%, scanning.tunneling.microscopy 1.1%, tunneling.microscopy 1.1%, dimer 1.0%, island 1.0%, termin 0.9%

Discriminating Terms

si 16.5%, si.111 7.8%, 111 4.6%, film 1.6%, si.100 1.1%, si.001 0.9%, scanning.tunneling 0.9%, stm 0.9%, nanoparticl 0.7%, scanning.tunneling.microscopy 0.7%, tunneling.microscopy 0.7%, terminated.si 0.7%, particl 0.7%, magnet 0.7%, nanotub 0.6%

Single Word Terms

si 228, surfac 196, 111 132, atom 125, microscopi 125, scan 113, structur 108, tunnel 106, electron 89, temperatur 88, deposit 75, energi 75, growth 74, format 74, form 72

Double Word Terms

si.111 127, scanning.tunneling 98, tunneling.microscopy 86, si.100 50, room.temperature 40, terminated.si 40, 111.surface 37, photoelectron.spectroscopy 36, si.001 35, hydrogen.terminated 34, electron.diffraction 32, energy.electron 32, si.surface 32, microscopy.stm 29, ray.photoelectron 28

Triple Word Terms

scanning.tunneling.microscopy 86, si.111.surface 34, energy.electron.diffraction 30, ray.photoelectron.spectroscopy 28, hydrogen.terminated.si 28, atomic.force.microscopy 25, tunneling.microscopy.stm 23, low.energy.electron 23, si.111.surfaces 20, si.100.surface 19, photoelectron.spectroscopy.xps 18, si.111.7x7 18, si.001.surface 17, terminated.si.111 15, surface.scanning.tunneling 14

Term Cliques

43.97% si scanning.tunneling atom si.001 tunnel scanning.tunneling.microscopy tunneling.microscopy island
44.81% si si.100 atom scanning.tunneling.microscopy tunneling.microscopy island
56.23% si surfac atom si.001 termin
46.18% si surfac scanning.tunneling atom stm si.001 tunnel scanning.tunneling.microscopy tunneling.microscopy dimer

47.37% si surfac si.100 atom stm scanning.tunneling.microscopy tunneling.microscopy dimer
50.00% si si.111 111 scanning.tunneling atom tunnel scanning.tunneling.microscopy tunneling.microscopy island
57.70% si si.111 111 surfac scanning.tunneling atom tunnel scanning.tunneling.microscopy tunneling.microscopy

Sample Cluster Record Titles

Self-organized SiC nanostructures on silicon

Scaling properties of a Si surface patterned by selective chemical etching

Physical properties and chemical reactivity of the buckled dimer on Si(100)

Epitaxial growth of 3C-SiC on Si(111) using hexamethyldisilane and tetraethylsilane

Imprinting Br-atoms at Si(111) from a SAM of CH3Br(ad), with pattern retention

Initial processes of hydrogen adsorption on Si(100) surface

Scanning tunneling microscopy/spectroscopy studies of two isomers of Ce@C-82 on Si(111)-(7x7) surfaces

Scanning tunnelling microscopy observations at initial stage of Cs adsorption on Si(III)-root 3x root 3-Ag surface

VUV laser photodesorption of hydrogen from Si(100)(2x1): H surface assisted by scanning tunneling microscope

Cluster Metrics

Authors
xue, qk 5
xu, gq 5
jia, jf 5
huang, jy 5
huang, hg 5
wu, kh 4
sakurai, t 4
oura, k 4
okado, h 4
katayama, m 4

fujikawa, y 4
custance, o 4
zotov, av 3
zegenhagen, j 3
yoshida, s 3

Sources
surface science 43
physical review b 28
applied physics letters 19
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journal of physical chemistry b 7
journal of applied physics 7
applied surface science 7
japanese journal of applied physics part 1-regular papers short notes & review papers 6
thin solid films 5
journal of vacuum science & technology a 5
journal of crystal growth 5
japanese journal of applied physics part 1-regular papers brief communications & review papers 5
journal of the korean physical society 4
japanese journal of applied physics part 2-letters & express letters 4
ultramicroscopy 3

Keywords
chemistry, physical 66
silicon 62
scanning-tunneling-microscopy 55
growth 54
physics, condensed matter 37
physics, applied 37
surface 31
si(001) 25
physics, multidisciplinary 24
films 23
adsorption 23
si 22
si(111) 21
physics, applied 21
si(100) 19

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2005 204
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Country

japan 67
usa 48
germany 24
peoples r china 18
france 18
south korea 14
canada 11
italy 7
russia 6
england 6
taiwan 5
singapore 5
brazil 5
australia 5
india 4

Institution

tohoku univ 13
osaka univ 13
univ illinois 10
chinese acad sci 10
univ tokyo 7
natl univ singapore 5
univ tsukuba 4
univ toronto 4
univ erlangen nurnberg 4
kyoto univ 4
arizona state univ 4
vladivostok state univ econ & serv 3
univ wisconsin 3
univ turku 3
univ paris 11 3

DataBase

science citation index 228

- # CLUSTER 190
  Silicon, silica, and silicide-containing substrates/ layers/ films: their properties and processes that occur on them (461 Records)

(Countries: Japan, USA, China, Germany, South Korea. Institutions: Nanjing University, National Tsing Hua University, CNR, Tohoku University, National Chiao Tung University. No USA institutions among leaders.).

Cluster Syntax Features

Descriptive Terms
si 62.5%, sio2 1.6%, silicon 1.3%, layer 1.3%, anneal 0.7%, silicid 0.7%, substrat 0.6%, interfac 0.5%, deposit 0.5%, oxid 0.5%, si.si 0.5%, si.substrate 0.4%, film 0.4%, si.sio2 0.3%, growth 0.3%

Discriminating Terms
si 47.9%, film 1.1%, sio2 0.8%, magnet 0.7%, particl 0.7%, carbon 0.6%, nanotub 0.6%, nanoparticl 0.6%, silicid 0.5%, polym 0.5%, surfac 0.5%, quantum 0.4%, structur 0.4%, si.si 0.4%, silicon 0.3%

Single Word Terms
si 461, layer 209, electron 207, silicon 202, structur 184, film 173, deposit 171, substrat 160, temperatur 157, high 150, surfac 148, microscopi 132, format 130, form 125, rai 121

Double Word Terms
electron.microscopy 109, transmission.electron 105, si.substrate 75, si.si 59, chemical.vapor 57, vapor.deposition 56, ray.diffraction 55, photoelectron.spectroscopy 52, ray.photoelectron 50, room.temperature 47, sio2.si 46, silicon.si 44, si.100 44, si.sio2 42, high.resolution 39

Triple Word Terms
transmission.electron.microscopy 95, chemical.vapor.deposition 55, ray.photoelectron.spectroscopy 50, photoelectron.spectroscopy.xps 25, plasma.chemical.vapor 25, high.resolution.transmission 23, electron.microscopy.tem 23, resolution.transmission.electron 23, atomic.force.microscopy 21, scanning.electron.microscopy 18, cross.sectional.transmission 16, sectional.transmission.electron 16, auger.electron.spectroscopy 15, ray.diffraction.xrd 12, si.nanocrystals.si 12

Term Cliques
39.98% si layer substrat deposit oxid si.substrate growth
37.71% si layer substrat interfac oxid si.substrate growth
37.66% si layer silicid substrat deposit si.substrate film growth
35.68% si layer silicid substrat interfac si.substrate film growth
42.37% si layer anneal deposit film si.sio2
39.73% si layer anneal interfac film si.sio2
40.59% si layer anneal substrat deposit oxid si.substrate
38.33% si layer anneal substrat interfac oxid si.substrate
38.20% si layer anneal silicid substrat deposit si.substrate film
36.23% si layer anneal silicid substrat interfac si.substrate film
44.32% si silicon substrat deposit si.si film
42.34% si silicon substrat deposit oxid si.si
45.62% si silicon layer substrat deposit film growth
43.91% si silicon layer substrat deposit oxid growth
46.23% si silicon layer anneal substrat deposit film
44.53% si silicon layer anneal substrat deposit oxid
38.05% si sio2 layer anneal deposit oxid si.sio2
39.08% si sio2 layer anneal deposit oxid si.substrate
35.79% si sio2 layer anneal interfac oxid si.sio2
36.81% si sio2 layer anneal interfac oxid si.substrate

Sample Cluster Record Titles

Coarsening of nano-crystalline SiC in amorphous Si-B-C-N

Novel Er-doped SiC/SiO2 nanocomposites: Synthesis via polymer pyrolysis and their optical characterization

Blue emission from hydrogen-containing a-Si : H/SiO2 multilayers and the investigation of its mechanism

Nanostructure formation by high temperature-pressure treatment of silicon implanted with hydrogen/helium

Study of surface segregation of Si on palladium silicide using Auger electron spectroscopy

Molecular dynamics study of nano-size silica melting by high heat flux

The effect of Au thickness and annealing conditions on SiO2 formation in the Au/Si system

[Ternary phase analysis of interfacial silicates grown in HfOx/Si and HF/SiO2/Si systems]

[Photoluminescence of GaAs nanowhiskers grown on Si substrate]

Cluster Metrics

Authors

ma, zy 8
huang, xf 8
chen, kj 8
li, w 6
wang, yq 5
smirani, r 5
ross, gg 5
kim, sh 5
han, pg 5
chu, pk 5
zou, hc 4
yasuda, k 4
wu, yc 4
wu, xl 4
siu, gg 4

Sources

applied physics letters 60
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japanese journal of applied physics part 1-regular papers short notes & review papers 17
applied surface science 16
physical review b 13
journal of the electrochemical society 13
japanese journal of applied physics part 1-regular papers brief communications & review papers 10
materials science and engineering b-solid state materials for advanced technology 9
journal of vacuum science & technology b 9
surface science 7
nanotechnology 7
journal of vacuum science & technology a 7
ieee electron device letters 7
electrochemical and solid state letters 7

Keywords

physics, applied 134
materials science, multidisciplinary 79
silicon 78

physics, applied 62
films 51
chemistry, physical 43
si 43
engineering, electrical & electronic 40
physics, condensed matter 40
silicon 39
growth 39
physics, condensed matter 36
physics, 34
photoluminescence 30
thin-films 25

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2005 413
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Country
japan 100
usa 87
peoples r china 54
germany 43
south korea 42
france 31
taiwan 26
italy 23
canada 16
russia 13
india 12
england 11
ukraine 10
spain 10
singapore 9

Institution
nanjing univ 13
natl tsing hua univ 12
cnr 12
tohoku univ 11
natl chiao tung univ 11
natl acad sci ukraine 9
hanyang univ 9
city univ hong kong 8
chinese acad sci 8
sungkyunkwan univ 7

russian acad sci 7
osaka univ 7
natl inst adv ind sci & technol 7
cnrs 7
waseda univ 6

DataBase
science citation index 461

- # CLUSTER 36
  Growth and characterization of silicon-germanium (SiGe) structures and their application to circuits, with focus on strained/ strain-relaxed SiGe layers (113 Records)

(Countries: USA, Japan, Taiwan, Germany. Institutions: RAS, CAS, National Tsing Hua University. Other USA include MIT, University of Illinois.).

Cluster Syntax Features

Descriptive Terms
sige 31.4%, strain 11.4%, si 9.3%, strained.si 4.2%, si0 3.1%, ge 2.7%, layer 2.0%, sige.si 1.5%, si.sige 1.3%, si1 1.3%, disloc 1.2%, xgex 1.1%, si1.xgex 0.9%, relax 0.9%, island 0.9%

Discriminating Terms
sige 21.0%, strain 6.3%, si 3.6%, strained.si 2.8%, si0 2.1%, film 1.5%, ge 1.4%, sige.si 1.0%, si.sige 0.8%, si1 0.8%, xgex 0.8%, nanoparticl 0.7%, particl 0.7%, si1.xgex 0.6%, magnet 0.6%

Single Word Terms
si 101, sige 97, strain 84, layer 81, substrat 64, high 55, ge 53, temperatur 48, grown 46, electron 45, structur 43, si0 41, relax 40, growth 39, surfac 38

Double Word Terms

strained.si 32, sige.si 31, si.sige 29, transmission.electron 28, electron.microscopy 28, si1.xgex 21, sige.layer 21, metal.oxide 21, chemical.vapor 19, vapor.deposition 19, relaxed.sige 19, oxide.semiconductor 19, ray.diffraction 17, si.001 17, si.layer 16

Triple Word Terms
transmission.electron.microscopy 27, chemical.vapor.deposition 19, metal.oxide.semiconductor 19, oxide.semiconductor.field 14, semiconductor.field.transistors 11, strained.si.sige 10, strained.si.layer 9, silicon.insulator.soi 8, si.sige.si 8, si.001.substrate 8, molecular.beam.epitaxy 8, high.resolution.ray 7, si.001.substrates 7, resolution.ray.diffraction 6, strained.si.layers 6

Term Cliques
44.25% strain si ge layer si1 disloc xgex si1.xgex relax
50.44% strain si ge layer sige.si si1 disloc
44.35% strain si si0 ge layer si1 disloc xgex si1.xgex
53.54% sige si sige.si island
60.94% sige strain si ge layer disloc relax
59.80% sige strain si ge layer sige.si disloc
60.18% sige strain si ge layer sige.si si.sige
61.06% sige strain si si0 ge layer disloc
57.19% sige strain si strained.si ge layer si.sige relax
57.30% sige strain si strained.si si0 ge layer si.sige

Sample Cluster Record Titles

Metal-induced crystallization of amorphous Si1-xGex by rapid thermal annealing

Self-forming silicide/SiGe-based tube structure on Si(001) substrates

The effect of Sb surfactant assisted growth on SiGe surface morphology

Shortened photoconductance lifetime of Si/SiGe hetero structures due to interfacial oxygen or carbon from incomplete in-situ hydrogen cleans

Design, fabrication and characterisation of strained Si/SiGe MOS transistors

Fabrication of thick, high-quality strained SiGe layer on ultra-thin silicon-on-insulator and modeling of film strain

Application of selective epitaxy for formation of ultra shallow SiGe-based junctions

SiGe-on-insulator material fabrication by oxygen implantation into SiGe/Si heterostructure and novel two-step annealing

Growth kinetic and doping of Si and SiGe epi layers on fullsheet substrates

Cluster Metrics

Authors
olsen, sh 4
o'neill, ag 4
novikov, av 4
krasil'nik, zf 4
chen, lj 4
zhang, m 3
zaima, s 3
vogg, g 3
taoka, n 3
takagi, s 3
stoffel, m 3
schmidt, og 3
schaffler, f 3
sakai, a 3
rolland, g 3

Sources
materials science in semiconductor processing 15
applied physics letters 15
materials science and engineering b-solid state materials for advanced technology 8
journal of crystal growth 7
thin solid films 6
electrochemical and solid state letters 5
physical review b 4
journal of applied physics 4
japanese journal of applied physics part 1-regular papers brief communications & review papers 4
semiconductor science and technology 3
physics of the solid state 3
journal of physics d-applied physics 3
japanese journal of applied physics part 2-letters & express letters 3
journal of vacuum science & technology b 2
journal of electronic materials 2

Keywords
engineering, electrical & electronic 33
physics, applied 32
physics, applied 29
physics, condensed matter 26
materials science, multidisciplinary 23
multidisciplinary 21

materials science, 21
films 18
si 16
silicon 15
sige 15
relaxation 12
mobility 12
layers 12
growth 12

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2005 101
2004 12

Country
usa 23
japan 16
taiwan 15
germany 14
peoples r china 9
russia 8
england 6
sweden 5
south korea 5
singapore 5
france 5
austria 5
switzerland 3
belgium 3
ukraine 2

Institution
russian acad sci 6
chinese acad sci 6
natl tsing hua univ 5
univ newcastle upon tyne 4
stmicroelect 4
natl univ singapore 4
natl chiao tung univ 4
mit 4
johannes kepler univ 4
cea 4
univ illinois 3
tohoku univ 3
royal inst technol 3
paul scherrer inst 3

nagoya univ 3

DataBase
science citation index 113

- # CLUSTER 42
  Germanium-based substances, including germanium nanocrystals, islands, and substrates, as well as heterostructures containing silicon (176 Records)

(Countries: USA dominant, China, Germany, Japan, France. Institutions: National University Singapore, Arizona State University, CAS, CEA. Other USA include University of Texas, Oak Ridge National Labs.).

Cluster Syntax Features

Descriptive Terms
ge 61.4%, si 6.5%, island 6.2%, ge.si 1.5%, si.ge 1.0%, germanium 0.8%, 001 0.8%, layer 0.6%, ge.nanocrystals 0.6%, ge.islands 0.5%, growth 0.5%, si.001 0.4%, nanocryst 0.4%, sige 0.4%, epitaxi 0.3%

Discriminating Terms
ge 41.2%, island 3.8%, si 2.3%, film 1.4%, ge.si 1.0%, si.ge 0.7%, particl 0.7%, carbon 0.6%, magnet 0.6%, nanoparticl 0.6%, nanotub 0.6%, germanium 0.5%, structur 0.4%, ge.nanocrystals 0.4%, polym 0.4%

Single Word Terms
ge 170, si 126, layer 86, surfac 77, deposit 67, temperatur 67, grown 66, growth 65, structur 63, electron 63, island 59, high 58, microscopi 58, atom 56, substrat 55

Double Word Terms
ge.si 53, si.ge 39, transmission.electron 35, electron.microscopy 34, si.001 32, ge.islands 27, si.100 26, ray.diffraction 21, self.assembled 19, ge.nanocrystals 19, chemical.vapor 18, vapor.deposition 18, scanning.tunneling 17, room.temperature 17, atomic.force 16

Triple Word Terms
transmission.electron.microscopy 28, chemical.vapor.deposition 18, molecular.beam.epitaxy 16, scanning.tunneling.microscopy 16, atomic.force.microscopy 14, self.assembled.ge 10, ge.si.001 8, electron.microscopy.tem 8, energy.electron.diffraction 7, high.energy.electron 7, pressure.chemical.vapor 7, ge.nanocrystals.embedded 7, ge.si.si 6, reflection.high.energy 6, si.001.islands 6

Term Cliques
48.86% ge layer growth nanocryst
42.33% ge layer ge.nanocrystals nanocryst
44.74% ge germanium layer ge.nanocrystals
48.86% ge si germanium layer growth sige
47.16% ge si si.ge layer sige epitaxi
49.43% ge si ge.si si.ge layer epitaxi
44.39% ge si island 001 layer growth sige epitaxi
43.25% ge si island 001 layer growth si.001 sige
42.68% ge si island ge.si 001 layer ge.islands growth epitaxi
41.67% ge si island ge.si 001 layer ge.islands growth si.001

Sample Cluster Record Title

Raman scattering studies in two kinds of Ge nanosystems under hydrostatic pressure

Electrical study of MOS structure with Ge embedded in SiO2 as floating gate for nonvolatile memory

Initial stages of Mn adsorption on Ge(111)

Interface modification in Co/Ge bilayer using swift heavy ions

Two-dimensional arrays of nanometre scale holes and nano-V-grooves in oxidized Si wafers for the selective growth of Ge dots or Ge/Si hetero-nanocrystals

Strain-mediated uniform islands in stacked Ge/Si(001) layers

An X-ray scattering study on inverted Ge-Si huts grown at low temperatures

Self-assembled In(Ga) as islands on Ge substrate

Size and density control of crystalline Ge islands on glass substrates by oxygen etching

Cluster Metrics

Authors

stoffel, m 6
schmidt, og 6
foo, yl 6
kwong, dl 5
hartmann, jm 5
rolland, g 4
nath, r 4
chi, dz 4
bogumilowicz, y 4
billon, t 4
zhu, cx 3
wang, xs 3
wang, j 3
vostokov, nv 3
tsong, ist 3

Sources

applied physics letters 22
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physical review b 20
materials science in semiconductor processing 9
physical review letters 6
nanotechnology 6
surface science 5
optical materials 5
microelectronic engineering 5
journal of crystal growth 5
applied surface science 5
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thin solid films 3
materials science and engineering b-solid state materials for advanced technology 3
journal of vacuum science & technology b 3

Keywords

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growth 42
silicon 36
physics, condensed matter 30
germanium 30
physics, applied 27
engineering, electrical & electronic 26
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ge 20
films 19
physics, condensed matter 18
quantum dots 17
multidisciplinary 12

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usa 50
peoples r china 24
germany 23
japan 22
france 21
singapore 15
taiwan 13
russia 9
spain 7
italy 6
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canada 5
india 4
belgium 4
brazil 3

Institution
natl univ singapore 10
arizona state univ 8
chinese acad sci 7
cea 7
inst mat res & engn 6
univ texas 5
univ paris 11 5
stmicroelect 5
russian acad sci 5

max planck inst festkorperforsch 5
inst microelect 5
cnrs 5
tohoku univ 4
oak ridge natl lab 4
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science citation index 176

- CLUSTER 117
  Ion implantation to modify or create materials, including nanocrystals, sometimes accompanied by or followed by annealing, thermal or laser (354 Records)

(Countries: USA, China, Japan, Germany. Institutions: Tsing Hua University, CAS, CNRS, CNR, Australian National University).

Cluster Syntax Features

Descriptive Terms
implant 50.9%, ion 8.0%, anneal 4.4%, ion.implantation 2.4%, si 2.0%, dose 2.0%, kev 1.2%, silicon 0.7%, layer 0.6%, depth 0.6%, sampl 0.6%, energi 0.4%, fluenc 0.4%, sio2

0.4%, nanocryst 0.4%

Discriminating Terms
implant 37.2%, ion 3.8%, anneal 2.1%, ion.implantation 1.8%, film 1.7%, dose 1.3%, kev 0.9%, particl 0.6%, nanotub 0.6%, magnet 0.5%, structur 0.5%, carbon 0.5%, quantum 0.4%, nanoparticl 0.4%, deposit 0.4%

Single Word Terms
implant 304, ion 268, anneal 187, surfac 155, temperatur 155, layer 151, sampl 148, energi 147, high 138, electron 136, si 134, format 121, dose 119, kev 111, microscopi 108

Double Word Terms
ion.implantation 135, electron.microscopy 89, transmission.electron 73, ray.diffraction 50, ion.beam 44, ion.implanted 39, thermal.annealing 37, room.temperature 37, ion.mass 37, secondary.ion 36, high.resolution 35, low.energy 34, implanted.samples 32, annealing.temperature 29, rutherford.backscattering 28

Triple Word Terms
transmission.electron.microscopy 67, secondary.ion.mass 35, ray.photoelectron.spectroscopy 23, ion.mass.spectrometry 23, rapid.thermal.annealing 21, electron.microscopy.tem 21, scanning.electron.microscopy 20, photoelectron.spectroscopy.xps 19, rutherford.backscattering.spectrometry 16, auger.electron.spectroscopy 15, atomic.force.microscopy 15, resolution.transmission.electron 13, aqueous.corrosion.behavior 13, sectional.transmission.electron 13, cross.sectional.transmission 13

Term Cliques
43.85% implant ion si silicon layer depth sampl energi sio2
45.61% implant ion si kev silicon layer depth sampl energi
43.66% implant ion ion.implantation si sampl fluenc nanocryst
44.76% implant ion ion.implantation si layer depth sampl energi sio2
43.22% implant ion ion.implantation si kev layer depth sampl energi fluenc
42.66% implant ion ion.implantation si dose sampl sio2 nanocryst
45.86% implant ion ion.implantation si dose layer sampl energi sio2
47.61% implant ion ion.implantation si dose kev layer sampl energi
42.88% implant ion anneal si dose silicon sampl sio2 nanocryst
45.73% implant ion anneal si dose silicon layer sampl energi sio2
47.32% implant ion anneal si dose kev silicon layer sampl energi

Sample Cluster Record Titles

Nanostructure formation on ion-eroded SiGe film surfaces

Direct observation of substitutional Au atoms in SrTiO3

The effect of implantation dose on the microstructure of silicon nanocrystals in SiO2

Nanoprecipitation in transparent matrices using an energetic ion beam

Ion irradiation for controlling composition and structure of metal alloy nanoclusters in SiO2

Nano-structure and tribological properties of B+ and Ti+ co-implanted silicon nitride

Effect of Sn ion implantation on electrochemical behavior of zircaloy-4

Surface analysis and corrosion behavior of zirconium samples implanted with yttrium and lanthanum

Effect of Sb+ implantation on copper silicides formation and morphology after annealing of Cu/Si structures

Cluster Metrics

Authors
bai, xd 14
skorupa, w 11
peng, dq 11
svensson, bg 7
chen, bs 7
ridgway, mc 6
privitera, v 6
pan, f 6
liu, xy 6
sun, h 5
mucklich, a 5
monakhov, ev 5
barcz, a 5
baek, s 5
sun, jm 4

Sources
nuclear instruments & methods in physics research section b-beam interactions with materials and atoms 42
materials science and engineering b-solid state materials for advanced technology 30
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surface & coatings technology 18
vacuum 11
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journal of the korean physical society 9
applied surface science 8
journal of non-crystalline solids 7
superlattices and microstructures 6
applied physics a-materials science & processing 6
optical materials 5
materials science in semiconductor processing 5
journal of the electrochemical society 5

Keywords

materials science, multidisciplinary 87
physics, applied 59
physics, condensed matter 52
physics, atomic, molecular & chemical 45
silicon 45
nuclear science & technology 43
instrumentation 42
physics, nuclear 42
instruments & 42
physics, applied 39
ion implantation 38
si 35
physics, condensed matter 31
engineering, electrical & electronic 27
implantation 27

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peoples r china 53
japan 50
germany 46
france 29
south korea 24
italy 22
england 17
russia 15
india 15

australia 15
poland 12
sweden 10
brazil 10
taiwan 8

Institution
tsing hua univ 18
chinese acad sci 14
cnrs 12
cnr 11
australian natl univ 11
forschungszentrum rossendorf ev 9
univ tokyo 7
univ surrey 7
univ oslo 7
polish acad sci 7
univ padua 6
russian acad sci 6
rossendorf inc 6
natl inst mat sci 6
katholieke univ leuven 6

DataBase
science citation index 354

- # CLUSTER 178
  Applications of ion/ electron beam/ irradiation techniques, including focused ion beam (FIB) technology, ion and electron-beam-induced deposition, and ion-beam milling (200 Records)

(Countries: Japan, USA. Institutions: National Institute of Materials Sciences. USA includes Arizona State University).

Cluster Syntax Features

Descriptive Terms

beam 15.1%, ion 11.7%, ion.beam 8.1%, irradi 4.8%, fib 4.6%, focused.ion 3.0%, focused.ion.beam 2.7%, electron.beam 2.6%, focus 2.2%, beam.induced 1.7%, electron 1.4%, deposit 1.4%, electron.beam.induced 1.3%, induc 0.8%, fabric 0.8%

Discriminating Terms

beam 10.7%, ion 6.7%, ion.beam 6.5%, fib 3.8%, irradi 3.0%, focused.ion 2.4%, focused.ion.beam 2.2%, electron.beam 2.0%, film 1.7%, focus 1.6%, beam.induced 1.4%, electron.beam.induced 1.1%, induced.deposition 0.6%, nanoparticl 0.6%, beam.induced.deposition 0.6%

Single Word Terms

beam 161, ion 135, electron 121, surfac 86, structur 85, deposit 85, irradi 81, high 71, energi 71, induc 70, focus 70, fabric 63, microscopi 63, layer 56, low 53

Double Word Terms

ion.beam 97, focused.ion 61, electron.beam 50, transmission.electron 45, electron.microscopy 44, beam.induced 37, electron.microscope 29, beam.fib 28, scanning.electron 28, vapor.deposition 27, chemical.vapor 27, induced.deposition 22, low.energy 21, high.resolution 19, atomic.force 17

Triple Word Terms

focused.ion.beam 59, ion.beam.fib 28, electron.beam.induced 28, transmission.electron.microscopy 27, chemical.vapor.deposition 26, beam.induced.deposition 21, transmission.electron.microscope 15, scanning.electron.microscope 14, atomic.force.microscopy 13, scanning.electron.microscopy 12, ion.beam.milling 11, electron.microscopy.tem 11, energy.loss.spectroscopy 11, electron.energy.loss 11, beam.induced.chemical 9

Term Cliques

35.00% irradi electron.beam electron electron.beam.induced induc
44.75% beam focus beam.induced electron deposit fabric
38.44% beam electron.beam beam.induced electron deposit electron.beam.induced induc fabric
43.14% beam fib focused.ion.beam focus electron deposit fabric
40.06% beam ion.beam fib focused.ion focused.ion.beam focus deposit fabric
44.86% beam ion ion.beam fib focused.ion focused.ion.beam focus

Sample Cluster Record Titles

[Application of a focused ion beam mill to the characterisation of a microstructure in tin plating on a Fe 42wt% Ni substrate]

[Fabrication of ordered array of tungsten nanoparticles on anodic porous alumina by electron-beam-induced selective deposition]

[Electron irradiation induced transformation of (Pb5Ca5)(VO4)(6)F-2 apatite to CaVO3 perovskite]

[Electron beam induced chemical modification of amorphous chalcogenide-metal bilayers and its application]

[Ion beam erosion of amorphous materials: evolution of surface morphology]

[Electron Microscopy on FIB prepared interfaces of biological and technical materials: First results]

[Focused ion beam preparation and EFTEM/EELS studies on vanadium nitride thin films]

[Focused ion beam (FIB): Applications in micro- and nanoanalysis in geosciences and applied mineralogy]

[Ion-beam-induced chemical-vapor deposition of FePt and CoPt particles]

Cluster Metrics

Authors

furuya, k 17
mitsuishi, k 14
shimojo, m 8
matsui, s 8
takeguchi, m 7
song, mh 6
kaito, t 6
tanaka, m 5
hoshino, t 5
xie, gq 4
ochiai, y 4
kato, t 4

kanda, k 4
ishida, m 4
haruyama, y 4

Sources

nuclear instruments & methods in physics research section b-beam interactions with materials and atoms 13
journal of vacuum science & technology b 13
japanese journal of applied physics part 1-regular papers brief communications & review papers 10
applied physics letters 10
journal of electron microscopy 9
journal of applied physics 9
applied surface science 9
journal of nuclear materials 7
praktische metallographie-practical metallography 5
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Keywords

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materials science, multidisciplinary 32
physics, applied 32
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physics, atomic, molecular & chemical 14
chemical-vapor-deposition 14
physics, condensed matter 14
films 14
instrumentation 13
physics, nuclear 13
nuclear science & technology 13
instruments & 13

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Country

japan 70

usa 39
germany 19
south korea 14
france 13
england 10
peoples r china 9
italy 9
taiwan 5
switzerland 5
singapore 5
russia 4
poland 4
netherlands 4
australia 4

Institution
natl inst mat sci 18
sii nanotechnol inc 8
univ tokyo 7
univ hyogo 7
tokyo inst technol 6
univ tsukuba 5
tohoku univ 5
osaka univ 5
kyushu univ 5
arizona state univ 5
yonsei univ 4
japan atom energy res inst 4
ecole polytech fed lausanne 4
univ cambridge 3
natl inst adv ind sci & technol 3

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science citation index 200

- # CLUSTER 149
  Lithography, including nanoimprint lithography and electron-beam lithography and focusing on nanopatterning (166 Records)

(Countries: USA, Japan, South Korea. Institutions: University of Wisconsin, Hewlett-Packard Laboratories. University of New Mexico, University of Michigan).

Cluster Syntax Features

Descriptive Terms
lithographi 13.5%, pattern 11.2%, imprint 6.4%, nanoimprint 5.4%, mask 5.2%, mold 5.0%, fabric 3.5%, resist 2.8%, nanoimprint.lithography 2.1%, wafer 1.5%, stamp 1.3%, substrat 0.9%, etch 0.9%, layer 0.8%, replic 0.8%

Discriminating Terms
lithographi 9.5%, pattern 6.5%, imprint 4.6%, nanoimprint 3.9%, mask 3.6%, mold 3.5%, nanoimprint.lithography 1.6%, film 1.5%, fabric 1.5%, resist 1.2%, stamp 0.9%, wafer 0.9%, nanoparticl 0.7%, carbon 0.6%, particl 0.6%

Single Word Terms
pattern 114, lithographi 101, fabric 90, substrat 68, surfac 67, high 66, layer 64, resist 57, low 52, etch 51, structur 48, thick 46, nanoimprint 46, electron 45, mask 42

Double Word Terms
nanoimprint.lithography 35, aspect.ratio 29, high.aspect 25, electron.beam 24, beam.lithography 20, high.resolution 15, low.cost 14, large.area 13, ray.lithography 11, scanning.electron 11, ion.beam 11, lithography.nil 11, room.temperature 10, self.assembled 9, reactive.ion 9

Triple Word Terms
high.aspect.ratio 22, electron.beam.lithography 16, nanoimprint.lithography.nil 11, focused.ion.beam 8, line.edge.roughness 7, reactive.ion.etching 7, scanning.electron.microscopy 7, edge.roughness.ler 6, atomic.force.microscopy 5, deep.ray.lithography 5, fabricated.electron.beam 4, extreme.ultraviolet.lithography 4, self.assembled.monolayers 4, ion.beam.fib 4, room.temperature.low 4

Term Cliques
23.80% imprint nanoimprint nanoimprint.lithography wafer substrat replic
28.11% imprint nanoimprint nanoimprint.lithography wafer substrat layer
18.78% imprint nanoimprint nanoimprint.lithography wafer stamp replic

39.76% pattern mask resist substrat etch layer
43.07% pattern mask fabric substrat etch layer
36.57% pattern nanoimprint fabric nanoimprint.lithography substrat etch replic
40.28% pattern nanoimprint fabric nanoimprint.lithography substrat etch layer
35.63% pattern nanoimprint mold fabric nanoimprint.lithography substrat replic
32.45% pattern imprint nanoimprint resist nanoimprint.lithography substrat etch replic
35.69% pattern imprint nanoimprint resist nanoimprint.lithography substrat etch layer
31.63% pattern imprint nanoimprint mold resist nanoimprint.lithography substrat replic
43.12% lithographi pattern nanoimprint fabric nanoimprint.lithography etch layer
35.84% lithographi pattern nanoimprint fabric nanoimprint.lithography stamp etch replic
35.02% lithographi pattern nanoimprint mold fabric nanoimprint.lithography stamp replic
32.00% lithographi pattern imprint nanoimprint nanoimprint.lithography stamp etch replic
34.94% lithographi pattern imprint nanoimprint resist nanoimprint.lithography etch replic
38.18% lithographi pattern imprint nanoimprint resist nanoimprint.lithography etch layer
31.17% lithographi pattern imprint nanoimprint mold nanoimprint.lithography stamp replic
34.11% lithographi pattern imprint nanoimprint mold resist nanoimprint.lithography replic

Sample Cluster Record Titles

Nano-scale patterning by mechano-chemical scanning probe lithography

Surface-initiated polymerization on nanopatterns fabricated by electron-beam lithography

Dynamic shadow mask technique: A universal tool for nanoscience

Electron-beam-based photomask repair

Investigations of the Ga+ focused-ion-beam implantation in resist films for nanometer lithography applications

Effect of electrostatic chucking and substrate thickness uniformity on extreme ultraviolet lithography mask flatness

Ultrathin membrane masks for electron projection lithography

Stress and image-placement distortions of 200 mm low-energy electron projection lithography masks

Formation of 15 nm scale Coulomb blockade structures in silicon by electron beam lithography with a bilayer resist process

Cluster Metrics

Authors
park, s 7
jung, gy 6
schift, h 5
lee, h 5
wu, w 4
nishio, k 4
masuda, h 4
gobrecht, j 4
arshak, k 4
williams, rs 3
wang, sy 3
tong, wm 3
thoms, s 3
padeste, c 3
nakahara, s 3

Sources
journal of vacuum science & technology b 27
microelectronic engineering 19
microsystem technologies-micro-and nanosystems-information storage and processing systems 14
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advanced materials 7
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journal of micromechanics and microengineering 5
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japanese journal of applied physics part 1-regular papers brief communications & review papers 4
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nanoimprint lithography 11
chemistry, physical 11
physics, condensed matter 11
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usa 47
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south korea 24
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taiwan 9
switzerland 7
peoples r china 7
france 7
england 7
italy 5
singapore 4
scotland 4
ireland 4
austria 4
canada 3

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univ wisconsin 6
paul scherrer inst 6
korea univ 6
hewlett packard labs 6
cnrs 5
univ limerick 4
tokyo metropolitan univ 4
korea inst machinery & mat 4
korea adv inst sci & technol 4
univ osaka prefecture 3
univ new mexico 3
univ michigan 3
univ glasgow 3
toumaz technol ltd 3

seoul natl univ 3

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science citation index 166

- # CLUSTER 113
  Etching, especially plasma etching and reactive ion etching (282 Records)

(Countries: USA, Japan, Korea. Institutions: Sungyunkwan University, CAS, Tohoku University. USA includes University of Maryland).

Cluster Syntax Features

Descriptive Terms
etch 64.1%, plasma 2.8%, silicon 2.1%, mask 1.0%, fabric 1.0%, surfac 0.7%, ion 0.6%, rate 0.5%, etch.rate 0.5%, ion.etching 0.5%, plasma.etching 0.5%, layer 0.5%, reactive.ion 0.5%, rough 0.4%, reactive.ion.etching 0.4%

Discriminating Terms
etch 45.3%, film 1.5%, plasma 1.2%, nanoparticl 0.6%, mask 0.6%, particl 0.6%, silicon 0.6%, nanotub 0.6%, magnet 0.5%, carbon 0.5%, temperatur 0.5%, structur 0.4%, quantum 0.4%, phase 0.4%, etch.rate 0.4%

Single Word Terms
etch 277, surfac 150, high 115, fabric 113, plasma 108, layer 102, ion 101, silicon 99, chemic 93, structur 91, rate 87, electron 80, low 78, microscopi 77, atom 69

Double Word Terms
atomic.force 53, ion.etching 52, reactive.ion 51, force.microscopy 46, plasma.etching 44, etch.rate 42, electron.microscopy 40, scanning.electron 39, coupled.plasma 34, inductively.coupled 33, wet.etching 27, surface.roughness 27, chemical.etching 24, ray.photoelectron 23, photoelectron.spectroscopy 23

Triple Word Terms
atomic.force.microscopy 45, reactive.ion.etching 43, scanning.electron.microscopy 31, inductively.coupled.plasma 29, ray.photoelectron.spectroscopy 23, force.microscopy.afm

22, chemical.vapor.deposition 17, high.aspect.ratio 16, ion.beam.etching 13, ion.etching.rie 12, electron.microscopy.sem 11, atomic.force.microscope 10, photoelectron.spectroscopy.xps 10, deep.reactive.ion 9, transmission.electron.microscopy 8

Term Cliques
43.26% etch surfac ion etch.rate layer rough
31.09% etch mask ion etch.rate ion.etching layer reactive.ion rough reactive.ion.etching
38.77% etch mask fabric ion plasma.etching rough
33.88% etch mask fabric ion ion.etching layer reactive.ion rough reactive.ion.etching
45.57% etch silicon surfac ion etch.rate layer
32.62% etch silicon mask ion etch.rate ion.etching layer reactive.ion reactive.ion.etching
35.42% etch silicon mask fabric ion ion.etching layer reactive.ion reactive.ion.etching
38.52% etch plasma surfac ion rate etch.rate plasma.etching rough
34.57% etch plasma mask ion rate etch.rate plasma.etching rough
31.28% etch plasma mask ion rate etch.rate ion.etching reactive.ion rough reactive.ion.etching
43.77% etch plasma silicon surfac ion rate etch.rate
32.66% etch plasma silicon mask ion rate etch.rate ion.etching reactive.ion reactive.ion.etching

Sample Cluster Record Titles

Carbon etching with a high density plasma etcher

Carbon hard masks for etching sub-90 nm structures

Exchange bias studies of NiFe/FeMn/NiFe trilayer by ion beam etching

Electron-assisted chemical etching of oxidized chromium

Plasma etching of nano-structured precursor-derived ceramic composites

Etching with electron beam generated plasmas

Application of ion beam etching technique to the direct fabrication of silicon microtip arrays

Nanoflash device with self-aligned double floating gates using scanning probe lithography and tetramethylammonium hydroxide wet etching

A new pre-etching pattern to determine < 110 > crystallographic orientation on both (100) and (110) silicon wafers

Cluster Metrics

Authors
wang, s 4
lee, ne 4
kim, dw 4
zimmer, k 3
zhang, f 3
yeom, gy 3
xu, j 3
tay, feh 3
song, ks 3
sato, k 3
rauschenbach, b 3
ra, hw 3
park, jh 3
oehrlein, gs 3
liu, c 3

Sources
journal of vacuum science & technology b 23
microelectronic engineering 18
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journal of applied physics 12
thin solid films 9
applied physics letters 9
nanotechnology 8
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japanese journal of applied physics part 1-regular papers brief communications & review papers 7
applied surface science 7
sensors and actuators a-physical 6
electrochemical and solid state letters 6
surface & coatings technology 5
microsystem technologies-micro-and nanosystems-information storage and processing systems 5
journal of the korean physical society 5

Keywords
physics, applied 87
engineering, electrical & electronic 79
physics, applied 46
materials science, multidisciplinary 42
fabrication 29
optics 27
materials science, coatings & films 25

films 23
silicon 20
physics, 20
physics, condensed matter 19
chemistry, physical 17
multidisciplinary 15
materials science, multidisciplinary 15
materials science, 15

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usa 61
japan 57
south korea 42
peoples r china 31
germany 25
france 20
taiwan 15
italy 13
singapore 12
netherlands 6
australia 6
sweden 5
scotland 5
india 4
canada 4

Institution
sungkyunkwan univ 11
chinese acad sci 11
tohoku univ 8
univ maryland 6
nanyang technol univ 6
natl univ singapore 5
natl tsing hua univ 5
natl chiao tung univ 5
nagoya univ 5
inst microelect 5
shanghai jiao tong univ 4
pusan natl univ 4
peking univ 4
inst bioengn & nanotechnol 4

inha univ 4

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science citation index 282

- # CLUSTER 111
  Hafnium dioxide (HfO2), hafnium-containing, and oxide films, compounds, and layers, with emphasis on dielectric properties, fabrication by atomic layer deposition (ALD), and use as gate dielectrics (195 Records)

(Countries: USA, South Korea. Institutions: Soeul National University, University of Helsinki, National Chiao Tung University, Nanjing University. USA include IBM Corp., Freescale Semiconductor, Inc.).

Cluster Syntax Features

Descriptive Terms
hfo2 13.4%, film 7.4%, dielectr 5.8%, deposit 5.0%, ald 4.6%, atomic.layer 3.9%, atomic.layer.deposition 3.4%, layer.deposition 3.0%, gate 2.7%, hf 2.1%, layer 2.1%, si 1.6%, leakag 1.1%, hfo2.films 1.1%, leakage.current 0.9%

Discriminating Terms
hfo2 10.5%, ald 3.6%, dielectr 3.5%, atomic.layer 3.1%, atomic.layer.deposition 2.7%, layer.deposition 2.4%, hf 1.6%, gate 1.6%, deposit 1.6%, film 0.9%, hfo2.films 0.9%, nanoparticl 0.8%, leakag 0.8%, particl 0.8%, magnet 0.7%

Single Word Terms
film 185, deposit 175, layer 152, dielectr 122, oxid 107, atom 104, si 98, temperatur 97, high 93, thick 91, thin 85, rai 83, gate 80, spectroscopi 79, metal 77

Double Word Terms
atomic.layer 91, layer.deposition 87, leakage.current 65, films.deposited 60, photoelectron.spectroscopy 54, ray.photoelectron 53, dielectric.constant 52, deposition.ald 47, thin.films 44, chemical.vapor 44, vapor.deposition 44, hfo2.films 37, electrical.properties 37, gate.dielectric 35, films.grown 35

Triple Word Terms
atomic.layer.deposition 85, ray.photoelectron.spectroscopy 53, layer.deposition.ald 46, chemical.vapor.deposition 41, leakage.current.density 29, transmission.electron.microscopy 29, photoelectron.spectroscopy.xps 24, equivalent.oxide.thickness 23, metal.oxide.semiconductor 19, high.resolution.transmission 15, resolution.transmission.electron 15, films.deposited.si 14, auger.electron.spectroscopy 13, atomic.layer.deposited 13, metal.organic.chemical 13

Term Cliques
63.96% film deposit atomic.layer atomic.layer.deposition layer.deposition layer si
60.59% film deposit ald atomic.layer atomic.layer.deposition layer.deposition layer
66.41% hfo2 film deposit atomic.layer layer si
56.67% hfo2 film dielectr deposit hf layer si hfo2.films
54.62% hfo2 film dielectr deposit gate hf layer si leakag leakage.current

Sample Cluster Record Titles

Improvements on surface carrier mobility and electrical stability of MOSFETs using HfTaO gate dielectric

Evaluation of a praseodymium precursor for atomic layer deposition of oxide dielectric films

Hafnium and zirconium tetramethylnonanedionates as new MOCVD precursors for oxide films

Growth of HfO2 films using an alternate reaction of HfCl4 and O-2 under atmospheric pressure

Preparation of HfO2 nano-films by atomic layer deposition using HfCl4 and O-2 under atmospheric pressure

A study on the lanthanum aluminate thin film as a gate dielectric material

Study of interfacial oxide layer of LaAlO3 gate dielectrics on Si for metal-insulator-semiconductor devices

Comparison between atomic-layer-deposited HfO2 films using O-3 or H2O oxidant and Hf[N(CH3)(2)](4) precursor

[Structural and electrical characterization of Al2O3/HfO2/Al2O3 on strained SiGe]

Cluster Metrics

Authors
hwang, cs 11
ritala, m 10
leskela, m 10
liu, zg 8
lu, j 7
lee, jh 7
lee, sw 6
kukli, k 6
jones, ac 6
yoon, sg 5
wu, d 5
tobin, pj 5
sajavaara, t 5
putkonen, m 5
niinisto, l 5

Sources
applied physics letters 20
journal of the electrochemical society 19
electrochemical and solid state letters 13
journal of applied physics 11
japanese journal of applied physics part 1-regular papers short notes & review papers 10
microelectronic engineering 9
thin solid films 8
materials science in semiconductor processing 8
journal of vacuum science & technology a 8
journal of vacuum science & technology b 7
chemical vapor deposition 6
applied physics a-materials science & processing 6
materials science and engineering b-solid state materials for advanced technology 5
chemistry of materials 5
applied surface science 5

Keywords
physics, applied 56
physics, applied 47
materials science, multidisciplinary 40
engineering, electrical & electronic 39
silicon 39

materials science, coatings & films 34
growth 34
chemical-vapor-deposition 32
electrochemistry 32
physics, condensed matter 28
si 20
physics, 19
oxide 19
gate dielectrics 19
films 19

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2004 30

Country

usa 56
south korea 52
japan 24
peoples r china 17
taiwan 16
finland 14
belgium 11
germany 9
england 9
singapore 8
india 6
france 6
sweden 5
slovakia 4
netherlands 4

Institution

seoul natl univ 13
univ helsinki 12
natl chiao tung univ 10
nanjing univ 9
univ liverpool 7
samsung adv inst technol 7
yonsei univ 6
univ texas 6
natl univ singapore 6
katholieke univ leuven 6
imec 5
ibm corp 5
freescale semicond inc 5

elect & telecommun res inst 5
chungnam natl univ 5

DataBase
science citation index 195

- # CLUSTER 139
  Gate dielectrics and metal-oxide semiconductor field-effect transistors (MOSFETs), emphasizing those made from silica (SiO_2), hafnium dioxide (HfO_2), silicon, and silicides (152 Records)

(Countries: USA, Japan, South Korea, Singapore. Institutions: Imec, University of Texas, National University of Singapore. Other USA include North Carolina State University, Rutgers State University, UCSB, International Sematech.).

Cluster Syntax Features

Descriptive Terms
gate 19.2%, sio2 4.8%, oxid 4.6%, dielectr 4.4%, hfo2 3.1%, si 3.0%, layer 1.9%, metal 1.6%, interfac 1.4%, stack 1.4%, silicon 1.2%, silicid 1.1%, metal.oxide 1.0%, leakag 1.0%, mosfet 0.9%

Discriminating Terms
gate 13.8%, sio2 2.8%, dielectr 2.5%, hfo2 2.3%, film 1.6%, oxid 1.4%, surfac 0.9%, stack 0.9%, silicid 0.8%, si 0.8%, metal.oxide 0.7%, leakag 0.7%, magnet 0.7%, particl 0.7%, carbon 0.7%

Single Word Terms
oxid 104, gate 99, si 93, metal 90, layer 88, sio2 79, high 78, dielectr 72, electron 67, silicon 67, devic 60, electr 58, thick 58, semiconductor 56, structur 56

Double Word Terms
metal.oxide 52, oxide.semiconductor 43, electron.microscopy 31, leakage.current 30, transmission.electron 28, oxide.thickness 26, gate.dielectric 26, gate.dielectrics 22, capacitance.voltage 22, equivalent.oxide 21, rapid.thermal 20, vapor.deposition 19, gate.stacks 19, chemical.vapor 18, high.gate 18

Triple Word Terms
metal.oxide.semiconductor 42, transmission.electron.microscopy 27, equivalent.oxide.thickness 20, chemical.vapor.deposition 18, oxide.semiconductor.field 15, oxide.thickness.eot 11, ray.photoelectron.spectroscopy 11, rapid.thermal.annealing 10, oxide.semiconductor.mos 10, interface.state.density 9, electron.energy.loss 9, conductive.atomic.force 8, leakage.current.density 8, semiconductor.field.transistors 8, complementary.metal.oxide 8

Term Cliques
30.13% metal silicid metal.oxide leakag mosfet
30.92% metal interfac silicid metal.oxide mosfet
42.32% si layer metal silicid metal.oxide leakag
44.52% si layer metal silicon silicid metal.oxide
42.98% si layer metal interfac silicid metal.oxide
37.76% gate dielectr interfac stack mosfet
46.16% gate dielectr hfo2 si layer stack
55.73% gate oxid si layer metal silicon metal.oxide
45.86% gate oxid dielectr metal metal.oxide leakag mosfet
46.43% gate oxid dielectr metal interfac metal.oxide mosfet
49.15% gate sio2 dielectr si layer interfac stack
52.92% gate sio2 oxid dielectr si layer metal metal.oxide leakag
53.36% gate sio2 oxid dielectr si layer metal interfac metal.oxide

Sample Cluster Record Titles

HfO2 MIS capacitor with copper gate electrode

High dielectric constant oxides

High-density MIM capacitors with HfO2 dielectrics

Physical and electrical characterization of polysilicon vs. TiN gate electrodes for HfO2 transistors

Thermally robust TaTbxN metal gate electrode for n-MOSFETs applications

Self-assembly of Ni nanocrystals on HfO2 and N-assisted Ni confinement for nonvolatile memory application

Irradiation induced weak spots in SiO2 gate oxides of MOS devices observed with C-AFM

Scaling capability improvement of silicon-on-void (SOV) MOSFET

A novel program-erasable high-(K) A1N-Si MIS capacitor

Cluster Metrics

Authors

kwong, dl 10
nafria, m 7
aymerich, x 7
li, mf 6
porti, m 5
foran, b 5
yu, hy 4
yokoyama, s 4
tung, ch 4
stemmer, s 4
ren, c 4
lee, bh 4
young, cd 3
yoo, wj 3
yang, h 3

Sources

applied physics letters 19
ieee electron device letters 12
microelectronics reliability 9
microelectronic engineering 9
journal of applied physics 9
japanese journal of applied physics part 1-regular papers short notes & review papers 9
materials science and engineering b-solid state materials for advanced technology 8

electrochemical and solid state letters 8
japanese journal of applied physics part 2-letters & express letters 6
thin solid films 5
ieee transactions on electron devices 5
journal of vacuum science & technology b 4
journal of vacuum science & technology a 3
journal of the electrochemical society 3
solid-state electronics 2

Keywords
engineering, electrical & electronic 55
physics, applied 40
physics, applied 36
materials science, multidisciplinary 27
silicon 16
films 16
physics, condensed matter 13
electrochemistry 11
si 10
optics 10
mosfets 10
sio2 9
oxide 9
dielectrics 9
multidisciplinary 8

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2005 134
2004 18

Country
usa 45
japan 23
south korea 18
singapore 16
germany 13
belgium 13
taiwan 12
spain 10
peoples r china 9
france 6
italy 5
england 5
sweden 4
ukraine 3
turkey 2

Institution
imec 11
univ texas 10
natl univ singapore 10
natl chiao tung univ 8
univ autonoma barcelona 7
inst microelect 7
n carolina state univ 6
rutgers state univ 5
nanyang technol univ 5
hiroshima univ 5
univ calif santa barbara 4
peking univ 4
osaka univ 4
natl tsing hua univ 4
int sematech 4

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science citation index 152

- # CLUSTER 122
  Field transistors, single-electron transistors, electron mobility transistors, and similar electronic devices, with emphasis on design and properties of gates (243 Records)

(Countries: USA, Japan, South Korea. Institutions: IBM Corp., University of Florida. Other USA include University of Illinois, Purdue University, UCLA.).

Cluster Syntax Features

Descriptive Terms
gate 39.2%, transistor 11.2%, devic 3.1%, current 1.9%, voltag 1.8%, field.transistors 1.7%, drain 1.6%, single.electron 1.2%, field 1.1%, channel 1.0%, fet 0.7%, mobil 0.6%, leakag 0.6%, gate.voltage 0.5%, tunnel 0.5%

Discriminating Terms
gate 27.0%, transistor 7.5%, film 1.9%, devic 1.2%, field.transistors 1.2%, drain 1.1%, surfac 0.8%, voltag 0.8%, single.electron 0.8%, particl 0.7%, nanoparticl 0.7%, magnet 0.6%, current 0.6%, crystal 0.5%, fet 0.5%

Single Word Terms
gate 203, transistor 169, devic 135, current 122, electron 115, voltag 113, field 111, high 100, channel 72, fabric 71, drain 71, singl 69, structur 64, two 60, temperatur 60

Double Word Terms
field.transistors 65, single.electron 35, gate.voltage 33, source.drain 31, field.transistor 31, carbon.nanotube 29, gate.length 29, leakage.current 27, electron.mobility 26, threshold.voltage 25, room.temperature 24, drain.current 24, electron.transistor 22, high.electron 22, nanotube.field 19

Triple Word Terms
single.electron.transistor 22, high.electron.mobility 21, carbon.nanotube.field 18, nanotube.field.transistors 16, electron.mobility.transistors 15, metal.oxide.semiconductor 12, gate.leakage.current 11, single.electron.transistors 11, field.transistors.fets 10, heterostructure.field.transistors 10, two.dimensional.electron 9, electron.mobility.transistor 9, chemical.vapor.deposition 8, organic.field.transistors 8, field.transistor.fet 7

Term Cliques
33.61% transistor single.electron tunnel
37.91% transistor devic current field.transistors drain field channel mobil leakag
40.10% transistor devic current voltag drain field channel mobil leakag
43.70% gate voltag drain field gate.voltage
43.36% gate transistor devic current field.transistors drain leakag tunnel
45.04% gate transistor devic current field.transistors drain field channel leakag
44.58% gate transistor devic current field.transistors drain field channel fet
47.23% gate transistor devic current voltag drain field channel leakag
46.78% gate transistor devic current voltag drain field channel fet

Sample Cluster Record Titles

Dynamics of a nanomechanical resonator coupled to a superconducting single-electron transistor

Humidity-dependent characteristics of thin film poly(3,4-ethylenedioxythiophene) field-effect transistor

Comparing carbon nanotube transistors - The ideal choice: A novel tunneling device design

Optimization of electron beam focusing for gated carbon nanotube field emitter arrays

Nanoscale post-breakdown conduction of HfO2/SiO2 MOS gate stacks studied by enhanced-CAFM

Single-electron transport in GaAs/AlGaAs nano-In-plane-gate transistors

Compact logic NAND-Gate based on a single in-plane quantum-wire transistor

Large gate modulation in the current of a room temperature single molecule transistor

Terahertz generation and detection by plasma waves in nanometer gate high electron mobility transistors

Cluster Metrics

Authors
lee, jw 6
pourfath, m 4
park, yj 4
park, wj 4
luth, h 4
kosina, h 4
guo, j 4
gehring, a 4
egawa, t 4
arulkumaran, s 4
appenzeller, j 4
yamamoto, k 3
watanabe, h 3
wang, yh 3
wallart, x 3

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physical review b 15
ieee electron device letters 15
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ieee transactions on nanotechnology 12
solid-state electronics 9
nano letters 8
microelectronic engineering 7
japanese journal of applied physics part 1-regular papers short notes & review papers 7
electronics letters 7
journal of the korean physical society 5
japanese journal of applied physics part 2-letters & express letters 5
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physica e-low-dimensional systems & nanostructures 4

Keywords
engineering, electrical & electronic 96
physics, applied 65
physics, applied 62
physics, condensed matter 24
transport 24
field-effect transistors 21
devices 21
multidisciplinary 17
materials science, 17
chemistry, multidisciplinary 13
physics, condensed matter 13
materials science, multidisciplinary 13
physics, multidisciplinary 12
materials science, multidisciplinary 12
physics, 12

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2005 218
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Country
usa 79
japan 48
south korea 29
germany 21

taiwan 19
france 17
italy 12
peoples r china 10
england 9
spain 6
russia 6
belgium 6
netherlands 5
canada 5
singapore 4

Institution
ibm corp 10
univ tokyo 8
univ florida 7
seoul natl univ 7
natl chiao tung univ 7
univ illinois 6
samsung adv inst technol 6
russian acad sci 6
nagoya inst technol 6
hokkaido univ 6
purdue univ 5
korea univ 5
univ calif los angeles 4
tokyo inst technol 4
tohoku univ 4

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- ## CLUSTER 60

  Metal-oxide semiconductor field-effect transistors (MOSFETs) and silicon-on-insulator (SOI) devices (128 Records)

(Countries: USA, Japan, Taiwan, South Korea. Institutions: National Chiao Tung University, National University of Singapore. USA include Purdue University, University of Texas, University of Florida, United Microelectronic Corp., IBM Corp.).

Cluster Syntax Features

Descriptive Terms

mosfet 23.6%, gate 8.1%, channel 6.8%, devic 3.0%, transistor 2.6%, soi 2.6%, drain 2.0%, metal.oxide.semiconductor 2.0%, oxide.semiconductor 2.0%, oxide.semiconductor.field 1.6%, semiconductor.field 1.6%, metal.oxide 1.6%, double.gate 1.3%, model 1.1%, semiconductor 1.1%

Discriminating Terms

mosfet 15.5%, gate 4.5%, channel 3.7%, film 1.7%, soi 1.6%, transistor 1.4%, metal.oxide.semiconductor 1.3%, drain 1.3%, oxide.semiconductor 1.2%, oxide.semiconductor.field 1.1%, devic 1.0%, semiconductor.field 1.0%, metal.oxide 0.9%, double.gate 0.9%, surfac 0.8%

Single Word Terms

mosfet 92, devic 91, channel 83, gate 83, oxid 69, field 67, transistor 62, semiconductor 60, metal 57, simul 54, current 54, silicon 50, voltag 49, model 48, length 46

Double Word Terms

oxide.semiconductor 53, metal.oxide 53, semiconductor.field 46, field.transistors 36, short.channel 34, threshold.voltage 31, silicon.insulator 26, source.drain 25, double.gate 24, field.transistor 20, gate.length 20, transistors.mosfets 19, insulator.soi 19, two.dimensional 18, gate.oxide 15

Triple Word Terms

metal.oxide.semiconductor 53, oxide.semiconductor.field 46, semiconductor.field.transistors 34, field.transistors.mosfets 19, silicon.insulator.soi 19, semiconductor.field.transistor 18, field.transistor.mosfet 12, gate.metal.oxide 8, induced.barrier.lowering 8, double.gate.mosfets 7, double.gate.metal 7, depleted.silicon.insulator 7, drain.induced.barrier 7, short.channel.sces 7, double.gate.mosfet 6

Term Cliques

49.92% mosfet gate devic transistor metal.oxide.semiconductor oxide.semiconductor oxide.semiconductor.field semiconductor.field metal.oxide semiconductor

47.11% mosfet gate devic transistor metal.oxide.semiconductor oxide.semiconductor oxide.semiconductor.field semiconductor.field metal.oxide double.gate
51.79% mosfet gate channel devic drain double.gate model
49.55% mosfet gate channel devic soi drain double.gate

Sample Cluster Record Titles

Effect of oxide breakdown on complementary metal oxide semiconductor circuit operation and reliability

Dependence of gate leakage current on location of soft breakdown spot in metal-oxide-semiconductor field-effect transistor

Nanoscale FD/SOI CMOS: Thick or thin BOX?

Quantum mechanical simulation of charge distribution in Schottky barrier MOSFETs

Electronic states in the inversion layer of a memory with nanoscale gate

Novel properties of erbium-silicided n-type Schottky barrier metal-oxide-semiconductor field-effect transistors

Two-dimensional quantum-mechanical modeling for strained silicon channel of double-gate MOSFET

Characteristics of ballistic tansport in short-channel MOSFETs

An analytical subthreshold current model for ballistic quantum-wire double-gate MOS transistors

Cluster Metrics

Authors
hiramoto, t 7
iannaccone, g 6
saitoh, m 5
lee, s 5
li, mf 4
huang, gw 4
autran, jl 4
yeo, yc 3

yang, jh 3
suzuki, e 3
rahman, a 3
park, yj 3
nagumo, t 3
munteanu, d 3
matsukawa, t 3

Sources
ieee transactions on electron devices 18
japanese journal of applied physics part 1-regular papers short notes & review papers 15
ieee electron device letters 10
applied physics letters 10
ieee transactions on nanotechnology 9
solid-state electronics 7
journal of the korean physical society 7
journal of applied physics 5
japanese journal of applied physics part 1-regular papers brief communications & review papers 3
ieice transactions on electronics 3
physical review b 2
molecular simulation 2
microelectronics journal 2
journal of non-crystalline solids 2
journal of computational and theoretical nanoscience 2

Keywords
engineering, electrical & electronic 65
physics, applied 39
physics, applied 36
mosfet 18
mosfets 15
mosfets 14
mobility 13
devices 12
multidisciplinary 11
simulation 11
materials science, 11
model 9
physics, multidisciplinary 8
mosfet 8
silicon 8

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2005 110
2004 18

Country
usa 27
japan 24
taiwan 16
south korea 15
italy 11
france 10
singapore 9
india 6
germany 6
peoples r china 5
scotland 3
belgium 3
austria 3
sweden 2
netherlands 2

Institution
natl chiao tung univ 16
natl univ singapore 9
univ tokyo 7
natl nano device labs 7
univ pisa 6
purdue univ 6
hiroshima univ 5
univ texas 4
univ florida 4
united microelect corp 4
seoul natl univ 4
peking univ 4
inst microelect 4
ibm corp 4
etri 4

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science citation index 128

- CLUSTER 224
  Electronic devices, circuits, and complementary metal-oxide semiconductor (CMOS) systems, emphasizing performance as measured by frequency, power, current, and voltage (331 Records)

(Countries: USA very dominant, Taiwan, Japan. Institutions: National Chiao Tung University dominant, Purdue University, National Nano Device Labs. Other USA include University of Florida, UCSB, Intel Corp., Hewlett-Packard Labs, University of Texas, UCLA, IBM Corp, Caltech, University of Illinois).

Cluster Syntax Features

Descriptive Terms

devic 19.8%, circuit 9.5%, cmo 3.4%, memori 2.8%, ghz 2.1%, power 2.0%, logic 1.9%, integr 1.5%, design 1.5%, transistor 1.4%, chip 1.3%, voltag 1.3%, esd 1.3%, oper 1.1%, fabric 1.0%

Discriminating Terms

devic 12.8%, circuit 7.1%, cmo 2.7%, film 2.2%, memori 2.0%, ghz 1.5%, logic 1.5%, power 1.0%, esd 1.0%, surfac 0.9%, chip 0.9%, integr 0.9%, transistor 0.8%, design 0.8%, particl 0.7%

Single Word Terms

devic 223, circuit 125, high 120, fabric 101, low 99, paper 96, electron 92, power 88, current 87, voltag 86, structur 86, oper 86, design 85, transistor 77, integr 77

Double Word Terms

low.power 23, room.temperature 19, heterojunction.bipolar 17, bipolar.transistors 16, power.consumption 14, threshold.voltage 14, high.speed 14, metal.oxide 13, high.frequency 13, oxide.semiconductor 12, equivalent.circuit 11, discharge.esd 11, esd.protection 11, integrated.circuits 11, low.cost 11

Triple Word Terms
metal.oxide.semiconductor 12, heterojunction.bipolar.transistors 11, electrostatic.discharge.esd 11, chip.esd.protection 7, silicon.insulator.soi 7, human.body.model 7, electron.beam.lithography 6, gaas.heterojunction.bipolar 6, oxide.semiconductor.cmos 5, complementary.metal.oxide 5, discharge.esd.protection 5, bipolar.transistors.hbts 5, heterojunction.bipolar.transistor 5, double.heterojunction.bipolar 5, esd.protection.design 5

Term Cliques
27.04% circuit cmo transistor voltag oper fabric
27.44% circuit cmo design voltag oper fabric
23.82% circuit cmo design voltag esd fabric
26.59% circuit cmo integr transistor voltag fabric
26.99% circuit cmo integr design voltag fabric
23.16% circuit cmo power design voltag esd
24.21% circuit cmo power logic transistor voltag oper
24.56% circuit cmo power logic design voltag oper
23.82% circuit cmo power logic integr transistor voltag
24.17% circuit cmo power logic integr design voltag
25.13% circuit cmo ghz transistor oper fabric
25.53% circuit cmo ghz design oper fabric
21.19% circuit cmo ghz design chip esd fabric
24.67% circuit cmo ghz integr transistor fabric
23.91% circuit cmo ghz integr design chip fabric
24.47% circuit cmo ghz power transistor oper
24.87% circuit cmo ghz power design oper
20.63% circuit cmo ghz power design chip esd
24.02% circuit cmo ghz power integr transistor
23.35% circuit cmo ghz power integr design chip
32.02% devic voltag esd fabric
34.62% devic transistor voltag oper fabric
34.08% devic integr transistor voltag fabric
28.00% devic memori logic transistor voltag oper
27.54% devic memori logic integr transistor voltage

Sample Cluster Record Titles

High-speed electroab sorption modulators buried with ruthenium-doped SI-InP

Molecular devices and machines

Enhancement of photovoltaic characteristics using a PEDOT interlayer in TiO2/MEHPPV heterojunction devices

[Design of a single-electron current source for nanoelectronic devices]

[Impact of scaling on the high current behavior of RF CMOS technology]

[InGaAs-InP DHBTs for increased digital IC bandwidth having a 391-GHz f(T) and 505-GHz f max]

[High current effects in double heterojunction bipolar transistors]

[A new Schmitt trigger circuit in a 0.13-mu m 1/2.5-V CMOS process to receive 3.3-V input signals]

[Estimation of delay variations due to random-dopant fluctuations in nanoscale CMOS circuits]

Cluster Metrics

Authors
huang, gw 13
ker, md 12
roy, k 9
chen, km 8
williams, rs 5
mukhopadhyay, s 5
kuekes, pj 5
chang, cy 5
robinett, w 4
raychowdhury, a 4
meng, cc 4
cho, mh 4
chen, hy 4
wu, th 3
worschech, l 3

Sources
applied physics letters 20
ieee transactions on nanotechnology 18
ieee journal of solid-state circuits 13
ieee transactions on electron devices 12
ieee electron device letters 10
journal of applied physics 9
ieice transactions on electronics 9
solid-state electronics 7
ieee transactions on microwave theory and techniques 7

ieee transactions on applied superconductivity 7
proceedings of the ieee 6
microelectronics reliability 6
nanotechnology 5
microsystem technologies-micro-and nanosystems-information storage and processing systems 5
microelectronic engineering 5

Keywords
engineering, electrical & electronic 167
physics, applied 77
physics, applied 52
multidisciplinary 32
materials science, 32
materials science, multidisciplinary 24
devices 22
computer science, hardware & architecture 16
chemistry, multidisciplinary 16
physics, condensed matter 16
optics 14
design 14
transport 12
nanotechnology 12
instruments & instrumentation 12

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2005 303
2004 26
2006 2

Country
usa 130
taiwan 39
japan 30
france 20
germany 18
south korea 16
peoples r china 14
england 14
netherlands 13
italy 13
belgium 9
switzerland 8
sweden 8
russia 7
spain 6

Institution
natl chiao tung univ 27
purdue univ 10
natl nano device labs 8
univ florida 7
univ calif santa barbara 7
intel corp 7
hewlett packard labs 7
univ texas 6
univ calif los angeles 6
ibm corp 6
cnrs 6
caltech 6
univ illinois 5
univ cambridge 5
stmicroelect 5

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- CLUSTER 243
  Modeling and design of electronic devices, including properties of those based on junctions (molecular junctions, metal junctions, Josephson junctions, and Schottky barriers), electron transport properties, current/ voltage characteristics, negative differential resistance (NDR) (407 Records)

(Countries: USA dominant, Japan, Germany. Institutions: RAS, University of Illinois, Northwestern University, Delft University of Technology, CAS. Other USA include Ohio State University, University of Texas.).

Cluster Syntax Features

Descriptive Terms
current 11.4%, voltag 6.9%, junction 6.7%, transport 5.4%, nois 2.4%, tunnel 2.4%, charg 2.3%, devic 2.2%, conduct 1.9%, current.voltage 1.6%, electr 1.4%, bia 1.4%, electron 1.4%, barrier 1.1%, switch 1.0%

Discriminating Terms
current 8.2%, junction 5.7%, voltag 5.3%, transport 3.9%, film 2.2%, nois 2.0%, tunnel 1.5%, current.voltage 1.4%, charg 1.1%, bia 1.0%, devic 1.0%, surfac 0.9%, magnet 0.8%, particl 0.7%, nanoparticl 0.7%

Single Word Terms
current 257, voltag 209, electron 197, transport 160, devic 141, electr 134, charg 124, temperatur 122, conduct 116, high 115, junction 106, two 102, metal 102, low 101, measur 99

Double Word Terms
current.voltage 100, room.temperature 37, electric.field 36, electron.transport 30, transport.properties 28, bias.voltage 24, negative.differential 24, schottky.barrier 23, electronic.transport 23, charge.transport 22, coulomb.blockade 21, electron.beam 20, space.charge 20, single.electron 19, current.density 19

Triple Word Terms
negative.differential.resistance 18, atomic.force.microscopy 11, differential.resistance.ndr 11, current.voltage.curves 10, electron.beam.lithography 10, current.voltage.characteristic 10, current.voltage.measurements 10, light.emitting.diodes 9, single.electron.tunneling 8, monte.carlo.simulations 7, schottky.barrier.diodes 7, two.dimensional.electron 7, electron.transport.properties 7, metal.oxide.semiconductor 7, atomic.force.microscope 7

Term Cliques
32.19% transport charg devic conduct electr electron switch
30.89% transport tunnel charg devic conduct electron switch
33.91% voltag charg devic conduct electr electron switch
32.61% voltag tunnel charg devic conduct electron switch
31.37% current nois bia
27.33% current nois current.voltage switch
35.32% current transport devic conduct current.voltage electr electron switch
33.28% current junction transport tunnel devic conduct current.voltage electron switch
33.80% current junction transport tunnel devic conduct current.voltage electron barrier
36.82% current voltag devic conduct current.voltage electr electron switch
34.67% current voltag junction tunnel devic conduct bia electron barrier
34.62% current voltag junction tunnel devic conduct current.voltage electron switch
35.14% current voltag junction tunnel devic conduct current.voltage electron barrier

Sample Cluster Record Titles

Two-dimensional electron transport through a barrier prepared by tip-induced oxidation

Analytical model of high-frequency noise spectrum in Schottky-barrier diodes

Coherent current transport in wide ballistic Josephson junctions

Electronic transport properties of carbon nanotube based metal/semiconductor/metal intramolecular junctions

Current measurement by real-time counting of single electrons

Metal nanocrystal memory with high-kappa tunneling barrier for improved-pata retention

Single-charge devices with ultrasmall Nb/AlOx/Nb trilayer Josephson junctions

Transport properties of single-channel quantum wires with an impurity: Influence of finite length and temperature on average current and noise

Influence of external voltage on electronic transport properties of molecular junctions: the nonlinear transport behaviour

Cluster Metrics

Authors
reggiani, l 7
wang, ck 4
varani, l 4
starikov, e 4
shiktorov, p 4
yoshida, m 3
xue, qk 3
williams, rs 3
wang, y 3
tour, jm 3
su, yk 3
stewart, dr 3
siegel, m 3
ratner, ma 3
luth, h 3

Sources
applied physics letters 47
physical review b 37
journal of applied physics 21
journal of physical chemistry b 14
physical review letters 12
nano letters 12
nanotechnology 10
ieee transactions on applied superconductivity 10

physica e-low-dimensional systems & nanostructures 6
journal of chemical physics 6
japanese journal of applied physics part 2-letters & express letters 6
solid-state electronics 5
small 5
mrs bulletin 5
journal of vacuum science & technology b 5

Keywords

physics, applied 100
physics, condensed matter 57
physics, applied 53
engineering, electrical & electronic 52
transport 43
chemistry, physical 37
materials science, multidisciplinary 35
physics, multidisciplinary 33
materials science, multidisciplinary 33
films 31
conductance 26
physics, condensed matter 24
devices 23
chemistry, multidisciplinary 22
physics, 17

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2005 364
2004 41
2006 2

Country

usa 125
japan 57
germany 43
peoples r china 32
italy 30
france 22
sweden 19
south korea 19
russia 18
netherlands 17
england 17
taiwan 16
spain 15
india 12
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Institution
russian acad sci 10
univ illinois 9
northwestern univ 9
delft univ technol 9
chinese acad sci 9
univ karlsruhe 8
ohio state univ 8
natl inst adv ind sci & technol 8
chalmers univ technol 8
univ texas 7
univ lecce 7
natl inst mat sci 7
natl cheng kung univ 7
univ tsukuba 6
univ tokyo 6

DataBase
science citation index 407

- # CLUSTER 53
  Properties and fabrication of magnetic tunnel junctions (MTJs) and investigation of magnetoresistance (121 Records)

(Countries: Japan, USA. Institutions: Tohoku University, Osaka University, National Institute of Advanced industrial S&T, Korea University, Japan S&T Agency. No USA institutional representation.).

Cluster Syntax Features

Descriptive Terms

tunnel 17.3%, junction 11.9%, magnetoresist 10.8%, magnetic.tunnel 6.1%, magnet 4.7%, tunnel.junctions 3.8%, mtj 3.7%, magnetic.tunnel.junctions 3.1%, spin 2.1%, barrier 2.1%, tmr 1.9%, current 1.0%, tunneling.magnetoresistance 1.0%, layer 1.0%, ferromagnet 0.9%

Discriminating Terms
tunnel 10.1%, junction 7.2%, magnetoresist 7.0%, magnetic.tunnel 4.1%, tunnel.junctions 2.5%, mtj 2.5%, magnetic.tunnel.junctions 2.1%, film 1.7%, tmr 1.3%, magnet 1.1%, barrier 1.0%, surfac 0.9%, tunneling.magnetoresistance 0.7%, spin 0.7%, particl 0.6%

Single Word Terms
magnet 98, tunnel 92, junction 87, magnetoresist 83, spin 63, layer 56, physic 49, barrier 45, temperatur 43, field 43, depend 43, current 41, structur 37, ratio 36, resist 34

Double Word Terms
magnetic.tunnel 60, tunnel.junctions 53, tunneling.magnetoresistance 28, tunnel.junction 28, magnetoresistance.tmr 21, spin.polarization 18, junctions.mtjs 18, tunnel.magnetoresistance 17, spin.polarized 16, magnetic.field 16, spin.dependent 16, room.temperature 16, tmr.ratio 13, transport.properties 10, spin.valve 10

Triple Word Terms
magnetic.tunnel.junctions 46, magnetic.tunnel.junction 21, tunnel.junctions.mtjs 17, tunnel.magnetoresistance.tmr 11, tunneling.magnetoresistance.tmr 9, tunnel.junction.mtj 7, spin.dependent.tunneling 7, barrier.magnetic.tunnel 6, focused.ion.beam 6, random.access.memory 6, current.perpendicular.plane 5, transmission.electron.microscopy 5, ion.beam.fib 4, two.dimensional.electron 4, bias.voltage.dependence 4

Term Cliques
40.08% spin current layer ferromagnet
49.59% magnetoresist spin ferromagnet
48.67% tunnel junction magnetic.tunnel magnet mtj barrier tmr current layer
50.32% tunnel junction magnetic.tunnel magnet mtj spin tmr current layer
46.28% tunnel junction magnetic.tunnel magnet tunnel.junctions mtj magnetic.tunnel.junctions barrier tmr tunneling.magnetoresistance layer
55.17% tunnel junction magnetoresist magnetic.tunnel magnet mtj spin tmr
48.31% tunnel junction magnetoresist magnetic.tunnel magnet tunnel.junctions mtj magnetic.tunnel.junctions barrier tmr tunneling.magnetoresistance

Sample Cluster Record Titles

Spin-dependent quantum oscillations in magnetic tunnel junctions with Ru quantum wells

A simple fabrication process using focused ion beam for deep submicron magnetic tunnel junctions

Magnetoresistance of sol-gel derived manganite nanoparticles

Tunnelling magnetoresistance of misfit layered cobaltite Ca3-xYxCo4O9 (x=0, 0.1, 0.2)

Spin-dependent tunnelling through epitaxial GaAs(001) and (110) barriers

Uncorrelated and correlated nanoscale lattice distortions in the paramagnetic phase of magnetoresistive manganites

Intergranular giant magnetoresistance in a spontaneously phase separated perovskite oxide

Large magnetocurrents in double-barrier tunneling transistors

Thermal stability of tunneling spin polarization

Cluster Metrics

Authors
yuasa, s 10
kubota, h 9
suzuki, y 8
miyazaki, t 6
de jonge, wjm 6
ando, y 6
ando, k 6
blamire, mg 5
shin, kh 4
rhie, k 4
pakala, m 4
lee, bc 4
huai, ym 4
fukushima, a 4
ding, yf 4

Sources
applied physics letters 24
journal of applied physics 23
physical review b 16
ieee transactions on magnetics 11
physical review letters 10
journal of magnetism and magnetic materials 8
japanese journal of applied physics part 2-letters & express letters 4

journal of physics-condensed matter 3
chinese physics letters 3
physica e-low-dimensional systems & nanostructures 2
journal of the korean physical society 2
japanese journal of applied physics part 1-regular papers short notes & review papers 2
ieee transactions on applied superconductivity 2
sensors and actuators a-physical 1
physics of the solid state 1

Keywords
physics, applied 51
magnetoresistance 26
physics, condensed matter 23
room-temperature 19
physics, multidisciplinary 19
magnetoresistance 14
engineering, electrical & electronic 14
physics, applied 14
films 14
junctions 11
film 11
materials science, multidisciplinary 9
junctions 8
physics, condensed matter 8
oxidation 6

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2005 112
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Country
japan 28
usa 22
germany 13
south korea 12
netherlands 11
france 10
england 10
peoples r china 9
taiwan 8
russia 5
ireland 4
india 4
ukraine 3
portugal 3
switzerland 2

Institution
tohoku univ 10
osaka univ 7
natl inst adv ind sci & technol 7
korea univ 7
japan sci & technol agcy 7
univ cambridge 6
eindhoven univ technol 6
cnrs 6
univ twente 5
univ paris 07 4
univ paris 06 4
philips res labs 4
nanjing univ 4
korea inst sci & technol 4
inha univ 4

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science citation index 121

- CLUSTER 95
  Field-emission properties of materials, especially carbon nanotubes (CNTs) and nanowires (180 Records)

(Countries: USA, China in first tier, followed by South Korea and Japan. Institutions: CAS, Peking University. USA include Vanderbilt University, University of North Carolina).

Cluster Syntax Features

Descriptive Terms

field 20.9%, emiss 16.3%, field.emission 14.6%, emitt 5.0%, electric.field 3.7%, electr 3.3%, current 2.6%, emission.current 2.3%, nanotub 1.2%, cnt 1.2%, emission.properties 1.1%, nanowir 0.9%, field.emission.properties 0.8%, arrai 0.8%, carbon 0.6%

Discriminating Terms

field 11.3%, field.emission 10.3%, emiss 9.6%, emitt 3.6%, electric.field 2.4%, film 1.7%, emission.current 1.7%, electr 1.4%, current 1.0%, emission.properties 0.7%, surfac 0.7%, nanoparticl 0.7%, magnet 0.6%, particl 0.6%, field.emission.properties 0.6%

Single Word Terms

field 177, emiss 126, current 107, electr 91, electron 88, carbon 68, properti 64, emitt 62, nanotub 61, densiti 59, high 57, physic 52, voltag 48, low 46, vacuum 45

Double Word Terms

field.emission 114, electric.field 72, emission.current 59, current.density 43, emission.properties 41, carbon.nanotubes 33, carbon.nanotube 33, electron.emission 27, turn.field 25, fowler.nordheim 24, vapor.deposition 19, field.emitters 18, chemical.vapor 18, threshold.field 16, emission.carbon 15

Triple Word Terms

field.emission.properties 36, field.emission.current 25, emission.current.density 25, chemical.vapor.deposition 17, electron.field.emission 12, field.emission.carbon 11, carbon.nanotube.cnt 10, current.density.field 10, field.emission.measurements 10, field.emission.displays 9, carbon.nanotube.field 9, emission.carbon.nanotube 9, low.turn.field 8, emitters.field.emission 8, carbon.nanotubes.cnts 7

Term Cliques

50.00% field electric.field electr nanowir
47.59% field emiss field.emission emission.properties nanowir field.emission.properties
44.95% field emiss field.emission emitt current emission.current nanotub emission.properties field.emission.properties arrai carbon
46.50% field emiss field.emission emitt current emission.current nanotub cnt arrai carbon

Sample Cluster Record Titles

Enhanced field emission of ZnO nanowires

Field emission properties of needle shaped GaN nanorod arrays

Self-assembly of metallic nanowires from aqueous solution

Microstructured silicon surfaces for field emission devices

Growth and field emission of hierarchical single-crystalline wurtzite AIN nanoarchitectures

Field emission properties of large-area nanowires of organic charge-transfer complexes

Field-emission properties of macroporous silicon grown at high anodization voltages

High-current-density field emitters based on arrays of carbon nanotube bundles

Local field emission from individual vertical carbon nanofibers grown on tungsten filament

Cluster Metrics

Authors
yu, dp 6
kang, wp 6
davidson, jl 6
zhao, q 5
xu, z 4
xu, ns 4
wong, ym 4
teo, kbk 4
silva, srp 4
nicolaescu, d 4
kim, jm 4
cheng, hm 4
xu, yb 3
wang, zl 3
wang, xq 3

Sources
applied physics letters 38
journal of vacuum science & technology b 20
journal of applied physics 14
nanotechnology 8
diamond and related materials 8
japanese journal of applied physics part 1-regular papers brief communications & review papers 7
physical review b 5

carbon 5
applied surface science 5
physical review letters 4
journal of the american chemical society 4
physica e-low-dimensional systems & nanostructures 3
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synthetic metals 2

Keywords
physics, applied 71
engineering, electrical & electronic 26
physics, applied 26
films 24
materials science, multidisciplinary 20
growth 20
field emission 20
emitters 20
carbon nanotubes 19
materials science, multidisciplinary 19
carbon nanotubes 18
arrays 15
chemistry, physical 14
chemical-vapor-deposition 12
physics, multidisciplinary 11

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2005 162
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usa 47
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south korea 24
japan 20
taiwan 17
england 14
germany 9
russia 8
france 8
singapore 5
romania 3
netherlands 3
sweden 2
slovenia 2

italy 2

Institution
chinese acad sci 16
peking univ 9
vanderbilt univ 6
natl tsing hua univ 6
univ cambridge 5
sungkyunkwan univ 5
samsung adv inst technol 5
natl taiwan univ 5
natl chiao tung univ 5
univ surrey 4
univ n carolina 4
univ lyon 1 4
seoul natl univ 4
korea univ 4
hanyang univ 4

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science citation index 180

- # CLUSTER 27

  Upconversion emission/ luminescence properties and spectroscopic studies of rare earth ions (Er3+, Yb3+, and Tm3+), especially in doped crystals and glass ceramics (82 Records)

(Countries: China completely dominant. Institutions: CAS, followed by City University Hong Kong. No USA institutional representation.).

Cluster Syntax Features

Descriptive Terms

er3 26.1%, upconvers 11.4%, yb3 8.0%, emiss 4.3%, tm3 3.2%, excit 2.7%, luminesc 2.3%, dope 1.9%, glass.ceramics 1.6%, glass 1.5%, crystal 1.2%, yb 1.0%, er3.ions 1.0%, er 1.0%, nanocryst 0.9%

Discriminating Terms

er3 16.2%, upconvers 7.1%, yb3 5.0%, tm3 2.0%, film 1.8%, emiss 1.6%, excit 1.1%, luminesc 1.0%, glass.ceramics 1.0%, surfac 0.9%, er3.ions 0.6%, yb 0.6%, carbon 0.6%, structur 0.6%, er 0.6%

Single Word Terms

emiss 62, excit 56, dope 54, er3 52, ion 46, absorpt 46, energi 38, transit 37, intens 36, luminesc 35, crystal 34, yb3 33, upconvers 32, laser 31, state 28

Double Word Terms

energy.transfer 23, er3.ions 20, er3.doped 15, glass.ceramics 14, room.temperature 13, two.photon 12, upconversion.luminescence 12, excited.state 11, rare.earth 11, oxyfluoride.glass 11, er3.yb3 10, upconversion.emission 10, state.absorption 10, judd.ofelt 9, green.red 8

Triple Word Terms

excited.state.absorption 10, oxyfluoride.glass.ceramics 9, transparent.oxyfluoride.glass 8, rare.earth.ions 7, emission.cross.section 6, judd.ofelt.theory 5, state.absorption.esa 5, energy.transfer.upconversion 5, glass.ceramics.caf2 4, stimulated.emission.cross 4, blue.green.red 4, two.photon.absorption 4, red.green.blue 4, judd.ofelt.parameters 4, transport.equilibration.vte 4

Term Cliques

38.29% luminesc dope crystal yb er
35.37% luminesc dope glass yb er
43.66% excit luminesc dope yb er
48.54% emiss luminesc dope crystal yb
45.61% emiss luminesc dope glass yb
39.37% emiss tm3 luminesc dope glass.ceramics glass nanocryst

41.11% upconvers emiss tm3 luminesc dope glass.ceramics nanocryst
49.83% upconvers yb3 emiss excit luminesc dope yb
47.41% upconvers yb3 emiss tm3 excit luminesc dope nanocryst
43.70% er3 luminesc dope crystal er3.ions er
41.26% er3 luminesc dope glass er3.ions er
52.93% er3 excit luminesc dope er
52.24% er3 emiss luminesc dope crystal er3.ions
42.84% er3 emiss luminesc dope glass.ceramics glass er3.ions nanocryst
57.11% er3 emiss excit luminesc dope nanocryst

Sample Cluster Record Titles

Up-conversion luminescence and near infrared luminescence of Er3+ in transparent oxyfluoride glass-ceramics

Fluorescence spectroscopy of Er3+ : LaOBr prepared by NH4Br solid state reaction

Spectroscopic properties of Er3+ ions in La-2(WO4)(3) crystal

Visible upconversion in rare earth ion-doped Gd2O3 nanocrystals

Enhanced cooperative absorption and upconversion in Yb3+ doped YAG nanophosphors

Blue upconversion emission of Tm3+-Yb3+ in ZrO2 nanocrystals: Role of Yb3+ ions

Spectroscopic properties of Er3+ in LiErP4O12 and LiErYP4O12 single crystals

Optical properties of a transparent CaF2 : Er3+ fluoropolymer nanocomposite

Er3+- and Tm3+-containing ultra-transparent oxyfluoride-based glass ceramics for wavelength division multiplexing optical amplifiers

Cluster Metrics

Authors
zhang, j 5
montagna, m 5
mattarelli, m 5
ferrari, m 5
zhang, dl 4
wang, j 4
pun, eyb 4
zhou, gq 3

zhao, zw 3
zhang, wp 3
yin, m 3
xu, xd 3
xu, j 3
wang, mq 3
vetrone, f 3

Sources
optical materials 12
applied physics letters 6
journal of applied physics 4
spectroscopy and spectral analysis 3
spectrochimica acta part a-molecular and biomolecular spectroscopy 3
journal of physical chemistry b 3
journal of non-crystalline solids 3
journal of luminescence 3
journal of crystal growth 3
physical review b 2
optics communications 2
journal of the electrochemical society 2
journal of the american ceramic society 2
journal of rare earths 2
journal of physics-condensed matter 2

Keywords
luminescence 25
materials science, multidisciplinary 18
optics 14
emission 14
ions 12
physics, applied 11
rare-earth ions 9
physics, condensed matter 9
spectroscopy 9
er3+ 9
materials science, ceramics 8
glasses 8
spectroscopy 7
chemistry, physical 7
yb3+ 7

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2005 59
2004 19
2006 4

Country

peoples r china 43
italy 10
usa 7
japan 6
france 6
russia 4
germany 4
canada 4
brazil 4
switzerland 3
spain 3
mexico 3
england 3
sweden 2
india 2

Institution

chinese acad sci 20
city univ hong kong 6
univ trent 5
tianjin univ 5
zhejiang univ 4
cnr 4
univ verona 3
univ sci & technol china 3
univ padua 3
univ nottingham 3
univ la laguna 3
univ bern 3
inst mexicano petr 3
concordia univ 3
xiangtan univ 2

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science citation index 82

- # CLUSTER 98
  Phosphorescence and luminescence of materials containing rare earth ions (especially Eu3+), with focus on synthesis by combustion method and from percursors (107 Records)

(Countries: China completely dominant; South Korea distant second. Institutions: CAS, followed by Tongji University, followed by Tsing Hua University).

Cluster Syntax Features

Descriptive Terms
eu3 18.5%, phosphor 15.4%, luminesc 6.6%, eu 4.7%, dope 2.2%, rare 1.9%, combust 1.8%, earth 1.7%, rare.earth 1.7%, precursor 1.5%, emiss 1.4%, red 1.2%, ce 1.0%, powder 0.9%, ion 0.8%

Discriminating Terms
eu3 12.3%, phosphor 10.2%, luminesc 3.8%, eu 3.0%, film 1.9%, rare 1.1%, combust 1.1%, rare.earth 1.1%, earth 1.0%, surfac 0.9%, dope 0.7%, red 0.6%, ce 0.6%, layer 0.6%, precursor 0.6%

Single Word Terms
luminesc 70, phosphor 65, synthesi 55, emiss 53, synthes 52, dope 52, powder 51, size 51, particl 48, properti 46, rai 44, eu3 44, structur 44, ion 43, intens 41

Double Word Terms
rare.earth 30, ray.diffraction 27, sol.gel 24, luminescent.properties 22, electron.microscopy 18, solid.state 17, diffraction.xrd 16, emission.spectra 14, state.reaction 13, combustion.synthesis 13, eu3.doped 13, eu3.ions 12, emission.intensity 12, transmission.electron 11, red.emission 11

Triple Word Terms
solid.state.reaction 13, ray.diffraction.xrd 11, ray.powder.diffraction 11, scanning.electron.microscopy 10, synthesis.luminescent.properties 8, rare.earth.ions 8, transmission.electron.microscopy 7, doped.rare.earth 7, diffraction.xrd.scanning 6, scanning.electronic.microscope 6, electron.microscopy.sem 6, eu3.ions.occupied 5, synthesized.sol.gel 5, composition.hybrid.precursors 5, rare.earth.coordination 5

Term Cliques
40.05% luminesc rare earth rare.earth precursor emiss powder
39.10% luminesc dope combust emiss ce ion
41.94% luminesc dope rare earth rare.earth emiss powder ion
37.27% luminesc dope rare earth rare.earth emiss ce ion
44.33% phosphor luminesc combust precursor emiss red powder
43.22% eu3 luminesc dope combust emiss red powder ion
44.74% eu3 phosphor luminesc combust emiss red powder ion
42.72% eu3 phosphor luminesc eu combust red powder

Sample Cluster Record Titles

Studies on upconversion mechanism of ZrO2 : Er3+, Yb3+ nanocrystals under excitation at 488 and 980 nm

Synthesis and characterization of Y203 : Eu phosphor derived by solution-combustion method

Phosphorescent organogels via "metallophilic" interactions for reversible RGB-color switching

In-situ wet chemical composition of multicomponent precursors to blue emitting Sr2CeO4 phosphors

Synthesis and luminescent properties of GdAlO3 : RE by combustion process

In-situ sol-gel composition of hybrid precursors to synthesize SrTiO3 : Pr3+ red ceramic phosphors

Preparation and luminescence of Y2O3 : EU3+ nanopowder

Preparation and characterization of a new phosphor Lu2O3 : Eu3+

Blue luminescence of nanocrystalline PbWO4 phosphor synthesized via a citrate complex route assisted by microwave irradiation

Cluster Metrics

Authors
yan, b 12
shi, jl 7
xu, j 6

zhou, sm 5
zhang, jj 5
xia, gd 5
su, xq 4
shi, y 4
huang, hh 4
gong, ml 4
feng, t 4
zhou, ly 3
wang, sm 3
nakamura, a 3
li, yd 3

Sources

journal of rare earths 9
journal of alloys and compounds 7
materials research bulletin 6
journal of solid state chemistry 6
journal of materials research 5
journal of crystal growth 5
optical materials 4
journal of non-crystalline solids 4
solid state communications 3
materials letters 3
materials chemistry and physics 3
journal of the american chemical society 3
journal of nanoscience and nanotechnology 3
journal of luminescence 3
high-performance ceramics iii, pts 1 and 2 3

Keywords

luminescence 34
materials science, multidisciplinary 32
photoluminescence 16
materials science, multidisciplinary 16
chemistry, multidisciplinary 12
chemistry, physical 11
photoluminescence 10
luminescence 10
phosphors 10
emission 10
phosphors 9
chemistry, applied 9
phosphor 9
nanoparticles 9
rare earths 8

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Country
peoples r china 61
south korea 9
usa 7
japan 6
taiwan 4
italy 4
france 4
brazil 4
russia 3
poland 3
spain 2
mexico 2
india 2
finland 2
south africa 1

Institution
chinese acad sci 24
tongji univ 12
tsing hua univ 5
russian acad sci 3
peking univ 3
natl cheng kung univ 3
zhanjiang normal coll 2
univ wroclaw 2
univ verona 2
univ turku 2
univ tokyo 2
univ sci & technol china 2
univ lyon 1 2
univ cagliari 2
univ autonoma metropolitana azcapotzalco 2

DataBase
science citation index 107

- # CLUSTER 219

  Studies on optical activity (emission, luminescence, photoluminescence, and fluorescence), especially in nanocrystals and thin films, and factors that affect activity (326 Records)

(Countries: China, USA, followed by Japan. Institutions: CAS dominant, followed by RAS, University of Hong Kong. USA includes Pacific Northwest National Labs.).

Cluster Syntax Features

Descriptive Terms
emiss 17.1%, excit 9.3%, luminesc 6.2%, nanocryst 3.9%, photoluminesc 3.3%, band 3.3%, dope 2.8%, intens 2.2%, spectra 1.7%, eu3 1.4%, fluoresc 1.2%, absorpt 1.2%, peak 1.0%, light 1.0%, decai 1.0%

Discriminating Terms
emiss 11.9%, excit 6.6%, luminesc 4.6%, nanocryst 2.3%, photoluminesc 2.1%, film 2.0%, band 1.7%, intens 1.3%, dope 1.2%, eu3 1.1%, surfac 0.9%, phosphor 0.7%, carbon 0.7%, magnet 0.7%, decai 0.7%

Single Word Terms
emiss 224, excit 179, band 138, intens 136, photoluminesc 130, spectra 126, luminesc 125, properti 123, temperatur 121, optic 105, structur 100, dope 99, two 95, electron 93, light 90

Double Word Terms
room.temperature 50, emission.spectra 34, time.resolved 27, optical.properties 25,

ray.diffraction 24, energy.transfer 24, emission.band 22, photoluminescence.spectra 22, emission.bands 22, band.gap 21, luminescence.properties 20, excitation.spectra 19, solid.state 19, light.emission 19, low.temperature 18

Triple Word Terms

time.resolved.photoluminescence 9, metal.organic.chemical 6, vacuum.ultraviolet.vuv 6, mn.doped.zns 6, broad.emission.band 6, two.emission.bands 6, ray.diffraction.xrd 6, chemical.vapor.deposition 6, full.width.half 5, scanning.electron.microscopy 5, time.resolved.fluorescence 5, self.trapped.excitons 5, width.half.maximum 5, solid.state.reaction 5, excitation.emission.spectra 5

Term Cliques

31.23% excit intens fluoresc absorpt decai
35.71% excit intens spectra fluoresc absorpt
37.88% excit band intens spectra absorpt peak
37.01% excit nanocryst band intens spectra absorpt
34.51% excit nanocryst band intens spectra eu3
39.72% excit nanocryst photoluminesc band intens spectra
33.87% excit luminesc nanocryst band dope intens eu3
38.34% excit luminesc nanocryst photoluminesc band dope intens
38.14% emiss excit intens fluoresc light decai
38.70% emiss excit intens spectra eu3 fluoresc
42.48% emiss excit band intens spectra eu3
44.61% emiss excit photoluminesc band intens spectra peak
39.70% emiss excit luminesc dope intens light decai
41.10% emiss excit luminesc dope intens peak light
40.71% emiss excit luminesc band dope intens eu3
41.45% emiss excit luminesc photoluminesc dope intens decai
42.79% emiss excit luminesc photoluminesc band dope intens peak

Sample Cluster Record Titles

The role of rare earth elements and Mn2+ point defects on the luminescence of bavenite

Photoluminescence of doped ZnS nanoparticles under hydrostatic pressure

Effect of reaction media on the growth and photoluminescence of colloidal CdSe nanocrystals

Photoelectric properties of lead tungstate crystals

Preparation and optical spectroscopy of Eu3+-doped GaN luminescent semiconductor from freeze-dried precursors

Low-temperature radio- and thermo-stimulated luminescence of SnO2-doped silica

[Synthesis, electrical properties, and optical characterization of Eu3+-doped La2Mo2O9 nanocrystalline phosphors]

[Is o-carborane photoluminescent?]

[Structural and spectroscopic investigations of bulk poly [bis(2-ethyl)hexylfluorene]]

Cluster Metrics

Authors

chen, w 6
xu, j 5
zhang, gb 4
yu, lx 4
song, hw 4
phillips, dl 4
lu, sz 4
li, gh 4
leung, yh 4
kwok, wm 4
joly, ag 4
djurisic, ab 4
chan, wk 4
zhang, xy 3
zhang, qr 3

Sources

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journal of nanoscience and nanotechnology 10
optical materials 9
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journal of the american chemical society 7
journal of physics-condensed matter 7
chemical physics letters 7
physics of the solid state 6
journal of rare earths 6
nanotechnology 5
journal of chemical physics 5
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Keywords

luminescence 68
physics, applied 50
photoluminescence 50
chemistry, physical 39
physics, condensed matter 36
emission 34
materials science, multidisciplinary 33
chemistry, multidisciplinary 30
materials science, multidisciplinary 28
photoluminescence 24
optics 23
physics, atomic, molecular & chemical 22
luminescence 21
nanoparticles 21
optical-properties 20

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Country
peoples r china 85
usa 61
japan 34
germany 25
france 23
russia 20
south korea 17
italy 15
india 13
ukraine 12
taiwan 11
canada 11
spain 7
poland 7
netherlands 7

Institution
chinese acad sci 31
russian acad sci 9
univ hong kong 7
univ sci & technol china 6
osaka univ 5
changchun univ sci & technol 5
univ montpellier 2 4

univ cagliari 4
tohoku univ 4
polish acad sci 4
pacific nw natl lab 4
nanjing univ 4
jilin univ 4
beijing jiaotong univ 4
zhejiang univ 3

DataBase
science citation index 326

- # CLUSTER 89
  Light-emitting diodes (LEDs), including organic LEDs and emphasizing construction and optimization of LEDs (263 Records)

(Countries: USA, China, followed by Taiwan, South korea, followed by japan. Institutions: CAS, National Chiao Tung University, National Cheng Kung University, Jilin University. USA include University of Florida, UCSB, University of South Carolina).

Cluster Syntax Features

Descriptive Terms
emit 13.3%, light.emitting 11.1%, light 8.7%, diod 6.1%, devic 5.2%, light.emitting.diodes 3.6%, emitting.diodes 3.6%, led 2.5%, effici 2.5%, electroluminesc 2.1%, emiss 1.9%, organic.light.emitting 1.6%, organic.light 1.6%, blue 1.1%, ol 1.0%

Discriminating Terms
emit 8.6%, light.emitting 7.5%, light 4.5%, diod 3.8%, light.emitting.diodes 2.4%, emitting.diodes 2.4%, devic 2.3%, film 1.5%, led 1.5%, electroluminesc 1.3%, organic.light.emitting 1.1%, organic.light 1.1%, effici 1.0%, surfac 0.8%, ol 0.7%

Single Word Terms

light 237, emit 232, diod 178, devic 173, effici 152, emiss 136, layer 130, fabric 109, organ 108, quantum 96, electroluminesc 95, structur 89, high 82, current 77, electron 77

Double Word Terms
light.emitting 217, emitting.diodes 132, organic.light 75, emitting.diode 52, emitting.devices 47, external.quantum 44, quantum.efficiency 37, tin.oxide 35, indium.tin 34, diodes.leds 33, light.emission 29, blue.light 27, output.power 23, turn.voltage 22, oxide.ito 21

Triple Word Terms
light.emitting.diodes 132, organic.light.emitting 75, light.emitting.diode 52, light.emitting.devices 45, indium.tin.oxide 34, emitting.diodes.leds 32, external.quantum.efficiency 32, blue.light.emitting 20, tin.oxide.ito 20, polymer.light.emitting 18, emitting.diodes.oleds 17, gan.light.emitting 15, tris.hydroxyquinoline.aluminum 13, white.organic.light 13, chemical.vapor.deposition 12

Term Cliques
51.81% emit light.emitting light light.emitting.diodes emitting.diodes effici emiss organic.light.emitting organic.light blue ol
51.95% emit light.emitting light devic effici electroluminesc emiss organic.light.emitting organic.light blue ol
58.06% emit light.emitting light diod light.emitting.diodes emitting.diodes effici emiss blue ol
59.91% emit light.emitting light diod light.emitting.diodes emitting.diodes led effici blue

Sample Cluster Record Titles

Emission of an intense large area electron beam from a slab of porous dielectric

Nonpolar InGaN/GaN emitters on reduced-defect lateral epitaxially overgrown a-plane GaN with drive-current-independent electroluminescence emission peak

Improved device efficiency and color purity: Spectral redshift and line narrowing for poly [2-methoxy,5-(2-ethylhexyloxy)-1,4-phenylenevinylene] via blending with phenyl-substituted poly [p-phenylene vinylene] derivatives

A top-emission organic light-emitting diode with a silicon anode and an Sm/Au cathode

Small molecular white organic light emitting devices with single emission zone

Correlating physical and chemical degradation in the performance of aluminum tris(8-

hydroxyquinoline) (Alq(3))-based OLEDs

AlGaN-based 280 nm light-emitting diodes with continuous-wave power exceeding 1 mW at 25 mA

Dodecanoxy-phenylethynylene oligomers for light emitting diodes

Direct emissive pattern formation in PPV type polymer with built-in photoresist properties and the application to light emitting devices

Cluster Metrics

Authors

zhao, y 7
liu, sy 7
cingolani, r 6
yang, sy 5
xu, xr 5
teng, f 5
sun, xw 5
speck, js 5
li, wl 5
denbaars, sp 5
chen, bj 5
cao, y 5
xu, z 4
wenzl, fp 4
wei, hz 4

Sources

applied physics letters 43
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thin solid films 10
japanese journal of applied physics part 1-regular papers brief communications & review papers 9
synthetic metals 8
japanese journal of applied physics part 2-letters & express letters 8
microelectronics journal 6
journal of crystal growth 6
japanese journal of applied physics part 1-regular papers short notes & review papers 6
journal of materials chemistry 5
current applied physics 5
chemistry of materials 5
optics express 4
journal of physical chemistry b 4

ieee photonics technology letters 4

Keywords
physics, applied 80
diodes 51
materials science, multidisciplinary 48
emission 42
physics, applied 35
engineering, electrical & electronic 30
devices 29
light-emitting-diodes 27
electroluminescence 27
materials science, multidisciplinary 25
layer 25
conjugated polymers 22
chemistry, physical 20
polymer science 19
physics, 19

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2005 234
2004 26
2006 3

Country
usa 58
peoples r china 50
taiwan 38
south korea 33
japan 23
germany 14
england 13
italy 11
singapore 8
austria 8
india 5
france 5
canada 5
sweden 4
scotland 3

Institution
chinese acad sci 15
natl chiao tung univ 12
natl cheng kung univ 10
jilin univ 8

univ florida 6
s china univ technol 6
acad sinica 6
univ lecce 5
univ calif santa barbara 5
samsung adv inst technol 5
nanyang technol univ 5
korea univ 5
city univ hong kong 5
univ s carolina 4
sensor elect technol inc 4

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- # CLUSTER 61
  Multiple quantum wells (MQWs), especially GaN, InGaN, and GaN/InGaN, and focusing on structural and photoluminescence properties (151 Records)

(Countries: USA, South Korea. Institutions: Polish Academy of Sciences, National Cheng Kung University, Gwangju Institute of S&T. USA include UCSB, Cornell University.).

Cluster Syntax Features

Descriptive Terms
gan 20.2%, ingan 13.8%, mqw 6.5%, quantum 6.1%, ingan.gan 5.7%, well 3.0%, multiple.quantum 2.5%, quantum.wells 2.1%, multipl 1.3%, gan.multiple 1.2%, gan.multiple.quantum 1.1%, multiple.quantum.wells 1.0%, led 0.9%, photoluminesc 0.9%, emiss 0.8%

Discriminating Terms

gan 12.1%, ingan 9.2%, mqw 4.3%, ingan.gan 3.9%, quantum 2.0%, film 1.9%, well 1.7%, multiple.quantum 1.6%, quantum.wells 1.2%, gan.multiple 0.8%, surfac 0.8%, gan.multiple.quantum 0.8%, nanoparticl 0.7%, multipl 0.7%, particl 0.7%

Single Word Terms

quantum 141, gan 120, ingan 89, well 86, structur 81, photoluminesc 72, multipl 66, grown 64, optic 63, high 60, temperatur 60, emiss 58, mqw 53, physic 53, carrier 45

Double Word Terms

quantum.wells 74, ingan.gan 70, multiple.quantum 65, gan.multiple 38, light.emitting 36, gan.quantum 33, room.temperature 26, optical.properties 26, quantum.mqw 25, emitting.diodes 25, vapor.deposition 22, diodes.leds 22, chemical.vapor 22, time.resolved 22, multi.quantum 20

Triple Word Terms

gan.multiple.quantum 37, multiple.quantum.wells 36, ingan.gan.multiple 25, light.emitting.diodes 25, ingan.gan.quantum 24, chemical.vapor.deposition 22, emitting.diodes.leds 21, multiple.quantum.mqw 19, quantum.wells.mqws 17, gan.quantum.wells 16, metalorganic.chemical.vapor 16, grown.metalorganic.chemical 13, quantum.confined.stark 13, quantum.wells.grown 12, time.resolved.photoluminescence 12

Term Cliques

39.74% mqw quantum multiple.quantum gan.multiple gan.multiple.quantum led emiss
43.71% mqw quantum well multiple.quantum quantum.wells multipl gan.multiple gan.multiple.quantum multiple.quantum.wells photoluminesc emiss
40.21% mqw quantum ingan.gan gan.multiple gan.multiple.quantum led emiss
46.03% mqw quantum ingan.gan well quantum.wells multipl gan.multiple gan.multiple.quantum photoluminesc emiss
47.68% gan ingan quantum multiple.quantum gan.multiple gan.multiple.quantum led emiss
48.68% gan ingan quantum well multiple.quantum quantum.wells multipl gan.multiple gan.multiple.quantum multiple.quantum.wells photoluminesc emiss
48.10% gan ingan quantum ingan.gan gan.multiple gan.multiple.quantum led emiss
51.23% gan ingan quantum ingan.gan well quantum.wells multipl gan.multiple gan.multiple.quantum photoluminesc emiss

Sample Cluster Record Titles

Investigation of the unusual temperature dependence of InGaN/GaN quantum well photoluminescence over a range of emission energies

Potentially modulated multi-quantum wells for high-efficiency solar cell applications

Luminescence and lasing in InGaN/GaN multiple quantum well heterostructures grown at different temperatures

Optical and electrical step-recovery study of minority-carrier transport in an InGaN/GaN quantum-well light-emitting diode grown on sapphire

Study of stimulated emission from InGaN/GaN multiple quantum well structures

InGaN/GaN multiple quantum disk nanocolumn light-emitting diodes grown on (111)Si substrate

Structural and optical characterizations of InxGa1-xN/GaN (0.15 <= x <= 0.30) multi-quantum well structures

Optical properties of In-rich InGaN/GaN single quantum well structures with high density of clusters

Blue luminescence from the InGaN multiple quantum wells

Cluster Metrics

Authors
suski, t 7
perlin, p 7
grzegory, i 7
zukauskas, a 6
speck, js 6
miasojedovas, s 6
leszczynski, m 6
jursenas, s 6
denbaars, sp 6
yoon, e 5
park, sj 5
nakamura, s 5
kim, hj 5
kang, tw 5
cho, yh 5

Sources
applied physics letters 40
journal of applied physics 16
journal of crystal growth 11
journal of the korean physical society 9
physica status solidi a-applications and materials science 6

physica e-low-dimensional systems & nanostructures 6
japanese journal of applied physics part 1-regular papers brief communications & review papers 5
microelectronics journal 4
journal of vacuum science & technology b 4
electrochemical and solid state letters 4
semiconductor science and technology 3
compound semiconductors 2004, proceedings 3
acta physica polonica a 3
superlattices and microstructures 2
semiconductors 2

Keywords

physics, applied 66
gan 32
physics, condensed matter 19
engineering, electrical & electronic 19
emission 19
light-emitting-diodes 18
physics, multidisciplinary 16
luminescence 15
molecular-beam epitaxy 14
photoluminescence 14
crystallography 12
gan 11
strain 11
growth 11
single 10

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2005 129
2004 22

Country

usa 37
south korea 36
taiwan 18
peoples r china 17
japan 15
germany 11
england 11
poland 10
lithuania 7
france 7
switzerland 4
spain 4

russia 3
italy 3
canada 3

Institution
polish acad sci 8
natl cheng kung univ 7
gwangju inst sci & technol 7
univ calif santa barbara 6
seoul natl univ 6
dongguk univ 6
chungbuk natl univ 6
vilnius univ 5
cornell univ 5
chonbuk natl univ 5
chinese acad sci 5
peking univ 4
natl taiwan univ 4
kyoto univ 4
korea res inst stand & sci 4

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science citation index 151

- # CLUSTER 74
  Gallium nitride (GaN) films, layers, and structures, primarily grown by vapor-phase/ molecular-beam epitaxy and chemical vapor deposition, as well as gallium heterostructures, especially those containing sapphire (270 Records)

(Countries: USA, Japan, China. Institutions: CAS, Chonbuk National University, National Cheng Kung University. USA include VCU, UCSB, UCB, SUNY Albany.).

Cluster Syntax Features

Descriptive Terms

gan 60.2%, disloc 2.0%, grown 1.7%, epitaxi 1.5%, layer 1.5%, growth 1.3%, sapphir 1.0%, substrat 0.8%, gan.films 0.6%, ga 0.5%, gan.layers 0.5%, si 0.4%, vapor 0.4%, growth.gan 0.3%, defect 0.3%

Discriminating Terms

gan 41.2%, disloc 1.1%, film 0.9%, particl 0.7%, epitaxi 0.7%, nanoparticl 0.7%, grown 0.6%, sapphir 0.6%, carbon 0.6%, magnet 0.6%, nanotub 0.6%, surfac 0.5%, gan.films 0.4%, oxid 0.4%, polym 0.4%

Single Word Terms

gan 268, grown 176, layer 166, substrat 151, growth 149, epitaxi 140, high 121, deposit 121, structur 118, vapor 113, film 111, temperatur 111, electron 106, chemic 100, rai 99

Double Word Terms

chemical.vapor 75, ray.diffraction 74, vapor.deposition 74, electron.microscopy 70, gan.films 56, transmission.electron 54, molecular.beam 54, beam.epitaxy 54, phase.epitaxy 47, metalorganic.chemical 47, gan.layers 42, atomic.force 41, high.resolution 41, metal.organic 41, layers.grown 39

Triple Word Terms

chemical.vapor.deposition 73, molecular.beam.epitaxy 54, transmission.electron.microscopy 49, metalorganic.chemical.vapor 43, vapor.phase.epitaxy 38, atomic.force.microscopy 36, metal.organic.chemical 31, high.resolution.ray 27, resolution.ray.diffraction 26, gan.films.grown 25, organic.chemical.vapor 25, scanning.electron.microscopy 24, vapor.deposition.mocvd 23, plasma.molecular.beam 23, width.half.maximum 18

Term Cliques

43.47% gan grown epitaxi growth gan.films ga gan.layers growth.gan
45.93% gan grown epitaxi layer growth substrat gan.films gan.layers si vapor growth.gan
44.01% gan grown epitaxi layer growth sapphir substrat gan.films gan.layers vapor growth.gan defect
47.14% gan disloc grown epitaxi layer growth substrat gan.films gan.layers si vapor
45.12% gan disloc grown epitaxi layer growth sapphir substrat gan.films gan.layers vapor defect

Sample Cluster Record Titles

Gallium nitride powders from ammonolysis: Influence of reaction parameters on structure and properties

Preparation of stoichiometric GaN(0001)-1 x 1 studied with spectromicroscopy

Misfit dislocation formation in the AlGaN/GaN heterointerface

Microstructural properties and atomic arrangements in GaN/sapphire and AlxGa1-xN/AlN/GaN/sapphire heterostructures

Micro-Auger electron spectroscopy studies of chemical and electronic effects at GaN-sapphire interfaces

Photoluminescence studies of GaN nanorods on Si (111) substrates grown by molecular-beam epitaxy

Correlation of in-situ reflectance spectra and resistivity of GaN/Al2O3 interfacial layer in metalorganic chemical vapor deposition

Epitaxial growth of GaN on (100) beta-Ga2O3 substrates by metalorganic vapor phase epitaxy

Growth of crack-free GaN on Si(111) with graded AlGaN buffer layers

Cluster Metrics

Authors

monemar, b 7
chang, sj 7
su, yk 6
morkoc, h 6
chua, sj 6
yun, f 5
xue, cs 5
weyher, jl 5
porowski, s 5
okumura, h 5
moon, yt 5
liliental-weber, z 5
larsen, pk 5
komninou, p 5
hassan, z 5

Sources
journal of crystal growth 57
applied physics letters 40
journal of applied physics 22
physica status solidi a-applications and materials science 10
physical review b 7
japanese journal of applied physics part 2-letters & express letters 7
superlattices and microstructures 6
journal of vacuum science & technology a 6
journal of the korean physical society 6
japanese journal of applied physics part 1-regular papers short notes & review papers 6
rare metal materials and engineering 5
applied surface science 5
thin solid films 4
journal of physics d-applied physics 4
journal of electronic materials 4

Keywords
physics, applied 79
crystallography 58
films 56
gan 44
growth 42
chemical-vapor-deposition 35
gan 33
physics, condensed matter 29
molecular-beam epitaxy 29
nitrides 28
materials science, multidisciplinary 25
layers 25
physics, applied 24
gallium nitride 24
vapor-phase epitaxy 23

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2005 223
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Country
usa 72
japan 47
peoples r china 38
south korea 29
germany 26

taiwan 22
france 14
poland 12
sweden 10
england 9
singapore 8
netherlands 8
malaysia 6
scotland 5
greece 5

Institution
chinese acad sci 15
chonbuk natl univ 10
natl cheng kung univ 8
virginia commonwealth univ 7
univ calif santa barbara 7
polish acad sci 7
linkoping univ 7
univ calif berkeley 6
inst mat res & engn 6
univ sains malaysia 5
tohoku univ 5
suny albany 5
shandong normal univ 5
samsung adv inst technol 5
osaka univ 5

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science citation index 270

- # CLUSTER 41
  Nitride (AlGaN, GaN, AlGaN/GaN, and AlN) structures grown and/or used for applications using ohmic contact, high-electron-mobility transistors (HEMTs), and heterojunction field-effect transistors (HFETs) (100 Records)

(Countries: USA, Japan, South Korea, Taiwan. Institutions: Nagoya institute of Technology, Gwangju Institute of S&T, National Cheng Kung University. USA include University of Illinois, University of Florida, Sandia National labs, Penn State University, Georgia Institute of Technology).

Cluster Syntax Features

Descriptive Terms
algan 22.7%, gan 19.1%, contact 6.6%, ohmic 4.8%, algan.gan 3.5%, layer 1.4%, ohmic.contact 1.4%, hemt 1.3%, anneal 1.2%, aln 1.1%, hfet 1.0%, ohmic.contacts 1.0%, resist 0.9%, contact.resistance 0.7%, grown 0.5%

Discriminating Terms
algan 15.0%, gan 11.1%, contact 3.4%, ohmic 3.2%, algan.gan 2.3%, film 1.5%, ohmic.contact 0.9%, hemt 0.8%, hfet 0.7%, surfac 0.7%, nanoparticl 0.7%, ohmic.contacts 0.7%, aln 0.6%, particl 0.6%, carbon 0.6%

Single Word Terms
gan 87, layer 66, algan 66, electron 58, high 55, deposit 46, contact 43, resist 42, structur 42, grown 40, thick 39, vapor 38, temperatur 38, metal 38, current 38

Double Word Terms
algan.gan 42, vapor.deposition 26, ohmic.contact 25, chemical.vapor 25, contact.resistance 24, ohmic.contacts 23, electron.mobility 23, ray.diffraction 23, electron.microscopy 23, high.electron 20, light.emitting 16, type.gan 15, low.resistance 15, gan.high 14, algan.layer 14

Triple Word Terms
chemical.vapor.deposition 24, high.electron.mobility 20, gan.high.electron 13, transmission.electron.microscopy 12, dimensional.electron.gas 12, vapor.phase.epitaxy 12, two.dimensional.electron 12, light.emitting.diodes 12, emitting.diodes.leds 11, metalorganic.chemical.vapor 11, electron.mobility.transistor 11, algan.gan.high 11, organic.chemical.vapor 11, metal.organic.chemical 11, electron.mobility.transistors 10

Term Cliques
32.29% contact ohmic ohmic.contact anneal ohmic.contacts resist contact.resistance

48.33% gan hemt resist
41.43% gan contact ohmic ohmic.contact anneal resist contact.resistance
45.33% algan gan algan.gan hemt aln grown
51.83% algan gan algan.gan layer hfet grown
53.67% algan gan algan.gan layer aln grown

Sample Cluster Record Titles

Study of the electrical, structural and surface morphological characteristics of Pt/Re/Au ohmic contacts on p-type GaN

Thermodynamic analysis of AlGaNHVPE growth

Influence of dislocation and ionized impurity scattering on the electron mobility in GaN/AlGaN heterostructures

Electrical and structural properties of low-resistance Pt/Ag/Au ohmic contacts to p-type GaN

Impact of layer structure on performance of unpassivated AlGaN/GaN HEMT

High temperature annealed Ge/Ag/Ni ohmic contact for InAlAs/InGaAs HEMTs

High temperature and high frequency characteristics of AlGaN/GaN MOS-HFETs with photochemical vapor deposition SiO2 layer

Growth of thick AlGaN by mixed-source hydride vapor phase epitaxy

Effect of various interlayers on epiwafer bowing in AlGaN/GaN high-electron-mobility transistor structures

Cluster Metrics

Authors
egawa, t 13
seong, ty 10
ishikawa, h 10
chang, sj 8
song, jo 7
adesida, i 6
park, sj 5

miyoshi, m 5
kim, kh 5
arulkumaran, s 5
tanaka, m 4
su, yk 4
oda, o 4
kuo, ch 4
yi, jy 3

Sources
applied physics letters 18
journal of crystal growth 13
journal of vacuum science & technology b 10
journal of applied physics 6
japanese journal of applied physics part 1-regular papers brief communications & review papers 5
electrochemical and solid state letters 5
solid-state electronics 4
physica status solidi a-applications and materials science 4
materials science and engineering b-solid state materials for advanced technology 4
ieee transactions on electron devices 4
journal of the electrochemical society 3
japanese journal of applied physics part 1-regular papers short notes & review papers 3
applied surface science 3
semiconductor science and technology 2
physica status solidi a-applied research 2

Keywords
physics, applied 33
engineering, electrical & electronic 25
physics, applied 19
gan 19
crystallography 13
materials science, multidisciplinary 11
sapphire 11
light-emitting-diodes 10
physics, condensed matter 9
nitrides 9
field-effect transistors 8
electrochemistry 8
electron-mobility transistors 7
physics, 7
physics, condensed matter 6

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2005 82

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Country
usa 27
japan 26
south korea 20
taiwan 18
peoples r china 7
germany 5
india 4
poland 2
malaysia 2
england 2
sweden 1
spain 1
slovenia 1
slovakia 1
singapore 1

Institution
nagoya inst technol 13
gwangju inst sci & technol 10
natl cheng kung univ 8
univ illinois 7
ngk insulators ltd 6
natl cent univ 6
chinese acad sci 5
univ florida 3
sandia natl labs 3
samsung adv inst technol 3
penn state univ 3
natl inst informat & commun technol 3
nagoya univ 3
korea maritime univ 3
georgia inst technol 3

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science citation index 100

- CLUSTER 62
  Zinc oxide (ZnO) thin films, emphasizing fabrication by magnetron sputtering, deposition, and annealing; doped ZnO films; and optical properties of ZnO films (254 Records)

(Countries: China dominant, followed by Japan, Korea, USA. Institutions: CAS dominant, followed by Shandong University, Chonnam National University. No USA institutional presence.).

Cluster Syntax Features

Descriptive Terms

zno 44.9%, film 11.7%, zno.films 11.5%, zinc 1.3%, anneal 0.9%, zno.film 0.9%, zn 0.8%, zinc.oxide 0.8%, substrat 0.7%, deposit 0.7%, zno.thin 0.6%, sputter 0.6%, zno.thin.films 0.5%, dope 0.4%, optic 0.4%

Discriminating Terms

zno 30.8%, zno.films 8.8%, film 2.4%, zinc 0.7%, carbon 0.7%, zno.film 0.7%, particl 0.6%, magnet 0.6%, surfac 0.6%, nanoparticl 0.6%, nanotub 0.6%, zinc.oxide 0.6%, quantum 0.4%, phase 0.4%, zno.thin 0.4%

Single Word Terms

film 253, zno 249, substrat 152, deposit 147, temperatur 135, structur 132, rai 126, properti 126, thin 119, diffract 112, optic 112, oxid 97, zinc 95, high 93, surfac 91

Double Word Terms

zno.films 170, ray.diffraction 103, thin.films 94, zinc.oxide 72, zno.thin 64, magnetron.sputtering 58, zno.film 58, films.grown 52, optical.properties 51, films.deposited 51, room.temperature 47, diffraction.xrd 42, properties.zno 40, electron.microscopy 38, oxide.zno 35

Triple Word Terms

zno.thin.films 57, ray.diffraction.xrd 42, zinc.oxide.zno 32, zno.films.grown 31, films.ray.diffraction 28, atomic.force.microscopy 25, zno.films.deposited 24, properties.zno.films 24, scanning.electron.microscopy 23, doped.zno.films 22, zinc.oxide.films 21, structural.optical.properties 17, optical.properties.zno 17, chemical.vapor.deposition 17, ray.photoelectron.spectroscopy 17

Term Cliques

47.46% zno film zno.films zn zinc.oxide substrat zno.thin sputter zno.thin.films dope optic
48.79% zno film zno.films anneal zn zinc.oxide substrat deposit zno.thin sputter zno.thin.films optic
48.17% zno film zno.films zinc zn zinc.oxide substrat zno.thin zno.thin.films dope optic
46.24% zno film zno.films zinc zno.film zn zinc.oxide substrat zno.thin zno.thin.films dope
49.44% zno film zno.films zinc anneal zn zinc.oxide substrat deposit zno.thin zno.thin.films optic
47.67% zno film zno.films zinc anneal zno.film zn zinc.oxide substrat deposit zno.thin zno.thin.films

Sample Cluster Record Titles

Sputtered deposited nanocrystalline ZnO films: A correlation between electrical, optical and microstructural properties

Improvement in microstructure and crystal alignment of ZnO films grown by metalorganic chemical vapor deposition using a seed layer

Electrons transfer between mercaptoacetic acid and ZnO nanocrystal thin film

Two-step growth of ZnO filins on silicon by atomic layer deposition

Nanocrystalline ZnO films prepared by pyrolysis of Zn-arachidate LB multilayers

Influence of annealing conditions of ZnO films on the properties of ZnS films prepared by sulfurizing ZnO films

Electrodeposition of ZnO-Fe granular films

Homoepitaxial growth of ZnO films on ZnO (11(2)over-bar0) substrates

Characterization of homoepitaxial and heteroepitaxial ZnO films grown by pulsed laser deposition

Cluster Metrics

Authors
liu, yc 8
zhang, xj 7
li, xm 7
yu, wd 6
ma, j 6
ma, hl 6
ji, f 6
zhang, z 5
zhang, rg 5
zhang, jy 5
zeng, zq 5
xue, qk 5
xu, j 5
wang, by 5
shen, dz 5

Sources
thin solid films 31
journal of crystal growth 21
applied surface science 19
applied physics letters 13
surface & coatings technology 7
journal of the korean physical society 7
journal of applied physics 7
applied physics a-materials science & processing 7
materials letters 4
journal of vacuum science & technology a 4
journal of physics d-applied physics 4
integrated ferroelectrics 4
acta physica sinica 4
superlattices and microstructures 3
materials science and engineering b-solid state materials for advanced technology 3

Keywords
materials science, multidisciplinary 78
thin-films 63
physics, applied 57
physics, 56
growth 39
condensed matter 36
deposition 36
zno 33
physics, applied 33

physics, condensed matter 31
chemistry, physical 30
thin-films 26
zno 26
room-temperature 25
photoluminescence 24

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2005 235
2004 16
2006 3

Country
peoples r china 88
japan 40
south korea 33
usa 26
india 18
france 13
taiwan 9
spain 8
greece 6
germany 6
singapore 5
new zealand 4
mexico 4
england 4
egypt 4

Institution
chinese acad sci 33
shandong univ 9
chonnam natl univ 7
tokyo inst technol 6
ne normal univ 6
natl cheng kung univ 6
nanjing univ 6
indian assoc cultivat sci 6
zhejiang univ 5
kyoto univ 5
jilin univ 5
beijing univ technol 5
univ montpellier 2 4
sungkyunkwan univ 4
natl inst adv ind sci & technol 4

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science citation index 254

- # CLUSTER 7
  Zinc oxide (ZnO) thin films, emphasizing growth by deposition, doped ZnO films, and emission/ magnetic/ optical/ electronic properties of ZnO films (70 Records)

(Countries: China dominant, followed by South korea, India, Japan. Institutions: CAS, Zhejiang University, nanyang Technological University. No USA institutional presence.).

Cluster Syntax Features

Descriptive Terms
zno 27.6%, zno.thin 18.7%, zno.thin.films 15.1%, thin.films 5.4%, thin 4.9%, film 4.8%, substrat 0.7%, deposit 0.6%, dope 0.5%, properties.zno 0.4%, emiss 0.4%, properties.zno.thin 0.4%, optic 0.3%, zno.films 0.3%, zno.thin.film 0.3%

Discriminating Terms
zno 16.4%, zno.thin 13.0%, zno.thin.films 10.5%, thin.films 2.5%, thin 1.7%, surfac 0.7%, particl 0.7%, nanoparticl 0.6%, carbon 0.6%, magnet 0.6%, nanotub 0.6%, structur 0.5%, crystal 0.4%, phase 0.4%, layer 0.4%

Single Word Terms

film 70, zno 70, thin 70, substrat 46, deposit 41, properti 40, temperatur 36, structur 35, rai 33, optic 33, diffract 30, photoluminesc 26, grown 25, surfac 24, emiss 24

Double Word Terms
thin.films 69, zno.thin 66, ray.diffraction 28, thin.film 24, films.deposited 21, zno.films 20, properties.zno 19, films.grown 15, room.temperature 14, optical.properties 14, zinc.oxide 13, band.gap 12, pulsed.laser 12, diffraction.xrd 12, laser.deposition 11

Triple Word Terms
zno.thin.films 64, thin.films.deposited 20, zno.thin.film 18, properties.zno.thin 14, thin.films.grown 14, ray.diffraction.xrd 12, pulsed.laser.deposition 11, optical.properties.zno 9, doped.zno.thin 8, zinc.oxide.zno 8, films.ray.diffraction 7, atomic.force.microscopy 7, thin.films.zno 7, laser.deposition.pld 6, type.zno.thin 6

Term Cliques
76.03% zno zno.thin zno.thin.films thin.films thin film dope properties.zno optic
73.86% zno zno.thin zno.thin.films thin.films thin film substrat emiss zno.films zno.thin.film
67.26% zno zno.thin zno.thin.films thin.films thin film substrat properties.zno emiss properties.zno.thin optic zno.films
76.29% zno zno.thin zno.thin.films thin.films thin film substrat deposit zno.films zno.thin.film
69.29% zno zno.thin zno.thin.films thin.films thin film substrat deposit properties.zno properties.zno.thin optic zno.films

Sample Cluster Record Titles

Growth of ZnO thin films - experiment and theory

Electronic properties of nano-porous TiO2- and ZnO-thin films-comparison of simulations and experiments

Improvement of electrical and optical properties of ZnO thin films prepared by MOCVD using UV light irradiation and in situ H-2 post-treatment

High mobility in ZnO thin films deposited on perovskite substrates with a low temperature nucleation layer

Surface characterization of electrochemically fabricated CuO doped ZnO thin film

On the properties of indium doped ZnO thin films

MOCVD growth and properties of ZnO thin films on LiNbO3 substrates

[Growth and optical characterization of ZnO thin films deposited on sapphire substrate by MOCVD technique]

[Electron beam induced light emission and charge conduction patterning in ZnO by using an AlOx layer]

Cluster Metrics

Authors
zhao, bh 5
ye, zz 5
zhu, lp 4
yuan, gd 4
liu, yc 4
zhang, jy 3
vijayakumar, kp 3
shin, bc 3
shen, dz 3
shan, fk 3
qian, q 3
lu, ym 3
liu, zf 3
liu, gx 3
lee, wj 3

Sources
applied physics letters 9
journal of crystal growth 6
journal of applied physics 5
applied surface science 5
thin solid films 4
superlattices and microstructures 3
semiconductor science and technology 3
solid state communications 2
solar energy materials and solar cells 2
physica e-low-dimensional systems & nanostructures 2
materials science in semiconductor processing 2
journal of electroceramics 2
journal of ceramic processing research 2
japanese journal of applied physics part 2-letters & express letters 2
transactions of nonferrous metals society of china 1

Keywords
physics, applied 16

photoluminescence 13
physics, condensed matter 12
growth 12
materials science, multidisciplinary 11
physics, condensed matter 10
chemical-vapor-deposition 9
sapphire 9
physics, 9
engineering, electrical & electronic 8
zinc-oxide 8
room-temperature 8
physics, applied 8
zno 7
zinc-oxide films 7

Publication Year
2005 67
2004 3

Country
peoples r china 27
south korea 11
india 10
japan 7
france 5
usa 4
singapore 4
romania 2
italy 2
germany 2
vietnam 1
turkey 1
spain 1
ireland 1
greece 1

Institution
chinese acad sci 9
zhejiang univ 5
nanyang technol univ 4
jilin univ 3
indian inst technol 3
dongeui univ 3
cochin univ sci & technol 3
univ sci & technol china 2
tsing hua univ 2

ntt adv technol corp 2
ne normal univ 2
natl inst mat sci 2
nagoya inst technol 2
jadavpur univ 2
inst mat res & engn 2

DataBase
science citation index 70

- # CLUSTER 67
  Zinc oxide (ZnO) nanowires and other nanostructures, focusing on growth, emission and pholuminescence properties, doped zinc nanostructures, and nanowire arrays (304 Records)

(Countries: China dominant, followed by USA, South Korea, followed by Japan, Taiwan. Institutions: CAS dominant, followed by University S&T China, Hanyang University, Zhejiang University. USA includes University of Florida.).

Cluster Syntax Features

Descriptive Terms
zno 68.2%, zno.nanowires 3.5%, nanowir 3.2%, zn 1.3%, growth 0.9%, emiss 0.9%, nanostructur 0.6%, zno.nanostructures 0.6%, doped.zno 0.5%, zinc 0.5%, photoluminesc 0.4%, dope 0.4%, grown 0.3%, arrai 0.3%, substrat 0.3%

Discriminating Terms

zno 45.1%, zno.nanowires 2.5%, film 1.7%, nanowir 1.2%, surfac 0.6%, carbon 0.6%, particl 0.6%, zn 0.6%, magnet 0.5%, nanotub 0.5%, nanoparticl 0.5%, zno.nanostructures 0.4%, quantum 0.4%, doped.zno 0.4%, structur 0.3%

Single Word Terms

zno 297, growth 139, temperatur 135, structur 133, electron 120, emiss 115, substrat 112, photoluminesc 104, properti 99, high 99, grown 96, nanowir 92, diffract 90, rai 88, microscopi 84

Double Word Terms

electron.microscopy 76, ray.diffraction 73, zno.nanowires 71, transmission.electron 57, room.temperature 52, scanning.electron 45, zno.nanostructures 39, doped.zno 37, zinc.oxide 37, low.temperature 35, single.crystalline 34, properties.zno 32, high.resolution 32, optical.properties 31, growth.zno 31

Triple Word Terms

transmission.electron.microscopy 51, scanning.electron.microscopy 38, chemical.vapor.deposition 26, ray.diffraction.xrd 22, high.resolution.transmission 18, resolution.transmission.electron 18, molecular.beam.epitaxy 18, zinc.oxide.zno 18, room.temperature.photoluminescence 17, metalorganic.chemical.vapor 15, optical.properties.zno 13, zno.nanowires.grown 13, electron.microscopy.tem 12, vapor.liquid.solid 12, aligned.zno.nanowires 12

Term Cliques

35.28% zno doped.zno dope arrai
40.95% zno emiss doped.zno dope
43.55% zno growth zinc arrai substrat
38.45% zno growth emiss nanostructur zno.nanostructures zinc photoluminesc substrat
46.93% zno zn dope
48.19% zno zn growth zinc
38.56% zno nanowir growth emiss nanostructur zno.nanostructures photoluminesc grown substrat
35.72% zno zno.nanowires nanowir doped.zno arrai
40.26% zno zno.nanowires nanowir emiss doped.zno
41.50% zno zno.nanowires nanowir growth arrai substrat
42.19% zno zno.nanowires nanowir growth emiss photoluminesc grown substrat

Sample Cluster Record Titles

Temperature-dependent growth mode and photoluminescence properties of ZnO nanostructures

Patterned growth of aligned ZnO nanowire arrays on sapphire and GaN layers

[Role of gallium wetting layer in high-quality ZnO growth on sapphire(0001) substrates]

[As-doped p-type ZnO produced by an evaporation/sputtering process]

[Preparation and photoluminescence of surface N-doped ZnO nanocrystal]

[Evolution of the morphology and optical properties of ZnO nanowires during catalyst-free growth by thermal evaporation]

[A low-temperature evaporation route for ZnO nanoneedles and nanosaws]

[Novel morphologies of ZnO nanotetrapods]

[Epitaxial growth and surface modeling of ZnO on c-plane Al2O3]

Cluster Metrics

Authors
liu, yc 11
fujita, s 11
li, y 8
lee, cj 8
liao, l 7
li, jc 7
chen, ic 7
zhu, lp 6
ye, zz 6
wang, th 6
norton, dp 6
li, xm 6
fu, q 6
cho, jh 6
zhang, y 5

Sources
applied physics letters 46
journal of crystal growth 33
nanotechnology 21
journal of physical chemistry b 20
materials letters 10
journal of applied physics 10
chemical physics letters 10
applied surface science 6
solid state communications 5
journal of solid state chemistry 5

journal of nanoscience and nanotechnology 5
superlattices and microstructures 4
journal of the korean physical society 4
chinese physics letters 4
advanced materials 4

Keywords
growth 85
physics, applied 83
nanorods 72
films 56
photoluminescence 51
nanowires 49
thin-films 45
zno 41
arrays 39
nanobelts 38
chemistry, physical 37
materials science, multidisciplinary 36
materials science, multidisciplinary 36
crystallography 35
nanostructures 34

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2005 283
2004 18
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2003 1

Country
peoples r china 122
usa 51
south korea 49
japan 30
taiwan 25
germany 16
france 13
singapore 9
spain 7
england 4
russia 3
mexico 3
india 3
ireland 2
canada 2

Institution
chinese acad sci 46
univ sci & technol china 14
hanyang univ 11
zhejiang univ 10
ne normal univ 9
natl cheng kung univ 9
ind technol res inst 9
univ florida 8
cnrs 8
wuhan univ 7
tsing hua univ 7
pohang univ sci & technol 7
peking univ 7
kyoto univ 7
tohoku univ 6

DataBase
science citation index 304

- CLUSTER 100
  Nanowires: growth by vapor deposition, nanowire arrays, silicon nanowires, single crystal nanowires (645 Records)

(Countries: China, USA dominant, followed by Japan, South Korea, Taiwan. Institutions: CAS dominant, followed by Peking University, National Institute of Material Science, University S&T China, National

Tsing Hua University, Nanjing University. USA include UCB, Penn State University.).

Cluster Syntax Features

Descriptive Terms
nanowir 76.0%, growth 1.3%, nanowire.arrays 0.6%, arrai 0.6%, diamet 0.6%, silicon 0.5%, vapor 0.4%, si 0.4%, wire 0.3%, silicon.nanowires 0.3%, single.crystalline 0.3%, fabric 0.3%, singl 0.2%, crystallin 0.2%, nanowires.synthesized 0.2%

Discriminating Terms
nanowir 52.0%, film 1.8%, nanoparticl 0.6%, surfac 0.6%, particl 0.6%, carbon 0.6%, nanotub 0.5%, layer 0.4%, quantum 0.4%, nanowire.arrays 0.4%, structur 0.4%, magnet 0.4%, polym 0.3%, size 0.3%, cell 0.3%

Single Word Terms
nanowir 642, growth 281, diamet 275, structur 247, electron 247, high 209, temperatur 208, singl 200, synthes 193, microscopi 192, deposit 191, mechan 176, length 173, vapor 171, fabric 169

Double Word Terms
electron.microscopy 171, transmission.electron 153, ray.diffraction 105, scanning.electron 97, single.crystalline 92, nanowires.synthesized 84, nanowire.arrays 77, high.resolution 76, chemical.vapor 74, vapor.deposition 70, liquid.solid 69, growth.mechanism 61, nanowires.grown 61, single.crystal 61, vapor.liquid 57

Triple Word Terms
transmission.electron.microscopy 137, scanning.electron.microscopy 78, chemical.vapor.deposition 65, vapor.liquid.solid 56, resolution.transmission.electron 52, high.resolution.transmission 50, electron.microscopy.tem 39, energy.dispersive.ray 31, liquid.solid.vls 29, ray.diffraction.xrd 28, electron.microscopy.sem 27, electron.microscopy.transmission 23, microscopy.transmission.electron 23, electron.microscopy.hrtem 22, dispersive.ray.spectroscopy 22

Term Cliques
38.42% nanowir diamet wire silicon.nanowires fabric
35.53% nanowir nanowire.arrays diamet single.crystalline fabric singl crystallin
35.68% nanowir nanowire.arrays arrai diamet single.crystalline fabric
35.99% nanowir nanowire.arrays arrai diamet wire fabric
41.89% nanowir growth diamet wire silicon.nanowires
34.78% nanowir growth diamet silicon vapor single.crystalline singl crystallin nanowires.synthesized
36.04% nanowir growth diamet silicon vapor silicon.nanowires nanowires.synthesized
35.66% nanowir growth diamet silicon vapor si single.crystalline singl crystallin
37.17% nanowir growth diamet silicon vapor si silicon.nanowires

Controlled growth of a single palladium nanowire between microfabricated electrodes

ZnO nanowires synthesized by vapor trapping CVD method

Controlling the diameter of Cu2O nanowires by electrodeposition

Ethanol sensor based on indium oxide nanowires prepared by carbothermal reduction reaction

Effects of the confined synthesis on conjugated polymer transport properties

The effects of oxidative environments on the synthesis of CuO nanowires on Cu substrates

Large-scale boron nanowire nanojunctions and their highly-oriented arrays

Cluster Metrics

Authors
zhang, ld 20
bando, y 11
zhang, y 10
li, q 10
golberg, d 10
yu, dp 9
li, gh 9
tang, cc 8
lee, st 8
chen, lj 8
zhang, xh 7
zhang, h 7
ye, ch 7
xue, cs 7
li, l 7

Sources
applied physics letters 85
nanotechnology 41
journal of physical chemistry b 38
applied physics a-materials science & processing 27
nano letters 24
advanced materials 24
journal of crystal growth 23
journal of applied physics 18
chemical physics letters 16

physical review b 11
physica e-low-dimensional systems & nanostructures 11
physical review letters 10
materials letters 10
journal of the american chemical society 10
small 9

Keywords

physics, applied 163
growth 143
materials science, multidisciplinary 114
materials science, multidisciplinary 101
arrays 80
chemistry, multidisciplinary 78
nanorods 74
chemistry, physical 71
nanotubes 65
nanowires 64
physics, applied 58
fabrication 57
films 52
nanostructures 51
physics, condensed matter 46

Publication Year

2005 568
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2006 10

Country

peoples r china 228
usa 177
japan 69
south korea 46
taiwan 41
germany 25
france 19
england 15
italy 14
sweden 13
spain 13
india 13
singapore 7
ireland 6
belgium 5

Institution
chinese acad sci 76
peking univ 24
natl inst mat sci 21
univ sci & technol china 20
natl tsing hua univ 19
nanjing univ 18
tsing hua univ 15
city univ hong kong 14
univ calif berkeley 13
pohang univ sci & technol 13
natl cheng kung univ 12
zhejiang univ 11
penn state univ 11
osaka univ 11
chinese univ hong kong 11

DataBase
science citation index 645

CATEGORY 4 - 508A2b (24 leaf clusters)

Magnetism and Tribology (6319 REC)

THRUST

()

- Spin, emphasizing properties and applications of qubits, spin-orbit interactions (SOIs) (especially Rashba SOIs), and studies of spin relaxation and polarization (139 Records) Cluster 55
- Spin polarization, spin-orbit interactions, spin dynamics, spin-dependent transport, and other spin-related phenomena as exhibited in and influenced by magnetic (especially ferromagnetic) fields and structures (481 Records) Cluster 141
- Superconductors, superconducting materials, and superconducting devices; vortex states, dynamics, and effects (188 Records) Cluster 159

- Applications and effects of external magnetic fields, especially magnetoresistance, ferrofluids, and uses of nanowires (418 Records) Cluster 162
- Magnetic properties of magnetic nanostructures (including arrays, films nanoparticles, nanotubes) and nanomaterials, emphasizing magnetic anisotropy, coercivity, magnetization reversal (657 Records) Cluster 171
- Properties of ferromagnetic and antiferromagnetic materials, especially manganese and iron compounds (355 Records) Cluster 193
- Magnetic properties of thin films (especially iron and cobalt films), focusing on anisotropy, coercivity, and preparation of films by sputtering, annealing, and deposition processes (266 Records) Cluster 181
- Iron-platinum (FePt) thin films, emphasizing their magnetic properties, fabrication, and the effect of annealing (53 Records) Cluster 0
- Amorphous and crystalline alloys (especially iron and cobalt), with emphasis on their magnetic properties, annealing processes, preparation by milling, and iron and cobalt (347 Records) Cluster 187
- Alloys (especially magnesium, copper, titanium, silver, and zirconium), focusing on structural and mechanical properties, effects of temperature, and corrosion resistance (520 Records) Cluster 160
- Alloys (especially nickel, copper, tin, titanium, and zirconium), emphasizing fusible/ eutectic alloys, formation of alloys, and mechanical/ structural characterization (139 Records) Cluster 123
- Preparation, reactions, and structure of composite materials, especially copper, nickel, and silver alloys (222 Records) Cluster 242
- Coatings formed by deposition, especially chemical vapor deposition and thermal and plasma spraying, emphasizing their properties, particularly hardness, wear/ corrosion resistance, and magnetic properties (487 Records) Cluster 150
- Nanotribological studies, focusing on friction, sliding, adhesive, and wear behavior (99 Records) Cluster 47
- Nanotribological studies, emphasizing wear behavior (especially steel substrates and silicon carbide [SiC] composites) and including analyses of sliding and abrasion (154 Records) Cluster 34
- Fabrication and characteristics of corrosion-resistant steel surfaces and layers (210 Records) Cluster 157

- Corrosion mechanisms and protection/ inhibition, especially of steel, zinc, and iron surfaces (76 Records) Cluster 66
- Crack, fatigue, and fracture processes, behavior, and mechanisms, emphasizing on analysis with scanning electron microscopy (210 Records) Cluster 118
- Materials subject to stress and strain, focusing on welded materials, residual stresses, effects of loading, and stress relaxation (131 Records) Cluster 115
- Nanoidentation, especially to test hardness, elasticity/ plasticity, and mechanical properties of materials (278 Records) Cluster 140
- Deformation behavior, shear bands, and related mechanical properties of materials and microstructures (239 Records) Cluster 112
- Dislocations, deformation, (crystal) twinning, and stress/ strain in materials, particularly crystals (147 Records) Cluster 86
- Grain boundary characteristics and processes, including diffusion, segregation, fracture, and growth (220 Records) Cluster 52
- Effects of and influences on grain size, emphasizing grain growth, texture characterization, and effect of annealing (283 Records) Cluster 166

- CLUSTER 55
  Spin, emphasizing properties and applications of qubits, spin-orbit interactions (SOIs) (especially Rashba SOIs), and studies of spin relaxation and polarization (139 Records)

(Countries: USA dominant, followed by Japan, Germany, China. Institutions: RAS, University of Toronto, Tohoku University, CAS. USA include SUNY Buffalo, U Iowa, UCSB, UCB).

Cluster Syntax Features

Descriptive Terms

spin 46.8%, quantum 7.6%, qubit 4.4%, rashba 1.9%, spin.orbit 1.4%, relax 1.4%, spin.relaxation 1.1%, polar 1.1%, orbit 0.9%, coupl 0.9%, electron 0.9%, split 0.8%, orbit.coupling 0.7%, spin.orbit.coupling 0.7%, rashba.spin 0.7%

Discriminating Terms
spin 27.9%, qubit 2.9%, quantum 2.7%, film 1.9%, rashba 1.3%, surfac 0.9%, spin.orbit 0.9%, spin.relaxation 0.7%, nanoparticl 0.6%, carbon 0.6%, particl 0.6%, relax 0.6%, crystal 0.5%, oxid 0.5%, rashba.spin 0.5%

Single Word Terms
quantum 130, spin 128, electron 86, coupl 55, field 51, magnet 47, two 47, system 46, interact 45, polar 45, state 44, structur 40, well 40, relax 38, dimension 37

Double Word Terms
quantum.wells 39, spin.orbit 33, orbit.coupling 27, spin.relaxation 26, magnetic.field 26, rashba.spin 25, spin.polarization 25, electron.spin 24, two.dimensional 22, spin.polarized 17, spin.splitting 14, spin.dynamics 14, nuclear.spin 14, dimensional.electron 14, electron.gas 12

Triple Word Terms
spin.orbit.coupling 27, rashba.spin.orbit 20, two.dimensional.electron 14, spin.orbit.interaction 10, dimensional.electron.gas 10, pure.spin.current 6, electron.spin.resonance 6, magnetic.field.spin 6, spin.relaxation.time 6, gaas.algaas.quantum 6, quantum.wells.spin 5, spin.relaxation.rate 5, nuclear.spin.polarization 5, semiconductor.quantum.wells 5, electron.spin.relaxation 5

Term Cliques
50.36% quantum qubit coupl
46.28% quantum qubit relax
52.76% spin quantum relax spin.relaxation electron split
54.32% spin quantum relax spin.relaxation polar electron
52.28% spin quantum rashba spin.relaxation electron split
53.84% spin quantum rashba spin.relaxation polar electron
40.07% spin quantum rashba spin.orbit orbit electron split orbit.coupling spin.orbit.coupling rashba.spin
41.73% spin quantum rashba spin.orbit orbit coupl electron orbit.coupling spin.orbit.coupling rashba.spin
41.01% spin quantum rashba spin.orbit polar orbit electron orbit.coupling spin.orbit.coupling rashba.spin

Sample Cluster Record Titles

[Magnetic field effects on spin relaxation in heterostructures]

[Local spin-density oscillations in coupled quantum wells]

[Semiclassical kinetic theory of electron spin relaxation in semiconductors]

[Quantum networks in the presence of the Rashba effect and a magnetic field]

[Magnetosubbands of semiconductor quantum wires with Rashba spin-orbit coupling]

[Spin relaxation of two-dimensional holes in strained asymmetric SiGe quantum wells]

[Electronic spins and localized magnetic moments in dilute magnetic semiconductor quantum wells]

[Rashba spin precession in quantum-Hall edge channels]

[Spin manipulation of free two-dimensional electrons in Si/SiGe quantum wells]

Cluster Metrics

Authors
sipe, je 5
najmaie, a 4
governale, m 4
sherman, ey 3
santini, p 3
pershin, yv 3
muraki, k 3
koiller, b 3
hu, xd 3
hirayama, y 3
hashimoto, k 3
guo, y 3
glazov, mm 3
carretta, s 3
awschalom, dd 3

Sources
physical review b 50
physical review letters 20
applied physics letters 9
physical review a 6
physica e-low-dimensional systems & nanostructures 6
journal of superconductivity 4

solid state communications 3
semiconductors 3
nature materials 2
journal of applied physics 2
international journal of modern physics b 2
ieee transactions on nanotechnology 2
europhysics letters 2
acta physica sinica 2
semiconductor science and technology 1

Keywords
physics, condensed matter 64
physics, multidisciplinary 32
physics, applied 20
transport 13
heterostructures 13
gaas 13
systems 12
semiconductors 12
physics, condensed matter 10
electrons 10
semiconductors 9
physics, atomic, molecular & chemical 9
wells 9
gas 9
quantum-wells 8

Publication Year
2005 123
2004 16

Country
usa 45
japan 17
germany 16
peoples r china 14
canada 13
russia 11
england 11
switzerland 8
italy 8
poland 6
netherlands 5
brazil 5
france 4
sweden 3

denmark 3

Institution
russian acad sci 9
univ toronto 6
tohoku univ 6
chinese acad sci 6
scuola normale super pisa 5
tsing hua univ 4
suny buffalo 4
japan sci & technol agcy 4
univ parma 3
univ modena & reggio emilia 3
univ iowa 3
univ calif santa barbara 3
univ calif berkeley 3
univ basel 3
tokyo inst technol 3

DataBase
science citation index 139

- # CLUSTER 141
  Spin polarization, spin-orbit interactions, spin dynamics, spin-dependent transport, and other spin-related phenomena as exhibited in

and influenced by magnetic (especially ferromagnetic) fields and structures (481 Records)

(Countries: USA, Japan, Germany. Institutions: CAS, Osaka University, CNRS. USA includes Argonne National Lab.).

Cluster Syntax Features

Descriptive Terms

spin 55.9%, magnet 7.1%, ferromagnet 1.7%, polar 1.4%, field 1.3%, current 1.0%, orbit 0.8%, spin.polarized 0.7%, spin.orbit 0.6%, magnetic.field 0.5%, state 0.5%, spin.polarization 0.5%, electron 0.5%, antiferromagnet 0.5%, coupl 0.4%

Discriminating Terms

spin 38.9%, magnet 2.4%, film 1.8%, ferromagnet 1.0%, surfac 0.9%, nanoparticl 0.6%, polar 0.6%, particl 0.5%, spin.polarized 0.5%, deposit 0.5%, orbit 0.5%, carbon 0.5%, oxid 0.5%, nanotub 0.5%, spin.orbit 0.4%

Single Word Terms

spin 480, magnet 354, electron 213, field 208, structur 156, temperatur 154, depend 150, polar 149, state 146, ferromagnet 144, two 137, interact 136, system 130, current 118, coupl 115

Double Word Terms

magnetic.field 106, spin.polarized 74, spin.orbit 69, spin.polarization 59, two.dimensional 51, spin.dependent 47, orbit.interaction 37, electron.spin 37, dimensional.electron 34, magnetic.fields 32, spin.transfer 30, spin.relaxation 30, ground.state 28, one.dimensional 26, spin.valve 26

Triple Word Terms

spin.orbit.interaction 37, two.dimensional.electron 31, rashba.spin.orbit 22, spin.orbit.coupling 21, dimensional.electron.gas 19, spin.polarized.current 16, density.functional.theory 15, spin.transfer.torque 14, external.magnetic.field 14, spin.lattice.relaxation 14, electron.spin.resonance 13, spin.dependent.transport 13, spin.polarized.electrons 12, spin.polarized.scanning 11, polarized.scanning.tunneling 10

Term Cliques

34.82% spin field orbit spin.orbit magnetic.field spin.polarization electron coupl
37.08% spin field orbit spin.orbit magnetic.field state electron coupl
34.90% spin field current orbit spin.orbit magnetic.field spin.polarization electron
37.16% spin field current orbit spin.orbit magnetic.field state electron
35.94% spin polar field orbit spin.orbit spin.polarization electron coupl
36.02% spin polar field current orbit spin.orbit spin.polarization electron
47.82% spin magnet field state antiferromagnet coupl
45.59% spin magnet field magnetic.field spin.polarization electron coupl

48.17% spin magnet field magnetic.field state electron coupl
45.68% spin magnet field current magnetic.field spin.polarization electron
48.26% spin magnet field current magnetic.field state electron
47.92% spin magnet polar field antiferromagnet coupl
46.87% spin magnet polar field spin.polarization electron coupl
46.96% spin magnet polar field current spin.polarization electron
45.60% spin magnet ferromagnet state antiferromagnet coupl
50.31% spin magnet ferromagnet state electron coupl
50.42% spin magnet ferromagnet current state electron
41.37% spin magnet ferromagnet polar spin.polarized antiferromagnet coupl
41.27% spin magnet ferromagnet polar spin.polarized spin.polarization electron coupl
41.35% spin magnet ferromagnet polar current spin.polarized spin.polarization electron

Sample Cluster Record Titles

Propagation of spin waves in a thin cylindrical magnon crystal

Nuclear spin bath effects in molecular nanomagnets: Direct quantum mechanical simulations

Spin correlation, excitation, and relaxation of antiferromagnetic hematite alpha-Fe2O3 nanoparticles

Spin-split two-dimensional electron gas perturbed by intense terahertz laser fields

A fast ab initio approach to the simulation of spin dynamics

Identification of transverse spin currents in noncollinear magnetic structures

Modulation of spin dynamics in a channel of a nonballistic spin field effect transistor

Nuclear spin temperature and magnetization transport in laser-enhanced NMR of bulk GaAs

Electron spin resonance and related phenomena of low-dimensional electronic systems in III-V compounds

Cluster Metrics

Authors

suzuki, y 11
yagami, k 7
chappert, c 6
wang, j 5

lu, mw 5
kimura, t 5
fukushima, a 5
devolder, t 5
crozat, p 5
bland, jac 5
bauer, gew 5
xi, hw 4
wernsdorfer, w 4
vaz, caf 4
tulapurkar, aa 4

Sources
physical review b 144
physical review letters 39
journal of applied physics 30
applied physics letters 25
journal of physics-condensed matter 14
journal of magnetism and magnetic materials 14
ieee transactions on magnetics 13
ieee transactions on nanotechnology 11
physics letters a 8
physica e-low-dimensional systems & nanostructures 8
physica b-condensed matter 8
polyhedron 6
microscopy research and technique 6
physica status solidi b-basic solid state physics 5
journal of the american chemical society 5

Keywords
physics, condensed matter 195
physics, multidisciplinary 76
physics, applied 68
engineering, electrical & electronic 34
transport 34
systems 34
physics, applied 31
magnetoresistance 30
films 29
materials science, multidisciplinary 28
physics, condensed matter 28
injection 23
spintronics 21
spintronics 19
multilayers 19

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2005 425
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usa 147
japan 82
germany 79
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russia 36
italy 27
south korea 24
netherlands 22
england 22
canada 17
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switzerland 13
india 13
poland 11

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chinese acad sci 20
osaka univ 16
cnrs 13
russian acad sci 11
natl inst adv ind sci & technol 11
univ hamburg 10
tsing hua univ 10
tohoku univ 10
univ tokyo 9
univ paris 11 9
delft univ technol 9
univ cambridge 8
japan sci & technol agcy 8
argonne natl lab 8
natl univ singapore 7

DataBase
science citation index 481

- # CLUSTER 159

  Superconductors, superconducting materials, and superconducting devices; vortex states, dynamics, and effects (188 Records)

(Countries: USA, Japan, Germany. Institutions: Katholieke University of Leuven, Tohoku University, RAS, Argonne National Lab. Other USA includes University of Illinois).

Cluster Syntax Features

Descriptive Terms

superconduct 16.7%, vortex 12.0%, magnet 9.4%, superconductor 4.9%, field 3.8%, pin 2.6%, domain 2.3%, domain.wall 1.8%, flux 1.4%, wall 1.4%, state 1.4%, current 1.3%, vortic 1.1%, magnetic.field 1.0%, ferromagnet 0.9%

Discriminating Terms

superconduct 12.2%, vortex 9.1%, superconductor 3.6%, magnet 3.6%, pin 1.9%, film 1.4%, domain.wall 1.3%, field 1.2%, domain 1.1%, surfac 0.9%, flux 0.9%, vortic 0.8%, nanoparticl 0.6%, particl 0.6%, carbon 0.6%

Single Word Terms

magnet 164, field 130, superconduct 93, temperatur 84, state 81, superconductor 60, current 59, vortex 58, two 56, measur 50, high 50, structur 49, electron 48, depend 48, critic 48

Double Word Terms

magnetic.field 63, critical.current 26, domain.wall 25, magnetic.fields 23, magnetic.flux 19, ground.state 16, current.density 16, quantum.interference 15, domain.walls 14, superconducting.state 14, micromagnetic.simulations 14, transition.temperature 13, superconducting.quantum 13, superconducting.transition 12, electron.microscopy 12

Triple Word Terms

superconducting.quantum.interference 13, quantum.interference.device 12, critical.current.density 12, interference.device.squid 8, transmission.electron.microscopy 6, superconducting.transition.temperature 5, domain.wall.pinning 5, scanning.tunneling.microscopy 5, high.temperature.superconductors 5, electron.beam.lithography 5, magnetic.field.temperature 4, function.magnetic.field 4, magnetic.domain.wall 4, external.magnetic.field 4, local.density.states 4

Term Cliques

35.87% magnet field pin domain domain.wall wall ferromagnet
34.57% magnet superconductor pin flux current vortic

44.77% magnet superconductor field current vortic magnetic.field
42.91% magnet superconductor field pin current vortic
41.58% vortex magnet field pin domain ferromagnet
37.94% vortex magnet superconductor flux state vortic
34.49% vortex magnet superconductor pin flux vortic
40.81% vortex magnet superconductor field vortic magnetic.field ferromagnet
44.45% vortex magnet superconductor field state vortic magnetic.field
39.21% vortex magnet superconductor field pin vortic ferromagnet
43.83% superconduct magnet superconductor flux current
46.17% superconduct magnet superconductor flux state
50.44% superconduct magnet superconductor field current magnetic.field
52.39% superconduct magnet superconductor field state magnetic.field

Sample Cluster Record Titles

Micromagnetic simulations of vortex-state excitations in soft magnetic nanostructures

Nanoscale-SiC doping for enhancing Jc and Hc2 in superconducting MgB2

Microscopic analysis of low-frequency flux noise in YBa2Cu3O7 direct current superconducting quantum interference devices

High frequency modes in vortex-state nanomagnets

Superconductivity in LiTi2O4 prepared by hybrid microwave method

Elastic constant in magnetic fields and singlet-triplet state of heavy fermion superconductor PrOS4Sb12

Influence of parity on the persistent currents of superconducting nanorings

Magnetic nanoparticles as efficient bulk pinning centers in type-II superconductors

Superconductor/ferromagnet current source

Cluster Metrics

Authors

moshchalkov, vv 11
vaz, caf 4
peeters, fm 4
murakami, m 4
morelle, m 4
klaui, m 4

dumpich, g 4
bland, jac 4
yamaguchi, t 3
weiss, d 3
wang, h 3
van bael, mj 3
silhanek, av 3
nowak, u 3
novosad, v 3

Sources

physical review b 39
physical review letters 22
applied physics letters 14
physica c-superconductivity and its applications 12
journal of applied physics 12
superconductor science & technology 10
journal of magnetism and magnetic materials 6
journal of low temperature physics 5
ieee transactions on applied superconductivity 5
physica e-low-dimensional systems & nanostructures 4
journal of physics-condensed matter 4
ieee transactions on magnetics 4
physica b-condensed matter 3
europhysics letters 3
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Keywords

physics, condensed matter 59
physics, applied 57
physics, multidisciplinary 35
physics, condensed matter 21
vortices 14
physics, applied 11
dots 11
engineering, electrical & electronic 10
wires 10
magnetoresistance 10
films 10
materials science, multidisciplinary 9
temperature 9
superconductivity 8
high-temperature superconductors 8

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Country

usa 53
japan 38
germany 34
france 14
belgium 14
russia 11
england 11
italy 9
switzerland 8
peoples r china 7
israel 7
ukraine 6
sweden 5
south korea 4
poland 4

Institution

katholieke univ leuven 10
tohoku univ 9
russian acad sci 8
argonne natl lab 8
univ cambridge 7
paul scherrer inst 6
cnrs 6
univ regensburg 5
univ illinois 5
univ tokyo 4
univ karlsruhe 4
univ duisburg essen 4
univ antwerp 4
shibaura inst technol 4
natl inst mat sci 4

DataBase

science citation index 188

- # CLUSTER 162

  Applications and effects of external magnetic fields, especially magnetoresistance, ferrofluids, and uses of nanowires (418 Records)

(Countries: USA, Japan, followed by China, Germany, followed by France, Russia. Institutions: National Institute of Materials Science, RAS, Tohoku University. USA includes MIT).

Cluster Syntax Features

Descriptive Terms

magnet 32.6%, field 21.7%, magnetic.field 16.8%, magnetic.fields 1.5%, magnetoresist 0.7%, wire 0.5%, external.magnetic 0.5%, extern 0.4%, nanowir 0.4%, external.magnetic.field 0.3%, ferrofluid 0.3%, ferromagnet 0.2%, transit 0.2%, depend 0.2%, quantum 0.2%

Discriminating Terms

magnet 19.3%, field 13.1%, magnetic.field 12.8%, film 1.7%, magnetic.fields 1.1%, surfac 0.9%, carbon 0.6%, oxid 0.5%, deposit 0.5%, layer 0.5%, magnetoresist 0.4%, nanotub 0.4%, crystal 0.4%, structur 0.4%, polym 0.4%

Single Word Terms

field 412, magnet 402, structur 135, temperatur 120, electron 115, high 109, two 108, depend 103, measur 90, induc 82, extern 82, state 78, model 78, low 73, properti 73

Double Word Terms

magnetic.field 326, magnetic.fields 106, external.magnetic 60, field.induced 38, field.magnetic 37, two.dimensional 30, high.magnetic 28, electric.field 24, ray.diffraction 23, temperature.dependence 23, room.temperature 22, field.strength 21, plane.magnetic 18, magnetic.nanoparticles 18, zero.field 18

Triple Word Terms

external.magnetic.field 47, magnetic.field.magnetic 25, magnetic.field.induced 19, high.magnetic.fields 18, magnetic.field.parallel 15, perpendicular.magnetic.field 14, magnetic.field.strength 13, plane.magnetic.field 13, two.dimensional.electron 12, function.magnetic.field 11, field.magnetic.field 11, magnetic.field.dependence 11, application.magnetic.field 10, external.magnetic.fields 10, uniform.magnetic.field 9

Term Cliques
34.69% magnet field magnetoresist nanowir external.magnetic.field ferromagnet transit depend
33.40% magnet field magnetoresist external.magnetic nanowir external.magnetic.field ferromagnet transit
37.63% magnet field magnetoresist wire nanowir ferromagnet depend
49.67% magnet field magnetic.fields wire quantum
39.99% magnet field magnetic.fields magnetoresist nanowir transit depend
38.52% magnet field magnetic.fields magnetoresist external.magnetic nanowir transit
39.58% magnet field magnetic.fields magnetoresist wire nanowir depend
47.85% magnet field magnetic.field external.magnetic.field ferromagnet transit depend
52.19% magnet field magnetic.field external.magnetic.field ferrofluid depend
46.38% magnet field magnetic.field external.magnetic external.magnetic.field ferromagnet transit
47.10% magnet field magnetic.field external.magnetic extern external.magnetic.field ferromagnet
46.07% magnet field magnetic.field external.magnetic extern external.magnetic.field ferrofluid
56.22% magnet field magnetic.field magnetic.fields transit depend
54.55% magnet field magnetic.field magnetic.fields ferrofluid depend
49.08% magnet field magnetic.field magnetic.fields external.magnetic transit quantum
48.09% magnet field magnetic.field magnetic.fields external.magnetic extern ferrofluid

Sample Cluster Record Titles

Magnetization dynamics of interacting iron nanocrystals in SiO2

Magnetic-field-controllable avalanche breakdown and giant magnetoresistive effects in Gold semi-insulating-GaAs Schottky diode

Zigzag-shaped magnetic sensors

Effects of static magnetic field on growth of leptospire, Leptospira interrogans serovar canicola: Immunoreactivity and cell division

Ferrofluid aggregation in chains under the influence of a magnetic field

Zero-field-cooled and field-cooled magnetization of individual nanomagnets and their assembly

Magnetic field dependent ordering in ferrofluids at SiO2 interfaces

Brillouin light scattering investigation of magnetostatic modes in symmetric and asymmetric NiFe/Cu/NiFe trilayered wires

[Temperature dependence of penetration and coherence lengths in lead nanowires]

Cluster Metrics

Authors
coey, jmd 5
yao, yd 4
watanabe, k 4
saitoh, e 4
piraux, l 4
pileni, mp 4
miyajima, h 4
koyama, k 4
kido, g 4
grundler, d 4
dumpich, g 4
brands, m 4
takamasu, t 3
sokmen, i 3
slavin, an 3

Sources
physical review b 54
journal of magnetism and magnetic materials 45
journal of applied physics 28
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ieee transactions on magnetics 14
physical review letters 13
journal of physics-condensed matter 10
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Keywords
physics, condensed matter 106
physics, applied 76
materials science, multidisciplinary 70
physics, condensed matter 66
physics, multidisciplinary 46
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physics, applied 29
chemistry, physical 20
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field 18
nanoparticles 17
films 17
transport 16
physics, mathematical 16
systems 15

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2005 363
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Country
usa 79
japan 70
peoples r china 43
germany 43
france 33
russia 30
taiwan 16
south korea 14
india 14
italy 12
spain 11
england 11
canada 11
turkey 10
sweden 10

Institution
natl inst mat sci 14
russian acad sci 12
tohoku univ 11
tokyo inst technol 8
kyoto univ 8
chinese acad sci 8
chalmers univ technol 7
univ tokyo 6
univ paris 11 6
univ paris 06 6
univ hamburg 5
natl inst adv ind sci & technol 5
mit 5

korea univ 5
af ioffe phys tech inst 5

DataBase
science citation index 418

- # CLUSTER 171
  Magnetic properties of magnetic nanostructures (including arrays, films nanoparticles, nanotubes) and nanomaterials, emphasizing magnetic anisotropy, coercivity, magnetization reversal (657 Records)

(Countries: USA, followed by Japan, China, Germany. Institutions: CAS, CNRS, RAS, CSIC. Other USA include Argonne National Lab, UCSB, Georgia Institute of Technology, University of Texas).

Cluster Syntax Features

Descriptive Terms
magnet 63.1%, anisotropi 2.7%, magnetic.properties 1.8%, field 1.5%, co 0.8%, coerciv 0.6%, domain 0.6%, exchang 0.6%, arrai 0.5%, fe 0.5%, ferromagnet 0.5%, magnetic.anisotropy 0.4%, nanowir 0.4%, revers 0.4%, properti 0.4%

Discriminating Terms
magnet 42.6%, anisotropi 1.8%, film 1.6%, magnetic.properties 1.2%, surfac 0.8%, carbon 0.7%, nanotub 0.6%, oxid 0.5%, deposit 0.5%, crystal 0.4%, si 0.4%, polym 0.4%, structur 0.4%, coerciv 0.4%, electron 0.4%

Single Word Terms
magnet 652, field 328, properti 264, structur 215, temperatur 214, anisotropi 193, measur 173, size 166, depend 151, high 144, system 143, particl 143, sampl 135, phase 132, physic 131

Double Word Terms
magnetic.properties 199, magnetic.field 103, magnetic.anisotropy 85, magnetization.reversal 63, saturation.magnetization 53, hysteresis.loops 45, room.temperature 44, magnetic.nanoparticles 42, magnetic.force 42,

temperature.dependence 42, electron.microscopy 40, ray.diffraction 40, soft.magnetic 39, exchange.coupling 38, force.microscopy 37

Triple Word Terms
magnetic.force.microscopy 29, transmission.electron.microscopy 21, zero.field.cooled 18, superconducting.quantum.interference 17, magneto.optical.kerr 16, external.magnetic.field 16, perpendicular.magnetic.anisotropy 15, scanning.electron.microscopy 14, quantum.interference.device 14, ferromagnetic.resonance.fmr 13, exchange.bias.field 13, force.microscopy.mfm 13, transmission.electron.microscope 12, structure.magnetic.properties 12, soft.magnetic.properties 12

Term Cliques
28.45% magnet anisotropi field co coerciv arrai ferromagnet magnetic.anisotropy nanowir revers
29.44% magnet anisotropi field co coerciv domain arrai ferromagnet magnetic.anisotropy revers
28.31% magnet anisotropi field co coerciv domain exchang fe ferromagnet magnetic.anisotropy revers
34.13% magnet anisotropi magnetic.properties field co coerciv magnetic.anisotropy nanowir properti
31.37% magnet anisotropi magnetic.properties field co coerciv arrai magnetic.anisotropy nanowir
33.21% magnet anisotropi magnetic.properties field co coerciv exchang fe magnetic.anisotropy property

Sample Cluster Record Titles

Micromagnetic simulations of hysteresis loops in ferromagnetic Reuleaux's triangles

Spatially resolved ferromagnetic resonance: Imaging of ferromagnetic eigenmodes

CoFe2O4 nanostructures with high coercivity

Magnetic properties, phase evolution, and coercivity mechanism of CoxZr98-xB2 (x=74-86) nanocomposites

Magnetization reversal and nanostructure refinement in magnetically annealed Nd2Fe14B/alpha-Fe-type nanocomposites

Core-loss analysis of an (Fe, Co, Ni)-based nanocrystalline soft magnetic alloy

Improvement of magnetic softness in nanocrystalline soft magnetic materials by rotating magnetic field annealing

Fully dense anisotropic nanocomposite Sm(Co,Fe,Zr,Cu,B)(z) (z=7.5-12) magnets

Magnetic behavior of Sm-Co-based permanent magnets during order/disorder phase transformations

Cluster Metrics

Authors
vazquez, m 8
shindo, d 8
morais, pc 8
du, yw 8
dieny, b 7
chang, wc 7
chang, cw 7
sort, j 6
singh, n 6
chiu, ch 6
chang, hw 6
adeyeye, ao 6
soukoulis, cm 5
pastor, gm 5
nogues, j 5

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journal of applied physics 79
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journal of the korean physical society 6
journal of alloys and compounds 6

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physics, applied 49
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particles 44
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russia 35
england 35
brazil 29
south korea 26
italy 16
india 15
poland 14
ireland 14
singapore 12

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tohoku univ 17
nanjing univ 13
argonne natl lab 13
univ calif san diego 12
univ tokyo 11
univ brasilia 11

osaka univ 10
univ oviedo 9
univ duisburg essen 9
georgia inst technol 9
univ texas 8

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- # CLUSTER 193
  Properties of ferromagnetic and antiferromagnetic materials, especially manganese and iron compounds (355 Records)

(Countries: USA, Japan, followed by China, Germany. Institutions: CAS, Tohoku University, Polish Academy of Sciences. USA includes University of Notre Dame).

Cluster Syntax Features

Descriptive Terms
magnet 32.1%, ferromagnet 7.2%, mn 3.7%, fe 2.9%, moment 2.4%, antiferromagnet 1.9%, magnetic.properties 1.7%, temperatur 1.6%, transit 1.3%, order 1.0%, compound 1.0%, curi 1.0%, cluster 0.8%, field 0.7%, magnetic.moment 0.7%

Discriminating Terms
magnet 20.2%, ferromagnet 5.6%, mn 2.6%, film 2.1%, moment 1.8%, antiferromagnet 1.5%, fe 1.5%, magnetic.properties 1.2%, surfac 1.0%, curi 0.8%, carbon 0.7%, magnetic.moment 0.6%, particl 0.6%, nanotub 0.6%, deposit 0.6%

Single Word Terms
magnet 344, temperatur 233, structur 217, ferromagnet 183, properti 179, field 153, rai 145, measur 134, diffract 129, order 126, phase 122, transit 122, electron 113, spin 102, state 101

Double Word Terms
magnetic.properties 123, ray.diffraction 109, room.temperature 72, curie.temperature 61, structure.magnetic 56, magnetic.moment 53, magnetic.field 46, magnetic.moments 39, magnetic.measurements 33, magnetic.susceptibility 33, magnetic.semiconductor 30, phase.transition 29, diluted.magnetic 27, low.temperature 26, crystal.structure 26

Triple Word Terms
structure.magnetic.properties 41, means.ray.diffraction 20, diluted.magnetic.semiconductor 19, transmission.electron.microscopy 17, powder.ray.diffraction 15, magnetic.circular.dichroism 15, ray.diffraction.xrd 14, ray.diffraction.magnetic 14, structural.magnetic.properties 14, ray.magnetic.circular 13, ray.diffraction.patterns 13, diluted.magnetic.semiconductors 12, superconducting.quantum.interference 12, crystal.structure.magnetic 11, quantum.interference.device 11

Term Cliques
47.51% magnet temperatur transit compound curi field
46.10% magnet magnetic.properties temperatur transit compound curi
48.36% magnet magnetic.properties temperatur transit order compound
46.60% magnet antiferromagnet temperatur transit order compound field
37.04% magnet moment magnetic.properties transit cluster magnetic.moment
40.47% magnet moment magnetic.properties transit order cluster
42.02% magnet moment magnetic.properties transit order compound
35.87% magnet moment antiferromagnet transit cluster magnetic.moment
39.30% magnet moment antiferromagnet transit order cluster
41.17% magnet moment antiferromagnet transit order compound field
43.10% magnet fe moment compound field
35.45% magnet fe moment magnetic.properties cluster magnetic.moment
41.41% magnet fe moment magnetic.properties compound
52.25% magnet ferromagnet temperatur transit curi field
41.03% magnet ferromagnet magnetic.properties transit cluster magnetic.moment
44.46% magnet ferromagnet magnetic.properties transit order cluster
50.85% magnet ferromagnet magnetic.properties temperatur transit curi
53.10% magnet ferromagnet magnetic.properties temperatur transit order
39.86% magnet ferromagnet antiferromagnet transit cluster magnetic.moment
43.29% magnet ferromagnet antiferromagnet transit order cluster
50.66% magnet ferromagnet antiferromagnet temperatur transit order field
42.44% magnet ferromagnet mn magnetic.properties order cluster
48.83% magnet ferromagnet mn magnetic.properties temperatur curi
51.08% magnet ferromagnet mn magnetic.properties temperatur order
41.27% magnet ferromagnet mn antiferromagnet order cluster
49.91% magnet ferromagnet mn antiferromagnet temperatur order

Sample Cluster Record Titles

[Precessional dynamics of elemental moments in a ferromagnetic alloy]

[X-ray absorption and magnetic circular dichroism studies of ion-bombarded ferromagnet-antiferromagnet bilayers]

[Single crystal growth, crystal structure characterization and magnetic properties of UCo0.5Sb2]

[Oscillatory Curie temperature in ultrathin ferromagnets: experimental evidence]

[Exchange-bias effects for MnO-MoO2+delta composite thin films]

[Fermi level effects on Mn incorporation in modulation-doped ferromagnetic III1-xMnxV heterostructures]

[Mossbauer study of mechanical alloyed Fe-doped TiO2 compounds]

[Interplay between superconductivity and ferromagnetism in Fe/V multilayered structure studied by polarized neutron reflectometry]

[Revealing antiferromagnetic order of the Fe monolayer on W(001): Spin-polarized scanning tunneling microscopy and first-principles calculations]

Cluster Metrics

Authors

wu, gh 8
katayama-yoshida, h 7
yang, fm 6
tegus, o 6
shen, j 6
bruck, e 6
sato, k 5
luo, hz 5
jia, l 5
chen, nx 5
zhang, y 4
vega, a 4
reiss, g 4
meng, fb 4
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journal of magnetism and magnetic materials 20
journal of alloys and compounds 15
applied physics letters 15
solid state communications 11
physical review letters 9
chemistry of materials 8
journal of solid state chemistry 7
journal of physical chemistry b 7
journal of superconductivity 6
international journal of modern physics b 5
journal of the korean physical society 4

Keywords
physics, condensed matter 135
physics, applied 55
materials science, multidisciplinary 39
chemistry, physical 36
physics, condensed matter 35
materials science, multidisciplinary 31
physics, multidisciplinary 30
films 30
ferromagnetism 26
semiconductors 20
chemistry, inorganic & nuclear 19
transition 19
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anisotropy 19
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usa 70
japan 61
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germany 40
france 33
russia 28
south korea 25
poland 23
spain 20
india 15

netherlands 10
taiwan 9
switzerland 8
brazil 8
england 7

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chinese acad sci 23
tohoku univ 15
polish acad sci 14
russian acad sci 11
osaka univ 9
csic 9
univ amsterdam 8
moscow mv lomonosov state univ 7
univ tokyo 6
univ sci & technol beijing 6
natl inst mat sci 6
korea inst sci & technol 6
european synchrotron radiat facil 6
cnrs 6
univ notre dame 5

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science citation index 355

- ## CLUSTER 181
  Magnetic properties of thin films (especially iron and cobalt films), focusing on anisotropy, coercivity, and preparation of films by sputtering, annealing, and deposition processes (266 Records)

(Countries: USA, China, Japan. Institutions: RAS, CAS, Tokyo Institute of Technology. USA include University of Alabama, ORNL.).

Cluster Syntax Features

Descriptive Terms
film 19.4%, magnet 16.3%, fe 5.2%, anisotropi 3.9%, co 3.5%, magnetic.properties 2.5%, thick 2.0%, coerciv 1.5%, sputter 1.3%, anneal 1.2%, ferromagnet 1.0%, perpendicular 1.0%, deposit 0.9%, underlay 0.8%, temperatur 0.7%

Discriminating Terms
magnet 9.1%, film 7.0%, fe 3.2%, anisotropi 3.0%, co 2.2%, magnetic.properties 1.9%, coerciv 1.1%, sputter 0.8%, thick 0.8%, surfac 0.7%, nanotub 0.7%, perpendicular 0.7%,

carbon 0.7%, underlay 0.7%, ferromagnet 0.7%

Single Word Terms
film 263, magnet 230, properti 148, structur 133, temperatur 131, deposit 129, thick 124, thin 108, substrat 107, anisotropi 95, sputter 92, layer 86, high 85, fe 80, coerciv 77

Double Word Terms
magnetic.properties 116, thin.films 71, ray.diffraction 53, magnetic.anisotropy 50, room.temperature 50, magnetron.sputtering 40, film.thickness 37, electron.microscopy 35, films.grown 34, films.deposited 34, soft.magnetic 30, fe.films 29, structural.magnetic 27, transmission.electron 27, films.thickness 25

Triple Word Terms
structural.magnetic.properties 24, soft.magnetic.properties 23, transmission.electron.microscopy 23, perpendicular.magnetic.anisotropy 18, films.soft.magnetic 13, structure.magnetic.properties 13, molecular.beam.epitaxy 13, atomic.force.microscopy 12, magnetic.properties.films 12, scanning.electron.microscopy 10, ray.diffraction.xrd 10, scanning.tunneling.microscopy 10, energy.electron.diffraction 10, magneto.optical.kerr 9, electron.microscopy.tem 9

Term Cliques
49.53% film magnet co sputter anneal ferromagnet deposit temperatur
49.86% film magnet co coerciv sputter anneal deposit temperatur
49.15% film magnet co magnetic.properties coerciv sputter anneal deposit
53.87% film magnet anisotropi thick sputter ferromagnet deposit
49.84% film magnet anisotropi thick sputter ferromagnet perpendicular
52.91% film magnet anisotropi magnetic.properties thick coerciv sputter deposit
44.78% film magnet anisotropi magnetic.properties thick coerciv sputter perpendicular underlay
50.97% film magnet anisotropi co sputter ferromagnet deposit
46.94% film magnet anisotropi co sputter ferromagnet perpendicular
50.38% film magnet anisotropi co magnetic.properties coerciv sputter deposit
42.52% film magnet anisotropi co magnetic.properties coerciv sputter perpendicular underlay
50.00% film magnet fe sputter anneal ferromagnet deposit temperatur
50.33% film magnet fe coerciv sputter anneal deposit temperatur
49.62% film magnet fe magnetic.properties coerciv sputter anneal deposit
51.50% film magnet fe anisotropi sputter ferromagnet deposit
50.85% film magnet fe anisotropi magnetic.properties coerciv sputter deposit

Sample Cluster Record Titles

Effect of nitrogen concentration on the magnetic properties of Fe-Ta-N thin films

Ag buffer layer effect on magnetization reversal of epitaxial Co films

Influence of hydrogen on magnetic properties of Fe films and multilayers

High-anisotropy nanocluster films for high-density perpendicular recording

Magnetic and transport properties of nanocomposite Fe/Fe3-delta O4 and Fe3-delta O4 films prepared by plasma-enhanced chemical vapour deposition

Preparation of high moment CoFe films with controlled grain size and coercivity

Periodic magnetic anisotropy in ultrathin ferromagnetic films on faceted surfaces

CoPt/C nanogranular magnetic thin film

Cluster Metrics

Authors

yang, z 5
gupta, a 5
zhang, y 4
zhang, wl 4
wu, p 4
wang, h 4
shvets, iv 4
lin, kw 4
zheng, rk 3
zhang, xx 3
yi, jb 3
xiao, g 3
tzeng, ym 3
shi, j 3
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journal of applied physics 44
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physical review b 22
applied physics letters 9
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applied surface science 7
journal of physics-condensed matter 6
technical physics letters 5
japanese journal of applied physics part 1-regular papers short notes & review papers 5

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journal of the korean physical society 4
applied physics a-materials science & processing 4
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Keywords
physics, applied 78
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physics, applied 45
physics, condensed matter 44
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thin-films 29
anisotropy 27
growth 25
engineering, electrical & electronic 24
physics, multidisciplinary 17
magnetic-properties 17
anisotropy 15
temperature 14
physics, 14

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russian acad sci 10
chinese acad sci 10
tokyo inst technol 8
shanghai jiao tong univ 7
lanzhou univ 7
hanyang univ 7
univ alabama 6
tohoku univ 6
natl univ singapore 6
univ york 5
trinity coll dublin 4
tianjin univ 4
oak ridge natl lab 4
natl tsing hua univ 4
natl chung hsing univ 4

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science citation index 266

- # CLUSTER 0
  Iron-platinum (FePt) thin films, emphasizing their magnetic properties, fabrication, and the effect of annealing (53 Records)

(Countries: Japan, USA, China, Taiwan, Singapore. Institutions: Data Storage Institute, University of Minnesota. Other USA includes University of Nebraska, University of Delaware).

Cluster Syntax Features

Descriptive Terms
fept 64.6%, film 2.8%, coerciv 2.6%, fept.films 2.6%, anneal 1.6%, magnet 1.3%, mgo 1.0%, ag 0.7%, koe 0.6%, fept.ag 0.6%, multilay 0.6%, perpendicular 0.5%, order 0.5%, layer 0.5%, fept.film 0.5%

Discriminating Terms
fept 39.5%, fept.films 1.6%, coerciv 1.4%, surfac 0.8%, nanotub 0.5%, electron 0.5%, mgo 0.4%, carbon 0.4%, crystal 0.4%, structur 0.4%, oxid 0.4%, anneal 0.4%, quantum 0.4%, fept.ag 0.4%, koe 0.4%

Single Word Terms
film 53, fept 52, magnet 41, coerciv 37, order 36, anneal 33, properti 32, structur 32, temperatur 32, thick 29, layer 29, high 28, deposit 26, grain 21, size 21

Double Word Terms
fept.films 27, magnetic.properties 25, thin.films 16, magnetron.sputtering 14, properties.fept 14, films.fept 13, fept.film 13, room.temperature 12, coercivity.koe 12, ordered.fept 12, grain.size 11, fept.thin 11, fept.grains 10, high.coercivity 10, ray.diffraction 10

Triple Word Terms
magnetic.properties.fept 13, fept.thin.films 11, perpendicular.magnetic.anisotropy 6, properties.fept.films 6, single.crystal.mgo 5, microstructure.magnetic.properties 5, structure.magnetic.properties 5, films.magnetron.sputtering 5, 001.preferred.orientation 4, face.centered.tetragonal 4, magnetron.sputtering.annealed 4, face.centered.cubic 4, magnetic.recording.media 4, perpendicular.magnetic.recording 4, films.face.centered 4

Term Cliques
62.89% fept film magnet ag layer fept.film
51.57% fept film magnet mgo ag fept.ag multilay perpendicular layer
56.81% fept film coerciv magnet mgo fept.ag multilay perpendicular layer
63.44% fept film coerciv anneal magnet fept.ag multilay layer
72.51% fept film coerciv anneal magnet koe order
67.92% fept film coerciv fept.films magnet layer fept.film
71.43% fept film coerciv fept.films magnet perpendicular order
65.09% fept film coerciv fept.films magnet koe order fept.film
64.62% fept film coerciv fept.films magnet mgo perpendicular layer

Sample Cluster Record Titles

FePt/C granular thin films for high-density magnetic recording

Magnetoresistance of FePt nanograins embedded in carbon matrix

Annealing effect on magnetic property and recording performance of [FePt/MgO]n perpendicular magnetic recording media

Calorimetric studies of the A1 to L1(0) transformation in binary FePt thin films with compositions in the range of 47.5-54.4 at.% Fe

[Structural and magnetic properties of nanostructured FePt/MgO granular films]

[Mechanism of magnetization process of island-like L1(0) FePt films]

[Structure and magnetic properties of [FePt/Ag](10) multilayer films]

[Improvement in hard magnetic properties of FePt films by introduction of Ti underlayer]

[Granular structure and magnetic properties of FePt/C films]

Cluster Metrics

Authors
chen, js 7
xu, xh 5
wu, hs 5
wang, jp 5
li, xl 4
zhao, zl 3
yi, jb 3
sun, ac 3
liu, e 3
kuo, pc 3
ding, yf 3
ding, j 3
chou, cy 3
chen, sc 3
zhang, zg 2

Sources
journal of applied physics 14
ieee transactions on magnetics 10
journal of magnetism and magnetic materials 6
surface & coatings technology 2
scripta materialia 2
applied physics letters 2
thin solid films 1
surface science 1
rare metal materials and engineering 1
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 1
nanotechnology 1
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materials science and engineering b-solid state materials for advanced technology 1

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langmuir 1

Keywords
physics, applied 18
materials science, multidisciplinary 13
thin-films 12
physics, applied 11
engineering, electrical & electronic 10
coercivity 10
nanoparticles 8
anisotropy 8
fept 7
recording media 7
physics, condensed matter 7
magnetic-properties 6
thin-films 6
temperature 6
microstructure 6

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japan 17
usa 11
peoples r china 10
taiwan 8
singapore 8
vietnam 1
south korea 1
italy 1
greece 1
germany 1
france 1
australia 1

Institution
data storage inst 5
univ minnesota 4
shanxi normal univ 4
natl univ singapore 4
natl tsing hua univ 3
natl taiwan univ 3
nanyang technol univ 3

univ nebraska 2
univ delaware 2
toyota technol inst 2
tohoku univ 2
sony corp 2
seagate technol 2
seagate res 2
nus 2

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- # CLUSTER 187
  Amorphous and crystalline alloys (especially iron and cobalt), with emphasis on their magnetic properties, annealing processes, preparation by milling, and iron and cobalt (347 Records)

(Countries: China, Japan, USA, Poland. Institutions: CAS, Warsaw University of Technology, Tohoku University, RAS. No USA institutional presence.).

Cluster Syntax Features

Descriptive Terms

fe 18.5%, alloi 14.1%, magnet 6.6%, amorph 4.7%, phase 3.2%, magnetic.properties 2.7%, ribbon 2.5%, anneal 2.1%, nanocrystallin 1.7%, co 1.6%, mill 1.0%, alpha.fe 0.9%, coerciv 0.9%, crystal 0.8%, grain 0.8%

Discriminating Terms

fe 12.9%, alloi 9.1%, amorph 2.8%, magnet 2.3%, film 2.0%, ribbon 1.9%, magnetic.properties 1.9%, surfac 1.0%, nanocrystallin 0.9%, anneal 0.8%, phase 0.8%, co 0.7%, alpha.fe 0.7%, nanoparticl 0.7%, nanotub 0.7%

Single Word Terms

alloi 227, fe 216, phase 198, magnet 194, properti 184, structur 176, temperatur 159, amorph 152, anneal 135, rai 119, crystal 116, high 114, diffract 106, nanocrystallin 103, size 102

Double Word Terms

magnetic.properties 125, ray.diffraction 96, electron.microscopy 55, alpha.fe 54, grain.size 49, transmission.electron 41, melt.spun 41, soft.magnetic 32, fe.co 32, amorphous.matrix 29, diffraction.xrd 29, differential.scanning 27, scanning.calorimetry 27, mechanical.alloying 25, amorphous.phase 25

Triple Word Terms

transmission.electron.microscopy 35, ray.diffraction.xrd 28, differential.scanning.calorimetry 27, microstructure.magnetic.properties 18, structure.magnetic.properties 18, melt.spun.ribbons 16, soft.magnetic.properties 15, scanning.electron.microscopy 15, scanning.calorimetry.dsc 14, atomic.force.microscopy 13, average.grain.size 13, magnetic.properties.melt 12, structural.magnetic.properties 12, properties.melt.spun 12, magnetic.properties.amorphous 11

Term Cliques

36.60% alloi amorph phase ribbon anneal nanocrystallin alpha.fe crystal grain
38.79% alloi magnet amorph phase magnetic.properties ribbon anneal nanocrystallin alpha.fe grain
35.16% fe magnet phase nanocrystallin mill alpha.fe coerciv grain
36.11% fe magnet phase magnetic.properties ribbon anneal nanocrystallin alpha.fe coerciv grain
35.33% fe magnet phase magnetic.properties ribbon anneal nanocrystallin co alpha.fe coerciv
38.65% fe alloi phase ribbon anneal nanocrystallin alpha.fe crystal grain
40.81% fe alloi magnet phase nanocrystallin mill alpha.fe grain
40.63% fe alloi magnet phase magnetic.properties ribbon anneal nanocrystallin alpha.fe grain
39.86% fe alloi magnet phase magnetic.properties ribbon anneal nanocrystallin co alpha.fe

Sample Cluster Record Titles

Pulse electric current sintering of nanostructured Fe-Co alloy

Effect of thermal treatment on the microstructure and magnetic properties of a bulk amorphous Fe72Al5P10Ga2C6B4Si1 alloy

Compositional effects on the physical properties of iron-nickel deposits prepared by means of pulse-reverse electroplating

Effect of milling time on Fe/SiO2 system prepared by mechanical alloying

Study of structural and magnetic properties of B-rich RE-Fe-B nanocomposite ribbons

Production of Fe-Ti-Si alloys from the ilmenite ore and their magnetic properties

Giant magnetoimpedance in as cast Fe84Nb3.5Zr3.5B9-xCux ribbons

Optical properties of surface layers of Co-based amorphous metallic alloys

Crystallization behavior of the Zr63Al7.5Cu17.5Ni10B2 amorphous alloy during isothermal annealing

Cluster Metrics

Authors

liu, y 11
inoue, a 8
hono, k 7
zhang, zd 6
kulik, t 6
greneche, jm 6
yan, b 5
tu, mj 5
qin, hw 5
lu, b 5
liu, bx 5
li, b 5
hu, jf 5
gopalan, r 5
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Keywords
materials science, multidisciplinary 132
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physics, applied 47
engineering 43
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slovakia 16
france 16
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ukraine 10
taiwan 7
singapore 5

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chinese acad sci 20
warsaw univ technol 14
tohoku univ 11
russian acad sci 9
slovak acad sci 8
shandong univ 8
tsing hua univ 7
shanghai univ 7
natl inst mat sci 7
nanjing univ 7
ifw dresden 7
cent iron & steel res inst 7
univ maine 6
silesian tech univ 6
polish acad sci 6

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science citation index 347

- # CLUSTER 160
  Alloys (especially magnesium, copper, titanium, silver, and zirconium), focusing on structural and mechanical properties, effects of temperature, and corrosion resistance (520 Records)

(Countries: China, USA, followed by Japan, Germany, France. Institutions: CAS, Tohoku University, RAS. USA includes UC Davis.).

Cluster Syntax Features

Descriptive Terms
alloi 65.5%, mg 1.5%, phase 1.2%, microstructur 0.9%, precipit 0.9%, corros 0.8%, cu 0.7%, ti 0.5%, grain 0.5%, ag 0.5%, mechan 0.4%, temperatur 0.4%, zr 0.3%, oxid 0.3%, nanocrystallin 0.3%

Discriminating Terms
alloi 47.0%, film 1.8%, mg 0.9%, nanoparticl 0.7%, carbon 0.7%, nanotub 0.6%, quantum 0.5%, magnet 0.5%, corros 0.4%, precipit 0.4%, polym 0.4%, particl 0.4%, surfac 0.4%, crystal 0.4%, field 0.3%

Single Word Terms
alloi 514, phase 224, structur 205, temperatur 203, electron 191, high 190, properti 171, microscopi 166, mechan 166, microstructur 164, rai 160, surfac 148, form 142, format 139, composit 138

Double Word Terms
electron.microscopy 139, ray.diffraction 107, transmission.electron 100, scanning.electron 72, mechanical.properties 58, room.temperature 49, grain.size 47, high.temperature 38, high.resolution 36, solid.solution 33, diffraction.xrd 33, microscopy.sem 31, microscopy.tem 30, mechanical.alloying 30, heat.treatment 29

Triple Word Terms
transmission.electron.microscopy 91, scanning.electron.microscopy 56, ray.diffraction.xrd 32, electron.microscopy.tem 30, electron.microscopy.sem 29, high.resolution.transmission 22, resolution.transmission.electron 22, differential.scanning.calorimetry 21, ray.photoelectron.spectroscopy 18, equal.channel.angular 17, scanning.electron.microscope 16, energy.dispersive.ray 14, scanning.calorimetry.dsc 13, channel.angular.pressing 13, diffraction.transmission.electron 11

Term Cliques
44.23% alloi grain temperatur oxid
41.35% alloi ti temperatur oxid
36.49% alloi corros grain nanocrystallin

37.21% alloi corros grain oxid
34.33% alloi corros ti oxid
42.12% alloi corros cu
35.55% alloi phase microstructur precipit ti mechan temperatur zr
33.10% alloi phase microstructur precipit ti ag temperatur zr
34.06% alloi mg phase microstructur grain mechan temperatur zr nanocrystallin
34.76% alloi mg phase microstructur precipit grain mechan temperatur zr
32.59% alloi mg phase microstructur precipit grain ag temperatur zr
31.73% alloi mg phase microstructur precipit cu ag temperatur zr

Sample Cluster Record Titles

Influence of annealing treatment on microstructure and cycling stability of la-rich Ml(NiCoMnAl)(5) alloy electrode for Ni/MH batteries

Segregation in Al-3(Sc,Zr) precipitates in Al-Sc-Zr alloys

Effect of cooling rate on the order in martensite of a Cu-Zn-Al alloy

Nanolayered structure of the rapid-quenched alloys on the basis of cobalt and titan

Solid state synthesis of nanocrystalline and/or amorphous 50Ni-50Ti alloy

Quantification of precipitate fraction in Al-Si-Cu alloys

Novel nanostructure and deformcifion behavior in rapidly quenched Cu-(Zr or Hf)-Ti alloys

Stress corrosion cracking of Alloy 600 in a high-temperature water containing sulfate and thiosulfate

Effect of boric acid on the stress corrosion cracking of SG tubing in high-temperature water

Cluster Metrics

Authors
inoue, a 13
lavernia, ej 7
han, bq 6
yavari, ar 5
eckert, j 5
zhang, z 4

zhang, lc 4
tu, mj 4
schultz, l 4
maurizio, c 4
lu, l 4
louzguine, dv 4
lei, yq 4
lai, mo 4
kato, h 4

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applied physics letters 10
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metallurgical and materials transactions a-physical metallurgy and materials science 9
surface science 8
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journal of non-crystalline solids 7

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materials science, multidisciplinary 212
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metallurgy & metallurgical 100
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japan 68
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south korea 25
poland 24
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india 16
canada 14
taiwan 11
singapore 11
brazil 11
spain 10

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chinese acad sci 23
tohoku univ 19
russian acad sci 16
xian jiaotong univ 11
cnrs 11
shanghai jiao tong univ 10
natl inst mat sci 10
harbin inst technol 10
warsaw univ technol 9
zhejiang univ 8
northwestern polytech univ 8
univ calif davis 7
polish acad sci 7
tokyo inst technol 6
tech univ darmstadt 6

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science citation index 520

- ## CLUSTER 123
  Alloys (especially nickel, copper, tin, titanium, and zirconium), emphasizing fusible/ eutectic alloys, formation of alloys, and mechanical/ structural characterization (139 Records)

(Countries: China, Japan, South Korea, USA. Institutions: CAS, Sungkyunkwan University. USA includes UCLA.)

Cluster Syntax Features

Descriptive Terms

ni 29.8%, alloi 9.9%, solder 7.7%, cu 7.7%, sn 5.7%, ti 2.4%, cu.ni 0.8%, ni.alloys 0.8%, imc 0.8%, eutect 0.7%, phase 0.7%, layer 0.7%, ni.cu 0.7%, microstructur 0.7%, zr 0.6%

Discriminating Terms

ni 19.4%, solder 5.7%, alloi 5.3%, cu 4.1%, sn 3.9%, film 1.6%, ti 1.2%, nanoparticl 0.7%, carbon 0.6%, nanotub 0.6%, cu.ni 0.6%, ni.alloys 0.6%, imc 0.6%, surfac 0.5%, particl 0.5%

Single Word Terms

ni 103, alloi 95, cu 61, layer 55, phase 55, form 51, rai 50, electron 49, temperatur 49, structur 46, composit 46, microstructur 42, surfac 42, format 39, interfac 39

Double Word Terms

electron.microscopy 28, ray.diffraction 26, scanning.electron 22, cu.ni 22, ni.cu 20, transmission.electron 18, ni.alloys 17, ni.ni 12, ni.alloy 12, mechanical.properties 11, ray.photoelectron 11, microscopy.sem 11, photoelectron.spectroscopy 10, ni.sn 9, intermetallic.compound 9

Triple Word Terms

scanning.electron.microscopy 18, transmission.electron.microscopy 15, electron.microscopy.sem 11, ray.photoelectron.spectroscopy 10, atomic.force.microscopy 7, ray.diffraction.xrd 6, photoelectron.spectroscopy.xps 6, lead.free.solder 6, electron.microscopy.tem 6, auger.electron.spectroscopy 6, cu.ni.sn 6, interface.solder.ni 5, intermetallic.compound.imc 5, sn.ag.cu 5, ag.cu.solder 5

Term Cliques

32.55% ti phase layer microstructur
23.17% cu cu.ni ni.cu microstructur zr
26.62% cu ti microstructur zr
33.63% cu ti layer microstructur
25.90% solder sn eutect phase microstructur
25.80% solder sn cu.ni imc phase layer microstructur
24.87% solder cu cu.ni imc layer ni.cu microstructur
26.76% solder cu sn eutect microstructur
26.41% solder cu sn cu.ni imc layer microstructur
37.59% alloi eutect phase microstructur
34.10% alloi ti phase microstructur zr
30.50% alloi ti ni.alloys phase zr
29.21% ni cu.ni ni.cu microstructur zr
34.82% ni cu.ni layer ni.cu microstructur
34.24% ni cu.ni phase microstructur zr
39.86% ni cu.ni phase layer microstructur
44.75% ni alloi phase microstructur zr
41.15% ni alloi ni.alloys phase zr

Sample Cluster Record Titles

Preparation and mechanical properties of Zr-based containing Co bulk metallic glass

Multilayered microstructure of a Pb-Sn alloy coating obtained by electrochemical deposition

Study on the initial electrodeposition behavior of Ni-P alloys

Multi-layer composite based on amorphous materials and quasicrystals, deposited by laser ablation

Structural, magnetic and corrosion properties of electrodeposited cobalt-nickel-molybdenum alloys

Magnetic behavior of half-Heusler alloy CuxNi1-xMnSb

An electrochemical study of Au-Ni alloy electrodeposition from cyanide-citrate electrolytes

Electroless Ni-P plating on AZ91D magnesium alloy from a sulfate solution

Corrosion of AB(5) alloy during the storage on the performance of nickel-metal-hydride battery

Cluster Metrics

Authors

jung, sb 5
kim, dg 4
inoue, a 4
yamashita, o 3
tu, kn 3
satou, k 3
odahara, h 3
kim, jw 3
kim, dh 3
du, yw 3
zhou, j 2
zheng, yc 2
zhang, y 2
zhang, f 2
yu, ch 2

Sources

physical review b 7
applied physics letters 7
scripta materialia 6
journal of alloys and compounds 6
surface & coatings technology 5
journal of electronic materials 4
ieee transactions on applied superconductivity 4
electrochemical and solid state letters 4
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materials transactions 3
materials science and engineering a-structural materials properties microstructure and processing 3
journal of the electrochemical society 3
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Keywords

materials science, multidisciplinary 42
engineering 20
metallurgy & metallurgical 20
chemistry, physical 18
engineering, electrical & electronic 17
physics, applied 16
microstructure 15

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alloys 12
materials science, coatings & films 11
physics, condensed matter 11
electrodeposition 10
physics, condensed matter 9
metallurgy & metallurgical engineering 9
nickel 9

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Country
peoples r china 34
japan 26
south korea 22
usa 20
france 9
germany 8
taiwan 5
spain 5
finland 4
england 4
norway 3
india 3
bulgaria 3
ukraine 2
singapore 2

Institution
chinese acad sci 7
sungkyunkwan univ 5
tohoku univ 4
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yonsei univ 3
xiamen univ 3
univ oslo 3
univ calif los angeles 3
univ barcelona 3
natl chiao tung univ 3
nanjing univ 3
harbin inst technol 3
ehime univ 3

city univ hong kong 3

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science citation index 139

- # CLUSTER 242
  Preparation, reactions, and structure of composite materials, especially copper, nickel, and silver alloys (222 Records)

(Countries: China, USA, Japan, Germany. Institutions: Tohoku University, CAS, National Institute of Material Science, Harbin Institute of Technology. USA include University of Wisconsin, Washington State University.).

Cluster Syntax Features

Descriptive Terms
ni 13.3%, precipit 6.4%, copper 5.6%, cu 5.5%, alloi 2.8%, phase 2.3%, nickel 1.8%, ag 1.2%, coat 1.0%, composit 0.9%, reaction 0.9%, crystal 0.8%, oxid 0.8%, metal 0.8%, solut 0.8%

Discriminating Terms
ni 10.9%, precipit 5.5%, copper 4.5%, cu 3.7%, film 2.7%, alloi 1.4%, nickel 1.3%, nanotub 0.8%, nanoparticl 0.8%, magnet 0.7%, quantum 0.6%, carbon 0.5%, ag 0.5%, phase 0.5%, polym 0.5%

Single Word Terms
rai 113, electron 107, phase 89, structur 88, scan 87, ni 83, microscopi 81, form 78, format 73, diffract 72, cu 72, composit 71, temperatur 70, solut 68, high 67

Double Word Terms

electron.microscopy 70, ray.diffraction 57, scanning.electron 50, transmission.electron 45, differential.scanning 33, diffraction.xrd 29, scanning.calorimetry 28, microscopy.tem 22, microscopy.sem 20, energy.dispersive 19, electron.microscope 19, calorimetry.dsc 19, photoelectron.spectroscopy 18, ray.photoelectron 18, solid.solution 16

Triple Word Terms

transmission.electron.microscopy 42, scanning.electron.microscopy 30, differential.scanning.calorimetry 27, ray.diffraction.xrd 23, electron.microscopy.tem 22, scanning.calorimetry.dsc 19, ray.photoelectron.spectroscopy 18, electron.microscopy.sem 17, scanning.electron.microscope 16, electron.microscope.sem 13, photoelectron.spectroscopy.xps 11, energy.dispersive.ray 10, resolution.transmission.electron 10, high.resolution.transmission 10, ray.powder.diffraction 10

Term Cliques

25.90% reaction crystal metal solut
23.72% phase nickel ag
30.97% cu alloi composit solut
26.35% cu alloi ag solut
21.51% copper coat oxid solut
26.43% copper cu reaction oxid metal solut
25.41% copper cu ag reaction solut
30.48% precipit alloi phase composit crystal solut
28.56% precipit alloi phase ag solut
26.13% ni coat composit oxid solut
26.58% ni coat composit crystal solut
23.51% ni nickel coat composit oxid
30.86% ni phase composit oxid metal solut
31.23% ni phase composit crystal metal solut
28.68% ni phase nickel composit oxid metal
29.58% ni cu composit oxid metal solut

Sample Cluster Record Titles

Self-organized regular array microstructure of LiNbO3-based crystal composites

Preparation of Cu-Ni alloys through a new chemical route

Structural and electrical changes in NdSrNiO4-delta by substitute nickel with copper

In situ formation of Ni nanoparticles supported on NiFe2O4 by calcination

Formation of copper nanocrystals in alkali-lime silica glass by means of different reducing agents

[Electroless Ni-Co-P coating of cenospheres using [Ag(NH3)(2)](+) activator]

[Study of formation of nano-quasicrystals and crystallization kinetics of Zr-Al-Ni-Cu metallic glass]

[Variation in the reaction zone and its effects on the strength of diffusion bonded titanium-stainless steel couple]

[Thermal behaviour of Cu-Mg-Mn and Ni-Mg-Mn layered double hydroxides and characterization of formed oxides]

Cluster Metrics

Authors

inoue, a 4
yu, ch 3
ting, yp 3
schmidt, ac 3
deng, sb 3
zhao, q 2
zeng, ax 2
yassar, rs 2
xu, bs 2
xiong, wh 2
wilde, g 2
weiland, h 2
wang, l 2
wang, g 2
tanaka, t 2

Sources

journal of alloys and compounds 11
acta materialia 8
materials science and engineering a-structural materials properties microstructure and processing 6
materials letters 5
journal of physical chemistry b 5
materials science and technology 4
journal of solid state chemistry 4
journal of non-crystalline solids 4
journal of materials research 4
zeitschrift fur metallkunde 3
thermochimica acta 3
metallurgical and materials transactions a-physical metallurgy and materials science 3
materials transactions 3

journal of thermal analysis and calorimetry 3
journal of the electrochemical society 3

Keywords

materials science, multidisciplinary 53
chemistry, physical 34
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metallurgy & metallurgical 27
materials science, multidisciplinary 25
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metallurgical engineering 12
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chemistry, physical 12
behavior 12
materials science, ceramics 11
chemistry, analytical 11

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usa 30
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france 11
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russia 8
england 8
spain 7
singapore 6
italy 6
austria 6
australia 6

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tohoku univ 6
chinese acad sci 6
natl inst mat sci 5

harbin inst technol 5
xiamen univ 4
russian acad sci 4
natl univ singapore 4
univ wisconsin 3
tokyo inst technol 3
natl taiwan univ 3
innsbruck univ 3
ben gurion univ negev 3
yokohama natl univ 2
washington state univ 2
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- # CLUSTER 150
  Coatings formed by deposition, especially chemical vapor deposition and thermal and plasma spraying, emphasizing their properties, particularly hardness, wear/ corrosion resistance, and magnetic properties (487 Records)

(Countries: China dominant, followed by Germany and England, followed by Japan, Korea, France, Poland. Institutions: CAS dominant, Xian Jiaotong University, Harbin Institute of Technology. No USA institutional presence.).

Cluster Syntax Features

Descriptive Terms
coat 56.3%, hard 1.9%, sprai 1.8%, deposit 1.8%, substrat 1.0%, wear 0.9%, alloi 0.9%, plasma 0.8%, ti 0.8%, tin 0.7%, resist 0.6%, corros 0.6%, coatings.deposited 0.5%, layer

0.5%, diamond 0.5%

Discriminating Terms
coat 39.7%, film 1.5%, sprai 1.3%, hard 1.1%, nanoparticl 0.8%, magnet 0.7%, nanotub 0.7%, carbon 0.5%, crystal 0.5%, quantum 0.5%, wear 0.5%, particl 0.4%, coatings.deposited 0.4%, structur 0.4%, field 0.4%

Single Word Terms
coat 467, deposit 292, surfac 253, substrat 230, properti 198, structur 189, electron 186, hard 186, high 171, layer 162, temperatur 157, mechan 157, rai 151, microscopi 147, resist 145

Double Word Terms
electron.microscopy 126, scanning.electron 114, ray.diffraction 108, coatings.deposited 102, transmission.electron 55, diffraction.xrd 54, magnetron.sputtering 54, mechanical.properties 52, vapor.deposition 46, microscopy.sem 44, atomic.force 38, wear.resistance 38, chemical.vapor 37, corrosion.resistance 36, properties.coatings 34

Triple Word Terms
scanning.electron.microscopy 83, ray.diffraction.xrd 53, transmission.electron.microscopy 50, electron.microscopy.sem 40, chemical.vapor.deposition 34, ray.photoelectron.spectroscopy 33, atomic.force.microscopy 28, scanning.electron.microscope 24, photoelectron.spectroscopy.xps 22, electron.microscopy.tem 21, chemical.vapour.deposition 19, force.microscopy.afm 17, plasma.chemical.vapor 16, reactive.magnetron.sputtering 16, electron.microscopy.ray 15

Term Cliques
39.37% coat alloi resist diamond
38.85% coat alloi resist corros layer
42.15% coat alloi ti layer
38.57% coat substrat tin resist corros layer
47.28% coat deposit plasma diamond
39.66% coat deposit substrat plasma ti tin coatings.deposited
38.86% coat sprai resist corros
39.58% coat sprai plasma coatings.deposited
38.89% coat hard wear resist diamond
42.85% coat hard substrat tin resist layer
40.66% coat hard substrat ti tin layer
40.90% coat hard substrat wear tin resist
44.93% coat hard deposit wear diamond
39.14% coat hard deposit substrat wear ti tin coatings.deposited

Sample Cluster Record Titles

[Effect of carrier gases on microstructural and electrochemical behavior of cold-sprayed 1100 aluminum coating]

[Multi-scale modeling and analysis of an industrial HVOF thermal spray process]

[Microstructure and chemistry of annealed Al-Cu-Fe-Cr quasicrystalline approximant coatings]

[Structure, physical properties and fractal character of surface topography of the Ti plus TiC coatings on sintered high speed steel]

[Nanocomposite hard coatings: Deposition issues and validation of their mechanical properties]

[Characterization and tribological properties of plasma sprayed FeS solid lubrication coatings]

[Corrosion resistance of plasma sprayed NiCrAl+(ZrO2+Y2O3) thermal barrier coating on 18-8 steel surface]

[Visco-elastic visco-plastic analysis of scratch resistance of organic coatings]

[Low-temperature processing of Fe-Al intermetallic coatings assisted by ball milling]

Cluster Metrics

Authors

dobrzanski, la 11
xu, kw 9
ma, sl 9
mitterer, c 7
ding, cx 6
an, mz 6
veprek, s 5
oliveira, fj 5
mayrhofer, ph 5
marple, br 5
ma, dy 5
liu, wm 5
lima, rs 5
de hosson, jtm 5
coddet, c 5

Sources

surface & coatings technology 91
thin solid films 34
journal of materials processing technology 21
rare metal materials and engineering 12
materials letters 12
materials science and engineering a-structural materials properties microstructure and processing 10
wear 9
journal of vacuum science & technology a 9
transactions of nonferrous metals society of china 8
vacuum 7
journal of thermal spray technology 7
diamond and related materials 7
applied surface science 6
scripta materialia 5
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 5

Keywords

materials science, multidisciplinary 142
materials science, coatings & films 117
physics, applied 72
films 64
microstructure 48
coatings 45
engineering 43
metallurgy & metallurgical 43
physics, 40
deposition 40
behavior 37
hardness 36
condensed matter 34
thin-films 34
metallurgy & metallurgical engineering 30

Publication Year

2005 428
2004 50
2006 8
2003 1

Country

peoples r china 130
usa 64
germany 37
england 37

japan 31
south korea 30
france 27
poland 24
taiwan 16
italy 15
spain 13
india 13
switzerland 11
canada 11
austria 11

Institution
chinese acad sci 33
xian jiaotong univ 14
harbin inst technol 14
silesian tech univ 11
tsing hua univ 9
tohoku univ 7
natl res council canada 7
hong kong polytech univ 7
univ technol belfort montbeliard 6
univ aveiro 6
univ sheffield 5
univ leoben 5
univ groningen 5
tech univ munich 5
sheffield hallam univ 5

DataBase
science citation index 487

- # CLUSTER 47
  Nanotribological studies, emphasizing friction behavior and including analyses of sliding, adhesion, and wear (99 Records)

(Countries: USA dominant, Japan, China. Institutions: Ohio State University extremely dominant. Other USA includes Georgia Institute of Technology.).

Cluster Syntax Features

Descriptive Terms

friction 49.1%, slide 6.5%, lubric 5.9%, tribolog 2.0%, forc 1.8%, wear 1.5%, adhes 1.3%, coeffici 1.3%, veloc 1.1%, friction.coefficient 1.1%, friction.force 1.0%, contact 0.8%, scale 0.7%, surfac 0.7%, nanotribolog 0.5%

Discriminating Terms

friction 31.1%, slide 4.0%, lubric 3.7%, film 1.4%, tribolog 1.2%, wear 0.7%, friction.coefficient 0.7%, friction.force 0.7%, structur 0.6%, nanoparticl 0.6%, veloc 0.6%, coeffici 0.6%, nanotub 0.5%, adhes 0.5%, particl 0.5%

Single Word Terms

friction 91, surfac 64, forc 58, slide 46, coeffici 45, properti 44, atom 39, tribolog 39, lubric 39, mechan 36, microscopi 35, wear 34, contact 33, test 29, materi 29

Double Word Terms

atomic.force 32, friction.coefficient 28, friction.force 26, force.microscopy 25, force.microscope 19, surface.roughness 13, friction.wear 12, tribological.properties 12, sliding.velocity 12, coefficient.friction 11, dependence.friction 10, electron.microscopy 10, relative.humidity 10, scanning.electron 10, diamond.carbon 10

Triple Word Terms

atomic.force.microscopy 18, atomic.force.microscope 17, friction.force.microscopy 8, micro.nanoelectromechanical.systems 8, diamond.carbon.dlc 8, force.microscopy.afm 8, force.microscope.afm 7, scanning.electron.microscopy 6, systems.mems.nems 6, electron.microscopy.sem 5, nanoelectromechanical.systems.mems 5, velocity.dependence.friction 5, friction.coefficient.wear 5, transmission.electron.microscopy 4, photoelectron.spectroscopy.xps 4

Term Cliques

40.61% friction slide forc adhes veloc friction.force contact scale surfac nanotribolog
43.55% friction slide forc wear veloc contact scale surfac nanotribolog
41.86% friction slide lubric tribolog adhes veloc contact surfac nanotribolog
48.74% friction slide lubric tribolog wear coeffici friction.coefficient surfac
43.43% friction slide lubric tribolog wear coeffici veloc contact surfac nanotribolog

Sample Cluster Record Titles

Sliding friction of Al-Cu-Fe-B quasicrystals

Nonmonotonic velocity dependence of atomic friction

Scale dependence of micro/nano-friction and adhesion of MEMS/NEMS materials, coatings and lubricants

Sliding friction behavior of bulk Ti3SiC2 under different normal pressures

Surface and sub-micron sub-surface evolution of Al390-T6 undergoing tribological testing under submerged lubrication conditions in the presence of CO2 refrigerant

Nano and macro tribology of elastomers

Friction at the nano-scale

Scale effect in dry friction during multiple-asperity contact

A comparative examination of the friction coefficient of two different sliding bearing

Cluster Metrics

Authors

bhushan, b 18
tambe, ns 8
zhang, zl 3
zhai, hx 3
wang, m 3
szoszkiewicz, r 3
miyake, s 3
huang, zy 3
zhou, y 2
wang, yf 2
vancso, gj 2
tocha, e 2
schonherr, h 2
rutland, mw 2
rigney, da 2

Sources

wear 12
tribology letters 5
surface & coatings technology 4
nanotechnology 4
ultramicroscopy 3
tribology international 3
review of scientific instruments 3

applied physics letters 3
physical review letters 2
microsystem technologies-micro-and nanosystems-information storage and processing systems 2
journal of vacuum science & technology a 2
journal of physics d-applied physics 2
journal of chemical physics 2
journal of adhesion science and technology 2
japanese journal of applied physics part 1-regular papers brief communications & review papers 2

Keywords

friction 29
engineering, mechanical 19
materials science, multidisciplinary 18
physics, applied 14
wear 14
adhesion 14
friction 13
surface 11
materials science, multidisciplinary 10
physics, applied 9
surfaces 8
films 8
engineering, chemical 7
coatings 7
wear 6

Publication Year

2005 89
2004 9
2006 1

Country

usa 37
japan 16
peoples r china 14
netherlands 5
south korea 4
poland 4
france 4
switzerland 3
sweden 3
italy 3
germany 3
england 3

taiwan 2
ukraine 1
turkey 1

Institution
ohio state univ 20
tohoku univ 3
nippon inst technol 3
ecole polytech fed lausanne 3
univ twente 2
univ evry val essonne 2
royal inst technol 2
jiao tong univ 2
inst elect mat technol 2
hitach maxell ltd 2
georgia inst technol 2
cnrs 2
chinese acad sci 2
andrzej soltan inst nucl studies 2
yonsei univ 1

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science citation index 99

- # CLUSTER 34
  Nanotribological studies, emphasizing wear behavior (especially steel substrates and silicon carbide [SiC] composites) and including analyses of sliding and abrasion (154 Records)

(Countries: China, USA, followed by England. Institutions: CAS, Tsing Hua University. USA include University of Wisconsin, University of Texas.).

Cluster Syntax Features

Descriptive Terms
wear 61.1%, friction 3.4%, slide 2.0%, abras 1.7%, tribolog 1.3%, wear.resistance 1.2%, steel 1.1%, friction.wear 1.1%, wear.rate 0.8%, test 0.8%, resist 0.7%, sic 0.7%, coat 0.7%, alloi 0.6%, worn 0.6%

Discriminating Terms
wear 38.7%, friction 1.9%, film 1.5%, slide 1.2%, abras 1.1%, wear.resistance 0.8%, tribolog 0.7%, friction.wear 0.7%, nanoparticl 0.6%, structur 0.5%, wear.rate 0.5%, nanotub 0.5%, magnet 0.5%, steel 0.5%, crystal 0.5%

Single Word Terms
wear 151, surfac 113, test 76, mechan 74, electron 74, resist 73, friction 69, scan 66, sem 64, properti 63, rate 61, slide 58, high 53, microscopi 53, steel 52

Double Word Terms
scanning.electron 56, wear.resistance 51, wear.rate 43, electron.microscopy 41, friction.wear 41, friction.coefficient 26, worn.surfaces 26, tribological.properties 24, wear.tests 23, wear.mechanism 23, sliding.wear 22, microscopy.sem 22, wear.behavior 21, atomic.force 20, electron.microscope 20

Triple Word Terms
scanning.electron.microscopy 36, electron.microscopy.sem 21, scanning.electron.microscope 17, friction.wear.properties 14, ray.photoelectron.spectroscopy 14, atomic.force.microscopy 11, photoelectron.spectroscopy.xps 11, transmission.electron.microscopy 10, atomic.force.microscope 10, electron.microscope.sem 9, friction.wear.tester 8, energy.dispersive.ray 8, ray.diffraction.xrd 7, auger.electron.spectroscopy 6, friction.coefficient.wear 6

Term Cliques
43.72% wear abras test resist sic coat
45.35% wear abras wear.resistance test resist sic
42.86% wear slide test resist sic coat worn

40.07% wear slide wear.rate test sic alloi worn
40.07% wear slide wear.rate test sic coat worn
42.86% wear slide steel wear.rate test alloi worn
41.64% wear slide wear.resistance test resist sic alloi worn
44.07% wear slide wear.resistance steel test resist alloi worn
43.43% wear friction slide steel friction.wear test resist coat worn
44.52% wear friction slide wear.resistance steel friction.wear test resist worn
40.39% wear friction slide tribolog steel friction.wear wear.rate test coat worn

Sample Cluster Record Titles

The wear behaviour of oxide ceramics - A Review

Nanomechanical and nanotribological properties of an antiwear tribofilm produced from phosphorus-containing additives on boundary-lubricated steel surfaces

Effects of methane plasma ion implantation on the microstructure and wear resistance of NiTi shape memory alloys

Micro/nanoscale mechanical and tribological characterization of SiC for orthopedic applications

The performances of BMI nanocomposites filled with nanometer SiC

Effect of chemical structure of borates on the tribological characteristics of magnesium alloy during sliding

Relationship between wear rate, surface pullout and microstructure during abrasive wear of alumina and alumina/SiC nanocomposites

Plasma immersion ion implanted Ti-B-based coatings: Tribological behaviour at room and high temperatures

Wear behavior of flame-sprayed Al2O3-TiO2 coatings on plain carbon steel substrates

Cluster Metrics

Authors
zhou, f 4
rainforth, wm 4
yang, j 3
xu, z 3
xu, bs 3

qi, lh 3
liu, wm 3
liu, j 3
li, dy 3
zhuang, dm 2
zhu, jh 2
zhou, zf 2
zhou, h 2
zhou, gs 2
zheng, ms 2

Sources

wear 25
tribology letters 7
tribology international 6
materials science and engineering a-structural materials properties microstructure and processing 6
surface & coatings technology 5
rare metal materials and engineering 5
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 5
journal of tribology-transactions of the asme 4
journal of materials processing technology 4
international journal of refractory metals & hard materials 4
thin solid films 3
journal of the american ceramic society 3
journal of central south university of technology 3
high-performance ceramics iii, pts 1 and 2 3
fractography of advanced ceramics ii 3

Keywords

materials science, multidisciplinary 37
engineering, mechanical 37
wear 34
materials science, multidisciplinary 30
friction 24
behavior 20
engineering 16
metallurgy & metallurgical 15
films 13
wear 11
sliding wear 11
metallurgy & metallurgical engineering 10
materials science, coatings & films 10
tribology 10
resistance 10

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2005 136
2004 15
2006 3

Country
peoples r china 48
usa 29
england 17
south korea 11
japan 11
germany 8
poland 7
india 6
canada 5
turkey 4
netherlands 3
ukraine 2
sweden 2
spain 2
slovakia 2

Institution
chinese acad sci 9
tsing hua univ 7
xian jiaotong univ 4
univ sheffield 4
yonsei univ 3
univ wisconsin 3
univ alberta 3
taiyuan univ technol 3
huaqiao univ 3
henan univ sci & technol 3
warsaw univ technol 2
univ texas 2
univ oxford 2
univ birmingham 2
univ barcelona 2

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science citation index 154

- # CLUSTER 157
  Fabrication and characteristics of corrosion-resistant steel surfaces and layers (210 Records)

(Countries: China dominant, USA, Japan. Institutions: CAS, Tsing Hua University, National Institute of Materials Science. USA include ORNL, Northeastern University.).

Cluster Syntax Features

Descriptive Terms
steel 31.2%, corros 11.9%, stainless 4.1%, stainless.steel 2.7%, layer 2.0%, resist 1.8%, nitrid 1.7%, surfac 1.5%, alloi 1.3%, aisi 1.2%, implant 1.1%, corrosion.resistance 1.1%, wear 0.8%, pit 0.7%, austenit 0.7%

Discriminating Terms
steel 23.0%, corros 8.6%, stainless 3.0%, stainless.steel 1.9%, film 1.8%, aisi 0.9%, nitrid 0.9%, corrosion.resistance 0.8%, nanoparticl 0.8%, resist 0.7%, magnet 0.6%, nanotub 0.6%, crystal 0.6%, particl 0.5%, structur 0.5%

Single Word Terms
surfac 150, steel 145, layer 102, electron 100, resist 88, corros 86, microscopi 83, rai 81, properti 78, scan 76, stainless 74, mechan 74, high 73, temperatur 70, test 70

Double Word Terms
scanning.electron 70, electron.microscopy 63, stainless.steel 62, ray.diffraction 50, corrosion.resistance 45, mechanical.properties 25, microscopy.sem 22, transmission.electron 22, electron.microscope 22, surface.layer 20, atomic.force 20, ray.photoelectron 20, diffraction.xrd 19, energy.dispersive 19, photoelectron.spectroscopy 18

Triple Word Terms
scanning.electron.microscopy 49, electron.microscopy.sem 21, ray.diffraction.xrd 19, scanning.electron.microscope 18, ray.photoelectron.spectroscopy 18, transmission.electron.microscopy 16, atomic.force.microscopy 14, photoelectron.spectroscopy.xps 11, energy.dispersive.ray 11, austenitic.stainless.steel 10, 304.stainless.steel 10, 316l.stainless.steel 9, electron.microscope.sem 9, microscopy.scanning.electron 7, electron.microscopy.tem 7

Term Cliques
32.68% layer resist surfac alloi implant corrosion.resistance wear austenit
30.24% layer resist nitrid surfac aisi implant wear austenit
32.14% layer resist nitrid surfac alloi implant wear austenit
30.00% stainless.steel layer nitrid surfac aisi implant austenit
35.33% stainless resist surfac aisi pit
32.65% stainless resist surfac alloi implant corrosion.resistance austenit
29.86% stainless resist nitrid surfac aisi implant austenit
32.04% stainless resist nitrid surfac alloi implant austenit
28.10% stainless stainless.steel nitrid surfac aisi implant austenit
36.19% corros layer resist surfac alloi implant corrosion.resistance wear
36.33% corros stainless resist surfac alloi corrosion.resistance pit
36.67% corros stainless resist surfac alloi implant corrosion.resistance
36.53% steel layer nitrid surfac aisi wear austenit
37.96% steel stainless.steel layer nitrid surfac aisi austenit
38.89% steel stainless stainless.steel surfac aisi pit
36.05% steel stainless stainless.steel nitrid surfac aisi austenit

Sample Cluster Record Titles

Effect of cross shear rolling on microstructure and properties of surface nanocrystallized 316L stainless steel

Characterization by electron diffraction of two thermodynamical phases of precipitation in nbmicroalloyed steels

Microstructure and properties of low temperature composite chromized layer on H13 tool steel

Steam oxidation of high-chromium ferritic steels containing palladium

Electrochemical corrosion behavior of low-carbon i-beam steels in a simulated Yucca Mountain repository environment

Surface modification of carbon steel and tool steel by auminizing with powder liquid coating and plasma nitriding

Surface characteristics of AISI 304L stainless steel after an atmospheric pressure plasma treatment

Long-term corrosion resistance of metallic reinforcements in concrete - a study of corrosion mechanisms based on archaeological artefacts

Ion beam nitriding of single and polycrystalline austenitic stainless steel

Cluster Metrics

Authors
man, hc 4
shih, hc 3
sen, u 3
chiu, ky 3
cheng, ft 3
chen, yy 3
casteletti, lc 3
bindal, c 3
bai, xd 3
zuo, y 2
zhu, sl 2
zhao, h 2
zhang, ch 2
zak, j 2
williamson, dl 2

Sources
surface & coatings technology 22
wear 11
corrosion science 10
materials science and engineering a-structural materials properties microstructure and processing 8
journal of materials processing technology 8
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 6
applied surface science 5
journal of nuclear materials 4
transactions of nonferrous metals society of china 3
thin solid films 3
rare metal materials and engineering 3
materials transactions 3
journal of the electrochemical society 3
corrosion 3
zeitschrift fur metallkunde 2

Keywords
materials science, multidisciplinary 65
materials science, coatings & films 30
engineering 29
metallurgy & metallurgical 29
metallurgy & metallurgical engineering 21

behavior 20
corrosion 17
coatings 17
microstructure 15
alloys 15
engineering, mechanical 14
materials science, multidisciplinary 14
iron 14
chemistry, physical 12
corrosion 11

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2005 180
2004 22
2006 8

Country

peoples r china 46
usa 20
japan 20
germany 13
brazil 12
taiwan 11
poland 11
india 11
france 10
turkey 9
south korea 7
australia 7
sweden 5
italy 5
canada 5

Institution

chinese acad sci 10
tsing hua univ 6
natl inst mat sci 6
xian jiaotong univ 5
univ sao paulo 5
sakarya univ 4
oak ridge natl lab 4
northeastern univ 4
hong kong polytech univ 4
dalian univ technol 4
chalmers univ technol 4
warsaw univ technol 3

slovak tech univ 3
silesian tech univ 3
shenyang univ technol 3

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science citation index 210

- # CLUSTER 66
  Corrosion mechanisms and protection/ inhibition, especially of steel, zinc, and iron surfaces (76 Records)

(Countries: China, India, USA. Institutions: CAS, University of Delhi. USA includes BNL.).

Cluster Syntax Features

Descriptive Terms
corros 48.2%, steel 6.2%, protect 2.1%, inhibit 1.9%, inhibitor 1.8%, corrosion.products 1.1%, coat 1.0%, zinc 0.8%, acid 0.8%, electrochem 0.8%, surfac 0.8%, product 0.6%, iron 0.5%, solut 0.5%, mild.steel 0.5%

Discriminating Terms
corros 32.0%, steel 3.7%, film 1.5%, protect 1.2%, inhibit 1.1%, inhibitor 1.1%, corrosion.products 0.8%, magnet 0.6%, particl 0.6%, nanotub 0.6%, nanoparticl 0.5%, structur 0.5%, crystal 0.5%, temperatur 0.5%, quantum 0.4%

Single Word Terms
corros 71, surfac 63, electron 40, scan 39, electrochem 37, steel 35, solut 35, rai 34, protect 33, microscopi 32, oxid 28, acid 27, mechan 26, sem 26, inhibit 26

Double Word Terms
scanning.electron 37, electron.microscopy 25, ray.diffraction 22, corrosion.products 15, corrosion.resistance 14, surface.morphology 13, microscopy.sem 11, corrosion.inhibition 11, energy.dispersive 10, diffraction.xrd 9, electrochemical.impedance 9, potentiodynamic.polarization 9, steel.surface 9, weight.loss 9, corrosion.rate 9

Triple Word Terms
scanning.electron.microscopy 25, electron.microscopy.sem 11, scanning.electron.microscope 9, ray.photoelectron.spectroscopy 9, ray.diffraction.xrd 8, electrochemical.impedance.spectroscopy 8, atomic.force.microscopy 6, energy.dispersive.ray 5, photoelectron.spectroscopy.xps 5, open.circuit.potential 5, langmuir.adsorption.isotherm 5, low.carbon.steel 4, surface.scanning.electron 4, energy.dispersive.spectroscopy 4, corrosion.mild.steel 4

Term Cliques
41.78% corros iron solut mild.steel
47.04% corros inhibit inhibitor acid electrochem surfac solut mild.steel
41.89% corros protect corrosion.products product iron solut
56.80% corros protect inhibitor electrochem surfac solut
36.05% corros steel zinc iron mild.steel
48.95% corros steel zinc surfac mild.steel
47.04% corros steel inhibit inhibitor acid electrochem surfac mild.steel
55.79% corros steel protect zinc surfac
50.79% corros steel protect coat electrochem
38.16% corros steel protect coat zinc product iron
37.78% corros steel protect corrosion.products zinc product iron
56.80% corros steel protect inhibitor electrochem surface

Sample Cluster Record Titles

Inhibition of corrosion of AZ91 magnesium alloy in ethylene glycol solution in presence of chloride anions

Microbiologically induced corrosion of copper

Effect of stoving and air drying lacquers on corrosion resistance and preserving decorative colours on copper

The influence of electrochemical surface modifications on naval steel corrosion

Corrosion protection of 316 L stainless steel by a TiO2 nanoparticle coating prepared by sol-gel method

Corrosion inhibition of mild steel by aerobic biofilm

Suppression of deicing salt corrosion of weathering steel bridges by washing

Control of Fe(O,OH)(6) nano-network structures of rust for high atmospheric-corrosion resistance

[Spectroscopic identification of protective and non-protective corrosion coatings on steel structures in marine environments]

Cluster Metrics

Authors
singh, g 3
venkatesha, tv 2
naik, ya 2
mele, c 2
mcnamara, b 2
liu, wm 2
li, xh 2
kalman, e 2
hanson, b 2
buck, e 2
bozzini, b 2
boshkov, n 2
zucchi, f 1
zinola, cf 1
zhu, jm 1

Sources
corrosion science 7
journal of the electrochemical society 5
transactions of the institute of metal finishing 4
surface engineering 3
surface & coatings technology 3
electrochimica acta 3
thin solid films 2
radiochimica acta 2
nuclear instruments & methods in physics research section b-beam interactions with materials and atoms 2
materials chemistry and physics 2
materials and corrosion-werkstoffe und korrosion 2
journal of applied electrochemistry 2
corrosion reviews 2
corrosion engineering science and technology 2
anti-corrosion methods and materials 2

Keywords
materials science, multidisciplinary 22
engineering 18
metallurgy & metallurgical 18

materials science, coatings & films 17
corrosion 17
behavior 11
electrochemistry 9
media 8
iron 8
electrochemistry 7
steel 6
corrosion 6
steel 6
adsorption 6
adsorption 5

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2005 70
2004 6

Country
peoples r china 12
india 12
usa 10
italy 6
japan 5
egypt 5
france 3
bulgaria 3
brazil 3
spain 2
south korea 2
hungary 2
england 2
belgium 2
australia 2

Institution
chinese acad sci 4
univ delhi 3
yunnan univ 2
univ lecce 2
univ ferrara 2
natl res ctr 2
kuvempu univ 2
hungarian acad sci 2
cent electrochem res inst 2
bulgarian acad sci 2
brookhaven natl lab 2

zhejiang univ 1
yon den consultant co 1
xian jiaotong univ 1
xiamen univ 1

DataBase
science citation index 76

- # CLUSTER 118
  Crack, fatigue, and fracture processes, behavior, and mechanisms, emphasizing on analysis with scanning electron microscopy (210 Records)

(Countries: USA, Japan, China, followed by Germany. Institutions: CAS dominant. USA include Princeton University, Georgia Institute of Technology.).

Cluster Syntax Features

Descriptive Terms
crack 26.2%, fatigu 16.3%, fractur 12.7%, specimen 2.3%, stress 2.1%, steel 1.7%, failur 1.3%, crack.growth 1.3%, test 1.2%, strength 0.9%, propag 0.9%, tough 0.8%, load 0.8%, fatigue.crack 0.8%, fracture.toughness 0.7%

Discriminating Terms
crack 17.6%, fatigu 11.2%, fractur 8.3%, film 1.7%, specimen 1.3%, stress 0.9%, crack.growth 0.9%, failur 0.9%, steel 0.8%, nanoparticl 0.7%, magnet 0.6%, carbon 0.6%, nanotub 0.6%, fatigue.crack 0.5%, structur 0.5%

Single Word Terms
fractur 127, crack 124, surfac 117, electron 105, scan 98, stress 97, fatigu 84, mechan 82,

test 79, microscopi 75, specimen 73, materi 73, sem 65, high 61, strength 60

Double Word Terms

scanning.electron 90, electron.microscopy 58, electron.microscope 39, fracture.surfaces 34, crack.growth 34, fracture.toughness 32, fatigue.crack 30, crack.propagation 29, mechanical.properties 24, room.temperature 23, fracture.surface 21, crack.tip 21, microscope.sem 19, fatigue.life 17, transmission.electron 17

Triple Word Terms

scanning.electron.microscopy 50, scanning.electron.microscope 36, electron.microscope.sem 19, fatigue.crack.propagation 14, electron.microscopy.sem 14, atomic.force.microscopy 12, transmission.electron.microscopy 12, low.cycle.fatigue 11, stress.corrosion.cracking 11, fatigue.crack.growth 10, crack.growth.rates 9, surfaces.scanning.electron 8, stress.intensity.factor 8, optical.scanning.electron 7, single.crystal.silicon 6

Term Cliques

31.81% stress steel failur test strength
35.33% fractur stress crack.growth propag load
36.48% fractur stress failur propag load
37.14% fractur stress failur test strength load
32.14% fractur specimen test strength tough fracture.toughness
39.29% fractur specimen stress test strength load
37.22% fractur specimen stress crack.growth test load
28.41% fatigu stress crack.growth propag load fatigue.crack
32.38% fatigu stress failur propag load
34.76% fatigu stress failur test load
33.81% fatigu specimen stress crack.growth test load
32.14% crack fractur crack.growth propag tough fracture.toughness
41.52% crack fractur stress crack.growth propag
42.67% crack fractur stress failur propag
45.05% crack fractur stress failur test
34.22% crack fractur specimen crack.growth test tough fracture.toughness
42.38% crack fractur specimen stress crack.growth test
33.57% crack fatigu stress crack.growth propag fatigue.crack
38.57% crack fatigu stress failur propag
36.86% crack fatigu stress steel fatigue.crack
38.25% crack fatigu stress steel failur test
38.97% crack fatigu specimen stress crack.growth test

Sample Cluster Record Titles

Crack growth anomalies in HAZ for parent steel P91

Investigating the mechanisms that cause quench cracking in aluminium alloy 7010

Machining a smooth surface of ceramic material by laser fracture machining technique

Cracking and decohesion of a thin Al2O3 film on a ductile Al-5%Mg substrate

Statistical fatigue properties in the large strain region of a stainless steel sheet for use as an abrasion strip on helicopter rotor blades

Failure analysis of explanted sternal wires

Silicon MEMS components: a fatigue life assessment approach

Investigation of wear mechanisms through in situ observation during microscratching inside the scanning electron microscope

Scratchability of soda-lime silica (SLS) glasses: Dynamic fracture analysis

Cluster Metrics

Authors
soboyejo, wo 3
shaw, ba 3
jung, p 3
eifler, d 3
chen, j 3
bouchaud, e 3
zhao, mc 2
zhang, j 2
yang, k 2
yamaguchi, m 2
vardosanidze, m 2
ullmaier, h 2
ueda, y 2
tanaka, h 2
takashima, k 2

Sources
materials science and engineering a-structural materials properties microstructure and processing 18
international journal of fatigue 9
advances in fracture and strength, pts 1- 4 9
engineering failure analysis 7
journal of materials science 6
fatigue & fracture of engineering materials & structures 6
acta materialia 6

acta metallurgica sinica 5
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 4
journal of the american ceramic society 4
fractography of advanced ceramics ii 4
physical review letters 3
metallurgical and materials transactions a-physical metallurgy and materials science 3
journal of the japan institute of metals 3
journal of nuclear materials 3

Keywords
materials science, multidisciplinary 58
engineering, mechanical 30
fracture 29
behavior 27
materials science, multidisciplinary 22
microstructure 19
fatigue 18
engineering 16
metallurgy & metallurgical 16
metallurgy & metallurgical engineering 15
growth 13
materials science, ceramics 12
deformation 12
mechanical-properties 11
mechanical-properties 11

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2005 179
2004 28
2006 3

Country
usa 50
japan 38
peoples r china 32
germany 20
france 13
england 13
south korea 9
italy 9
taiwan 7
australia 7
spain 6
canada 6
india 5

czech republic 5
switzerland 4

Institution
chinese acad sci 8
univ newcastle upon tyne 4
seoul natl univ 4
nagoya univ 4
kagoshima univ 4
cea saclay 4
univ tokyo 3
univ sevilla 3
univ dayton 3
princeton univ 3
osaka univ 3
northwestern polytech univ 3
natl inst mat sci 3
georgia inst technol 3
csic 3

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science citation index 210

- CLUSTER 115
  Materials subject to stress and strain, focusing on welded materials, residual stresses, effects of loading, and stress relaxation (131 Records)

(Countries: USA, China, Japan, France. Institutions: Kyoto Institute of Technology, CAS. USA include Colorado School of Mines, USAF, University of Michigan, University of Dayton.).

Cluster Syntax Features

Descriptive Terms
stress 43.5%, weld 7.7%, residu 7.2%, residual.stress 5.9%, residual.stresses 1.9%, strain 1.3%, steel 1.2%, compress 0.9%, tensil 0.8%, peen 0.6%, surfac 0.6%, load 0.4%, surface.stress 0.3%, layer 0.3%, relax 0.3%

Discriminating Terms

stress 28.4%, weld 5.4%, residu 4.6%, residual.stress 4.1%, film 1.6%, residual.stresses 1.3%, nanoparticl 0.6%, magnet 0.6%, nanotub 0.6%, steel 0.6%, carbon 0.6%, particl 0.5%, strain 0.5%, compress 0.5%, peen 0.5%

Single Word Terms

stress 121, surfac 62, residu 57, mechan 53, materi 46, high 42, rai 42, tensil 41, compress 40, measur 39, diffract 38, electron 37, temperatur 36, structur 36, layer 33

Double Word Terms

residual.stress 42, ray.diffraction 34, residual.stresses 33, electron.microscopy 21, scanning.electron 17, compressive.stress 14, mechanical.properties 13, finite.element 12, stress.distribution 12, transmission.electron 10, surface.layer 10, compressive.residual 10, stress.strain 10, tensile.stress 10, stainless.steel 10

Triple Word Terms

transmission.electron.microscopy 10, scanning.electron.microscopy 10, atomic.force.microscopy 6, scanning.electron.microscope 6, residual.stress.distribution 6, four.point.bending 5, austenitic.stainless.steel 5, compressive.residual.stress 5, compressive.residual.stresses 5, residual.stress.state 5, electron.microscope.sem 4, tensile.residual.stress 4, residual.stresses.surface 4, residual.compressive.stress 4, ray.diffraction.xrd 3

Term Cliques

19.85% weld steel
38.55% stress surfac surface.stress relax
32.44% stress strain surface.stress relax
34.50% stress residu peen load relax
38.78% stress residu strain layer relax
37.56% stress residu strain load relax
41.83% stress residu strain tensil load
39.95% stress residu strain steel tensil layer
36.39% stress residu residual.stresses compress peen load
40.33% stress residu residual.stresses compress tensil load
36.86% stress residu residual.stress peen surfac layer relax
36.47% stress residu residual.stress residual.stresses steel compress peen surfac layer
39.10% stress residu residual.stress residual.stresses steel compress tensil surfac layer

Sample Cluster Record Titles

A study on a rigid body boundary layer interface force model for stress calculation and stress-strain behaviour of nanoscale uniaxial tension

Effect of oxide and nitride films on strength of silicon: A study using controlled small-scale flaws

Residual stress determination on lithium disilicate glass-ceramic by nanoindentation

Residual compressive stress field in TC18 ultra-high strength titanium alloy by shot peening

The evaluation of Young's modulus and residual stress of nickel films by microbridge testings

Analysis by speckle interferometry of the dependency of yield stress on residual stress

Stress fields of a spheroidal inhomogeneity with an interphase in an infinite medium under remote loadings

Non-destructive analysis of surface stresses using grazing incident x-ray diffraction

A new method for measuring residual stress relaxation during nanoindentation

Cluster Metrics

Authors

pezzotti, g 6
zhou, y 2
xu, kw 2
wang, k 2
wang, f 2
vignal, v 2
temiz, s 2
shirokoff, j 2
sekiguchi, y 2
sathish, s 2
rasmussen, pa 2
ozel, a 2
oltra, r 2
micele, l 2
marya, m 2

Sources

microsystem technologies-micro-and nanosystems-information storage and processing systems 6
residual stresses vii, proceedings 5
metallurgical and materials transactions a-physical metallurgy and materials science 5
materials science and engineering a-structural materials properties microstructure and processing 5
journal of materials science & technology 3

journal of applied physics 3
journal of adhesion science and technology 3
applied surface science 3
applied physics letters 3
transactions of nonferrous metals society of china 2
surface & coatings technology 2
rare metal materials and engineering 2
optics and lasers in engineering 2
materials transactions 2
materials science and technology 2

Keywords
materials science, multidisciplinary 36
engineering 17
metallurgy & metallurgical 17
residual stress 15
metallurgy & metallurgical engineering 12
materials science, multidisciplinary 12
behavior 12
physics, applied 11
engineering, electrical & electronic 10
physics, applied 9
deformation 9
multidisciplinary 8
microstructure 8
materials science, 8
residual stress 7

Publication Year
2005 109
2004 21
2006 1

Country
usa 29
peoples r china 21
japan 15
france 13
south korea 10
germany 8
taiwan 6
england 5
australia 4
turkey 3
spain 3
poland 3

italy 3
india 3
canada 3

Institution
kyoto inst technol 6
chinese acad sci 6
seoul natl univ 3
ensam 3
colorado sch mines 3
usaf 2
univ michigan 2
univ dayton 2
univ bourgogne 2
univ aix marseille 3 2
tech univ denmark 2
russian acad sci 2
pusan natl univ 2
polish acad sci 2
peking univ 2

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science citation index 131

- CLUSTER 140
  Nanoidentation, especially to test hardness, elasticity/ plasticity, and mechanical properties of materials (278 Records)

(Countries: USA, followed by China, Japan. Institutions: CAS, Tsing Hua University, University Poitiers, ORNL, CNRS. Other USA include UCB, OSU, University of Tennessee, University of Illinois, UCSF).

Cluster Syntax Features

Descriptive Terms

indent 32.0%, nanoindent 10.3%, hard 4.9%, elast 4.5%, modulu 3.1%, load 2.8%, plastic 2.2%, deform 2.1%, contact 1.1%, elastic.modulus 1.1%, disloc 1.0%, test 0.9%, tip 0.9%, curv 0.8%, stress 0.8%

Discriminating Terms

indent 22.6%, nanoindent 7.1%, hard 2.9%, elast 2.7%, modulu 1.9%, film 1.4%, load 1.4%, plastic 1.3%, deform 1.1%, elastic.modulus 0.7%, nanoparticl 0.7%, particl 0.6%, magnet 0.6%, nanotub 0.6%, carbon 0.6%

Single Word Terms

indent 174, nanoindent 148, hard 129, elast 126, properti 116, modulu 115, load 115, mechan 114, materi 111, surfac 97, deform 96, plastic 93, test 87, measur 76, model 71

Double Word Terms

elastic.modulus 62, mechanical.properties 60, atomic.force 44, young.modulus 39, finite.element 31, plastic.deformation 28, force.microscopy 27, load.displacement 24, contact.area 22, hardness.elastic 22, indentation.depth 22, electron.microscopy 21, transmission.electron 20, elastic.plastic 20, nano.indentation 19

Triple Word Terms

atomic.force.microscopy 27, hardness.elastic.modulus 21, atomic.force.microscope 17, transmission.electron.microscopy 15, hardness.young.modulus 11, force.microscopy.afm 11, molecular.dynamics.simulations 9, load.displacement.curve 7, elastic.modulus.hardness 7, load.displacement.curves 7, force.microscope.afm 7, young.modulus.hardness 6, microscopy.atomic.force 6, soda.lime.glass 6, force.displacement.curves 6

Term Cliques

33.32% nanoindent elast load deform contact elastic.modulus tip curv
33.85% nanoindent elast modulu load contact elastic.modulus test tip curv
37.54% nanoindent hard elast modulu load elastic.modulus test tip
35.67% indent load plastic deform disloc stress
38.55% indent elast load test curv stress
38.28% indent elast load plastic deform curv stress
35.79% indent nanoindent load plastic deform contact disloc tip
37.81% indent nanoindent elast load plastic deform contact tip curv
38.33% indent nanoindent elast modulu load contact test tip curv
39.00% indent nanoindent hard load plastic disloc tip

43.06% indent nanoindent hard elast load plastic tip
42.58% indent nanoindent hard elast modulu load test tip

Sample Cluster Record Titles

Hardness and elastic modulus of ion-nitrided titanium obtained by nanoindentation

Investigation of nanoindentation on Co/Mo multilayers by the continuous stiffiess measurement technique

Comparison of the Young's modulus of polysilicon film by tensile testing and nanoindentation

Deformation free energy and elastic description of a self-assembled system

On the evaluation of stresses during nanoindentation with sharp indenters

Investigation of mechanical properties of diatom frustules using nanoindentation

Mechanical properties determined by nanoindentation tests

Nanoporous Au: A high yield strength material

A microelectromechanical load sensor for in situ electron and x-ray microscopy tensile testing of nanostructures

Cluster Metrics

Authors

le bourhis, e 6
youn, sw 5
pharr, gm 5
patriarche, g 5
kang, cg 5
gong, jh 5
zhou, hx 3
zhang, zy 3
wei, l 3
swain, mv 3
riviere, jp 3
pippan, r 3
peng, zj 3
michailidis, n 3

miao, hz 3

Sources
materials science and engineering a-structural materials properties microstructure and processing 20
journal of materials research 18
applied physics letters 14
thin solid films 13
acta materialia 13
physical review b 9
surface & coatings technology 8
scripta materialia 6
nanotechnology 6
journal of applied physics 6
acta metallurgica sinica 6
wear 5
rare metal materials and engineering 5
journal of the mechanics and physics of solids 5
journal of micromechanics and microengineering 4

Keywords
materials science, multidisciplinary 109
nanoindentation 73
hardness 63
nanoindentation 51
indentation 38
load 37
physics, applied 34
materials science, multidisciplinary 28
engineering 27
metallurgy & metallurgical 27
physics, applied 25
mechanical-properties 25
indentation 24
behavior 24
deformation 23

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2005 235
2004 33
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2003 1

Country
usa 86
peoples r china 45

japan 34
germany 22
france 21
south korea 17
england 16
taiwan 10
italy 9
spain 8
australia 8
singapore 7
sweden 5
russia 5
ukraine 4

Institution
chinese acad sci 12
tsing hua univ 9
univ poitiers 7
oak ridge natl lab 7
cnrs 7
univ calif berkeley 6
tohoku univ 6
ohio state univ 6
univ tennessee 5
univ sydney 5
univ illinois 5
univ cambridge 5
univ calif san francisco 5
shanghai jiao tong univ 5
pusan natl univ 5

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- # CLUSTER 112
  Deformation behavior, shear bands, and related mechanical properties of materials and microstructures (239 Records)

(Countries: USA, China, followed by Russia, Germany, followed by Japan, South Korea, Poland. Institutions: CAS, RAS, UFA State Aviation Technical University. USA include UCD, JHU, University of Tennessee).

Cluster Syntax Features

Descriptive Terms
deform 34.1%, grain 6.0%, plastic 5.6%, strain 5.1%, plastic.deformation 3.6%, shear 2.3%, microstructur 1.2%, mechan 0.8%, shear.bands 0.7%, nanocrystallin 0.7%, alloi 0.7%, disloc 0.7%, boundari 0.7%, ultrafine.grained 0.6%, materi 0.6%

Discriminating Terms
deform 23.1%, plastic 3.6%, grain 2.9%, strain 2.7%, plastic.deformation 2.5%, film 2.0%, shear 1.4%, surfac 0.7%, nanoparticl 0.7%, magnet 0.6%, nanotub 0.6%, carbon 0.6%, particl 0.5%, shear.bands 0.5%, deposit 0.5%

Single Word Terms
deform 213, grain 139, strain 129, plastic 120, mechan 104, high 103, size 98, materi 95, microstructur 90, structur 84, temperatur 83, electron 71, stress 67, microscopi 67, metal 66

Double Word Terms
plastic.deformation 94, electron.microscopy 58, transmission.electron 54, grain.size 52, room.temperature 36, strain.rate 36, mechanical.properties 35, channel.angular 32, equal.channel 31, shear.bands 30, grain.boundary 29, ultrafine.grained 28, angular.pressing 26, grain.boundaries 24, high.pressure 23

Triple Word Terms
transmission.electron.microscopy 47, equal.channel.angular 31, channel.angular.pressing 26, angular.pressing.ecap 18, bulk.metallic.glass 15, high.pressure.torsion 15, grain.boundary.sliding 14, electron.microscopy.tem 14, plastic.deformation.spd 12, scanning.electron.microscopy 11, ultra.fine.grained 9, resolution.transmission.electron 9, high.resolution.transmission 9, ultrafine.grained.ufg 8, strain.rate.sensitivity 8

Term Cliques
40.48% deform strain shear microstructur alloi disloc boundari materi
40.66% deform strain shear microstructur shear.bands alloi

44.49% deform grain strain microstructur mechan alloi disloc boundari materi
41.38% deform grain strain microstructur mechan alloi disloc boundari ultrafine.grained
41.46% deform grain plastic microstructur mechan nanocrystallin alloi disloc boundari materi
38.66% deform grain plastic microstructur mechan nanocrystallin alloi disloc boundari ultrafine.grained
41.63% deform grain plastic plastic.deformation mechan nanocrystallin alloi disloc boundari materi
38.83% deform grain plastic plastic.deformation mechan nanocrystallin alloi disloc boundari ultrafine.grained

Sample Cluster Record Titles

Modeling elastic and plastic deformations in nonequilibrium processing using phase field crystals

Crystalline properties and morphological changes in plastically deformed isotatic polypropylene evaluated by X-ray diffraction and transmission electron microscopy

Evolution of crystallographic orientations in an aluminum single crystal during tensile deformation

Strength of ultrafine-grained corrosion-resistant steels after severe plastic deformation

The role of dynamic recrystallization in [001] single-crystal W and W-Ta alloy ballistic rod penetration into steel targets

Characteristics of adiabatic shear bands in the orthogonal, cutting of 30CrNi(3)MOV steel

AFM observations of slip band development in Al single crystals

Plastic flow of ultrahigh pressure metamorphic rocks: microstructure and deformation mechanisms.

Methodical features of the measurement of mechanical properties of ultrafine-grained materials

Cluster Metrics

Authors

lavernia, ej 7
valiev, rz 6
kurzydlowski, kj 6
wei, bc 5

schafler, e 5
ma, e 5
han, bq 5
valiev, r 4
pippan, r 4
pakiela, z 4
lojkowski, w 4
kim, kb 4
eckert, j 4
das, j 4
baier, f 4

Sources

acta materialia 20
materials science and engineering a-structural materials properties microstructure and processing 17
applied physics letters 15
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 13
bulk and graded nanometals 12
scripta materialia 9
reviews on advanced materials science 9
physics of metals and metallography 7
metallurgical and materials transactions a-physical metallurgy and materials science 5
icotom 14: textures of materials, pts 1and 2 5
advanced engineering materials 5
zeitschrift fur metallkunde 4
physica status solidi a-applications and materials science 4
materials science and technology 4
journal of materials science 4

Keywords

materials science, multidisciplinary 98
engineering 44
metallurgy & metallurgical 44
behavior 35
severe plastic-deformation 30
metallurgy & metallurgical engineering 30
microstructure 30
metals 27
deformation 26
physics, applied 23
copper 20
mechanical-properties 19
deformation 18
nanocrystalline 17

ductility 17

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2005 201
2004 34
2006 4

Country
usa 51
peoples r china 48
russia 33
germany 30
japan 21
south korea 16
poland 16
austria 11
france 8
ukraine 7
denmark 6
australia 6
switzerland 4
singapore 4
canada 4

Institution
chinese acad sci 17
russian acad sci 15
ufa state aviat tech univ 14
univ calif davis 10
polish acad sci 9
harbin inst technol 9
warsaw univ technol 8
univ vienna 8
johns hopkins univ 7
forschungszentrum karlsruhe 6
univ tennessee 5
city univ hong kong 5
tech univ darmstadt 4
shanghai jiao tong univ 4
riso natl lab 4

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science citation index 239

- # CLUSTER 86

  Dislocations, deformation, (crystal) twinning, and stress/ strain in materials, particularly crystals (147 Records)

(Countries: USA dominant, China, followed by Germany, France. Institutions: CAS, Paul Scherrer Institute, LANL. Other USA include LLNL, MIT, UCB, Georgia Institute of Technology, University of Illinois, SNL, Ohio State University, North Carolina State University.).

Cluster Syntax Features

Descriptive Terms

disloc 47.4%, deform 5.8%, twin 4.8%, stress 3.2%, grain 2.2%, boundari 1.6%, slip 1.3%, plastic 1.3%, strain 1.3%, creep 1.2%, nucleat 0.6%, glide 0.5%, partial.dislocations 0.5%, cu 0.5%, nanocrystallin 0.5%

Discriminating Terms

disloc 31.8%, deform 3.4%, twin 3.1%, film 1.8%, stress 1.5%, slip 0.9%, creep 0.8%, boundari 0.8%, grain 0.7%, plastic 0.7%, nanoparticl 0.7%, surfac 0.7%, carbon 0.6%, magnet 0.6%, nanotub 0.6%

Single Word Terms

disloc 130, deform 76, stress 68, mechan 66, grain 64, high 59, electron 55, strain 50, temperatur 50, microscopi 49, size 49, boundari 48, transmiss 47, plastic 45, structur 42

Double Word Terms

transmission.electron 45, electron.microscopy 42, grain.boundary 23, plastic.deformation 21, dislocation.density 21, ray.diffraction 18, partial.dislocations 18, grain.boundaries 17, strain.rate 15, grain.size 14, molecular.dynamics 14, high.resolution 13, microscopy.tem 13, dislocation.nucleation 12, room.temperature 12

Triple Word Terms
transmission.electron.microscopy 39, electron.microscopy.tem 13, molecular.dynamics.simulations 10, resolution.transmission.electron 10, transmission.electron.microscope 9, high.resolution.transmission 9, high.strain.rate 7, grain.boundary.sliding 7, shockley.partial.dislocations 5, deformation.nanocrystalline.materials 4, liquid.nitrogen.temperature 4, atomic.force.microscopy 4, force.microscopy.afm 4, ray.diffraction.peak 4, dislocation.cell.structure 4

Term Cliques
28.91% deform strain partial.dislocations cu
33.50% deform plastic strain cu
23.95% deform twin glide partial.dislocations cu
26.19% deform twin slip plastic glide cu
29.15% deform twin grain boundari nucleat partial.dislocations nanocrystallin
28.57% deform twin grain boundari nucleat glide partial.dislocations
29.68% deform twin grain boundari slip plastic nucleat glide
41.98% disloc deform stress grain strain partial.dislocations nanocrystallin
40.62% disloc deform stress grain strain creep partial.dislocations
49.09% disloc deform stress grain plastic strain
39.29% disloc deform stress grain boundari nucleat partial.dislocations nanocrystallin
38.78% disloc deform stress grain boundari nucleat glide partial.dislocations
40.43% disloc deform stress grain boundari creep partial.dislocations
38.62% disloc deform stress grain boundari slip plastic nucleat glide

Sample Cluster Record Titles

Evidence of dislocations in melt-crystallised and plastically deformed polypropylene

Dislocation climb in nanocrystalline materials under high-strain-rate superplastic deformation

Partial and split dislocations in deformed nanocrystalline metals

Room temperature dislocation plasticity in silicon

Twinning and recrystallisation as crack tip deformation mechanisms during fracture

Strain-induced grain refinement of cobalt during surface mechanical attrition treatment

Nanoscale defect structures at crystal-glass interfaces

[Microcrack initiation and growth in heat-resistant 15Kh2MFA steel under cyclic deformation]

[Deformation behaviour and microstructure of nanocrystalline electrodeposited and high pressure torsioned nickel]

Cluster Metrics

Authors
van swygenhoven, h 7
derlet, pm 6
ungar, t 5
misra, a 5
lu, k 5
froseth, ag 5
ovid'ko, ia 4
hoagland, rg 4
viswanathan, gb 3
lu, l 3
hirth, jp 3
farkas, d 3
argon, as 3
zhou, sj 2
zhou, mz 2

Sources
materials science and engineering a-structural materials properties microstructure and processing 20
acta materialia 13
philosophical magazine 11
applied physics letters 6
zeitschrift fur metallkunde 5
scripta materialia 4
metallurgical and materials transactions a-physical metallurgy and materials science 4
reviews on advanced materials science 3
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 3
physical review letters 3
philosophical magazine letters 3
journal of materials science 3
journal of applied physics 3
international journal of plasticity 3
polymer 2

Keywords

materials science, multidisciplinary 76
engineering 25
metallurgy & metallurgical 25
metallurgy & metallurgical engineering 23
deformation 23
metals 22
behavior 19
mechanics 16
copper 16
physics, applied 15
dislocations 14
physics, applied 12
stress 10
crystals 10
alloys 10

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2005 121
2004 21
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2003 1

Country
usa 59
peoples r china 19
germany 12
france 12
japan 10
switzerland 9
russia 8
canada 7
india 6
hungary 6
poland 4
italy 4
ukraine 3
taiwan 3
spain 3

Institution
chinese acad sci 12
paul scherrer inst 8
los alamos natl lab 7
lorand eotvos univ 6
lawrence livermore natl lab 6
mit 5

univ calif berkeley 4
russian acad sci 4
georgia inst technol 4
univ illinois 3
univ antwerp 3
sandia natl labs 3
polish acad sci 3
ohio state univ 3
n carolina state univ 3

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science citation index 147

- # CLUSTER 52
  Grain boundary characteristics and processes, including diffusion, segregation, fracture, and growth (220 Records)

(Countries: Japan, USA, followed by Germany, China, France. Institutions: University of Tokyo, RAS, Tohoku University, National Institute of Materials Science. USA includes UCB, ORNL.).

Cluster Syntax Features

Descriptive Terms
boundari 34.5%, grain 25.3%, grain.boundary 15.2%, grain.boundaries 4.7%, diffus 0.7%, segreg 0.7%, bicryst 0.4%, nanocrystallin 0.4%, phase 0.3%, sigma 0.3%, cu 0.3%, fractur 0.2%, microstructur 0.2%, disloc 0.2%, intergranular 0.2%

Discriminating Terms
boundari 22.5%, grain 14.7%, grain.boundary 10.3%, grain.boundaries 3.1%, film 1.4%, nanoparticl 0.7%, surfac 0.7%, nanotub 0.6%, carbon 0.5%, particl 0.5%, quantum 0.4%, segreg 0.4%, magnet 0.4%, crystal 0.4%, polym 0.4%

Single Word Terms
boundari 220, grain 207, electron 95, high 93, structur 91, microscopi 77, temperatur 73, phase 68, transmiss 60, atom 56, energi 55, size 54, materi 53, surfac 51, diffus 48

Double Word Terms
grain.boundary 159, grain.boundaries 131, electron.microscopy 57, transmission.electron 56, high.resolution 33, grain.size 27, resolution.transmission 19, room.temperature 18, grain.growth 17, boundary.diffusion 15, nanocrystalline.materials 14, boundary.energy 13, ray.diffraction 13, tilt.grain 13, high.angle 13

Triple Word Terms
transmission.electron.microscopy 44, resolution.transmission.electron 19, high.resolution.transmission 19, grain.boundary.diffusion 15, grain.boundary.energy 13, grain.boundary.structure 13, grain.boundary.sliding 12, transmission.electron.microscope 11, electron.microscopy.tem 11, atomic.force.microscopy 10, grain.boundary.segregation 10, electron.microscopy.hrtem 9, angle.grain.boundaries 9, scanning.electron.microscopy 8, tilt.grain.boundaries 7

Term Cliques
48.38% boundari grain grain.boundaries nanocrystallin phase microstructur disloc
46.75% boundari grain grain.boundaries nanocrystallin phase cu disloc
46.17% boundari grain grain.boundaries segreg phase sigma cu
48.90% boundari grain grain.boundaries segreg nanocrystallin phase microstructur
47.27% boundari grain grain.boundaries segreg nanocrystallin phase cu
47.60% boundari grain grain.boundaries diffus segreg nanocrystallin microstructur
45.97% boundari grain grain.boundaries diffus segreg nanocrystallin cu
50.19% boundari grain grain.boundary nanocrystallin phase microstructur disloc
48.57% boundari grain grain.boundary nanocrystallin phase cu disloc
50.30% boundari grain grain.boundary bicryst cu disloc
47.99% boundari grain grain.boundary segreg phase sigma cu
41.14% boundari grain grain.boundary segreg nanocrystallin cu fractur intergranular
45.34% boundari grain grain.boundary segreg nanocrystallin phase microstructur intergranular
43.92% boundari grain grain.boundary segreg nanocrystallin phase cu intergranular
40.23% boundari grain grain.boundary segreg bicryst cu fractur intergranular
45.06% boundari grain grain.boundary segreg bicryst sigma cu
44.20% boundari grain grain.boundary diffus segreg nanocrystallin microstructur intergranular
42.78% boundari grain grain.boundary diffus segreg nanocrystallin cu intergranular

Sample Cluster Record Titles

Dislocation-grain boundary interactions in martensitic steel observed through in situ nanoindentation in a transmission electron microscope

[Numerical and experimental analysis of Cu diffusion in plasma-treated tungsten barrier]

[Local properties of grain boundaries in semiconducting ceramics]

[Temperature dependence of oxygen ion transport in Sr plus Mg-substituted LaGaO3 (LSGM) with varying grain sizes]

[Application of magnetic field to the control of grain boundary segregation in iron]

[Toughening of brittle materials by grain boundary engineering]

[Does nanocrystalline Cu deform by Coble creep near room temperature?]

[Nanoscale waviness of low-angle grain boundaries]

[The control of grain boundary segregation and segregation-induced brittleness in iron by the application of a magnetic field]

Cluster Metrics

Authors
yamamoto, t 11
ikuhara, y 10
watanabe, t 9
tsurekawa, s 9
matsunaga, k 6
tsuzaki, k 4
straumal, bb 4
shibata, n 4
ohmura, t 4
zhang, j 3
yoshida, h 3
wu, js 3
west, gd 3
suzuki, t 3
soer, wa 3

Sources
acta materialia 17
journal of materials science 15
applied physics letters 10
materials science and engineering a-structural materials properties microstructure and processing 8
zeitschrift fur metallkunde 7
journal of applied physics 7

reviews on advanced materials science 6
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 6
physical review b 6
scripta materialia 5
diffusion in materials: dimat 2004, pt 1and 2 5
solid state ionics 4
philosophical magazine 4
journal of the electrochemical society 4
journal of materials research 4

Keywords

materials science, multidisciplinary 86
engineering 33
metallurgy & metallurgical 32
physics, applied 24
growth 22
metallurgy & metallurgical engineering 21
segregation 21
microstructure 17
grain boundary 16
diffusion 16
alloys 14
chemistry, physical 13
thin-films 13
metals 13
materials science, ceramics 12

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Country

japan 52
usa 48
germany 31
peoples r china 22
france 21
russia 17
england 16
south korea 8
taiwan 7
netherlands 7
australia 6

sweden 5
singapore 5
switzerland 4
spain 4

Institution
univ tokyo 14
russian acad sci 13
tohoku univ 11
natl inst mat sci 11
max planck inst met res 7
cnrs 7
chinese acad sci 7
univ calif berkeley 5
kyoto univ 5
univ gottingen 4
oak ridge natl lab 4
nanyang technol univ 4
chalmers univ technol 4
warsaw univ technol 3
univ warwick 3

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science citation index 220

- CLUSTER 166
  Effects of and influences on grain size, emphasizing grain growth, texture characterization, and effect of annealing (283 Records)

(Countries: USA, China, followed by Japan, Germany. Institutions: CAS, RAS, CNR. USA include UCD, UCB.)

Cluster Syntax Features

Descriptive Terms
grain 53.8%, grain.size 7.2%, size 3.3%, nanocrystallin 2.8%, grain.growth 1.9%, microstructur 1.1%, growth 1.0%, grain.sizes 0.6%, textur 0.5%, boundari 0.5%, sampl

0.3%, phase 0.3%, temperatur 0.3%, anneal 0.3%, materi 0.3%

Discriminating Terms
grain 39.2%, grain.size 5.3%, film 1.7%, nanocrystallin 1.6%, grain.growth 1.5%, size 0.9%, carbon 0.7%, nanoparticl 0.7%, nanotub 0.6%, surfac 0.6%, quantum 0.5%, grain.sizes 0.5%, polym 0.4%, structur 0.4%, microstructur 0.4%

Single Word Terms
grain 279, size 198, electron 108, temperatur 104, high 103, nanocrystallin 88, growth 87, microstructur 86, mechan 81, structur 78, phase 78, properti 77, boundari 75, microscopi 72, materi 70

Double Word Terms
grain.size 149, electron.microscopy 64, transmission.electron 57, grain.growth 49, grain.sizes 49, ray.diffraction 44, grain.boundaries 42, scanning.electron 37, average.grain 28, room.temperature 26, grain.boundary 26, mechanical.properties 19, size.distribution 18, coarse.grained 18, high.resolution 18

Triple Word Terms
transmission.electron.microscopy 44, scanning.electron.microscopy 29, average.grain.size 22, grain.size.distribution 18, electron.microscopy.tem 14, size.grain.size 11, grain.size.grain 11, reduction.grain.size 10, ray.diffraction.xrd 10, transmission.electron.microscope 8, electron.microscopy.sem 8, sem.transmission.electron 8, atomic.force.microscopy 6, temperature.grain.size 6, abnormal.grain.growth 6

Term Cliques
37.76% grain microstructur growth boundari sampl temperatur anneal
39.17% grain microstructur growth boundari sampl phase temperatur
38.26% grain grain.growth microstructur growth boundari phase temperatur
33.57% grain grain.growth microstructur growth textur boundari temperatur anneal
41.22% grain nanocrystallin growth boundari sampl temperatur
40.16% grain nanocrystallin grain.growth growth boundari temperatur
46.79% grain grain.size size grain.sizes phase temperatur materi
45.23% grain grain.size size grain.sizes sampl temperatur anneal
46.64% grain grain.size size grain.sizes sampl phase temperatur
45.89% grain grain.size size microstructur boundari phase temperatur materi
44.52% grain grain.size size microstructur boundari sampl temperatur anneal
45.76% grain grain.size size microstructur boundari sampl phase temperatur
48.61% grain grain.size size nanocrystallin boundari temperatur materi
48.46% grain grain.size size nanocrystallin boundari sampl temperatur
47.30% grain grain.size size nanocrystallin grain.sizes temperatur materi
47.15% grain grain.size size nanocrystallin grain.sizes sampl temperatur

Sample Cluster Record Titles

Interface intermixing and in-plane grain size in aluminum transition-metal bilayers

The influence of time, temperature, and grain size on indentation creep in high-purity nanocrystalline and ultrafine grain copper

Effect of nanocrystalline grain size on the electrochemical and corrosion behavior of nickel

Formation of Mg2Ni nanofibres in a Mg-based metal matrix composite

Grain size dependence of optical properties and positron annihilation parameters in Bi2O3 powder

The effect of prepared parameters on the microstructure of electrodeposited nanocrystalline nickel coating

Radon emanation dependence on grain configuration

Grain structure of thin electrodeposited and rolled copper foils

Crystal grain growth at the alpha-uranium phase transformation in praseodymium

Cluster Metrics

Authors

ramasamy, s 5
gao, rw 5
feng, wc 5
zhang, jx 4
thangadurai, p 4
song, xy 4
mazzone, am 4
li, w 4
kaito, c 4
yang, ky 3
suzuki, h 3
schoenung, jm 3
sato, t 3
lavernia, ej 3
kurzydlowski, kj 3

Sources

journal of applied physics 10
materials science and engineering a-structural materials properties microstructure and processing 9
journal of materials science 9
acta materialia 9
thin solid films 8
bulk and graded nanometals 8
journal of the american ceramic society 7
applied physics letters 7
scripta materialia 6
journal of magnetism and magnetic materials 6
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 5
metallurgical and materials transactions a-physical metallurgy and materials science 5
ieee transactions on magnetics 5
applied physics a-materials science & processing 5
zeitschrift fur metallkunde 4

Keywords
materials science, multidisciplinary 98
engineering 36
metallurgy & metallurgical 36
microstructure 32
physics, applied 30
physics, applied 25
growth 21
behavior 20
materials science, ceramics 18
grain growth 15
physics, condensed matter 14
nickel 14
films 14
deformation 14
alloys 14

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2005 238
2004 36
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Country
usa 68
peoples r china 53
japan 36
germany 29
south korea 19

france 17
russia 16
india 14
england 14
poland 10
italy 10
taiwan 7
israel 7
spain 6
canada 6

Institution
chinese acad sci 11
russian acad sci 8
cnr 7
warsaw univ technol 6
univ calif davis 6
shandong univ 6
korea adv inst sci & technol 6
univ saarland 5
univ madras 5
univ calif berkeley 5
technion israel inst technol 5
ritsumeikan univ 5
univ new s wales 4
univ cambridge 4
seoul natl univ 4

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CATEGORY 5 - 508B1a (9 leaf clusters)

Properties of Thin Films (2251 REC)
THRUST
()

- Thin films and processes related to film thickness, including dewetting, deposition, and growth (411 Records) Cluster 225
- Films, focusing on polymer and polyimide films, mechanical and optical properties (such as the refractive index), effects of irradiation, and conductivity (558 Records) Cluster 251
- Properties and fabrication by deposition of multilayer films, especially Langmuir, Blodgett, Langmuir-Blodgett, and polyelectrolyte films (231 Records) Cluster 200
- Preparation, characterization, and applications of layered double hydroxides (LDHs) (47 Records) Cluster 8
- YBCO (YBa2Cu3O7-x) films, emphasizing YBCO conductors and growth of buffer layers, especially CeO2 (59 Records) Cluster 16
- Indium tin oxide (ITO) thin films, focusing on transparency, transmittance, and resistivity of ITO films (95 Records) Cluster 33
- Oxide (especially WO3 and SnO2) films, emphasizing formation of anodic films, use as gas sensors, and electrochemical applications (238 Records) Cluster 209
- Preparation of films by magnetron sputtering, especially titanium (Ti), titanium nitride (TiN), and aluminium nitride (AlN) films (230 Records) Cluster 172
- Growth and characterization of films, focusing on effects of annealing, deposition, and copper, silicon, and gallium nitride films (382 Records) Cluster 231

- # CLUSTER 225
  Thin films and processes related to film thickness, including dewetting, deposition, and growth (411 Records)

(Countries: USA dominant, followed by China, Japan, Germany. Institutions: CAS, University of Illinois, Tsing Hua University. Other USA include UCB, University of Texas, ORNL.)

Cluster Syntax Features

Descriptive Terms
film 37.9%, thick 14.2%, film.thickness 5.9%, substrat 2.5%, surfac 1.5%, thin 1.1%, ultrathin 0.8%, interfac 0.5%, metal 0.5%, dewet 0.5%, layer 0.5%, lubric 0.5%, deposit 0.5%, silver 0.4%, growth 0.4%

Discriminating Terms
film 23.0%, thick 12.1%, film.thickness 6.2%, substrat 0.9%, nanotub 0.8%, magnet 0.8%, carbon 0.8%, nanoparticl 0.8%, ultrathin 0.7%, particl 0.7%, dewet 0.6%, structur 0.5%, quantum 0.5%, oxid 0.5%, dot 0.5%

Single Word Terms
film 408, thick 342, surfac 231, substrat 204, thin 195, deposit 125, structur 122, temperatur 120, microscopi 110, layer 108, measur 107, properti 103, atom 96, electron 95, forc 94

Double Word Terms
film.thickness 196, thin.films 83, atomic.force 71, force.microscopy 64, films.thickness 47, thin.film 47, electron.microscopy 41, ray.diffraction 32, thick.films 30, film.substrate 29, film.surface 27, films.grown 27, thick.film 25, microscopy.afm 24, film.thicknesses 24

Triple Word Terms
atomic.force.microscopy 59, force.microscopy.afm 24, transmission.electron.microscopy 20, scanning.electron.microscopy 16, surface.plasmon.resonance 15, films.film.thickness 12, ray.photoelectron.spectroscopy 11, surface.raman.scattering 11, glass.transition.temperature 11, film.thickness.film 10, poly.methyl.methacrylate 9, function.film.thickness 9, atomic.force.microscope 9, van.der.waals 9, electron.microscopy.tem 8

Term Cliques
42.38% film surfac metal deposit silver
43.67% film surfac ultrathin lubric
33.40% film surfac ultrathin interfac metal dewet growth
34.41% film surfac ultrathin interfac metal dewet layer

41.68% film surfac thin interfac metal deposit growth
42.68% film surfac thin interfac metal layer deposit
38.06% film surfac thin interfac metal dewet growth
39.07% film surfac thin interfac metal dewet layer
37.37% film film.thickness surfac ultrathin interfac dewet growth
46.14% film film.thickness substrat surfac thin interfac deposit growth
42.97% film film.thickness substrat surfac thin interfac dewet growth
43.98% film thick film.thickness surfac ultrathin interfac dewet layer
51.04% film thick film.thickness substrat surfac thin interfac layer deposit
48.23% film thick film.thickness substrat surfac thin interfac dewet layer

Sample Cluster Record Titles

Stimulated processes of production of silver nanoparticles in GeO2-Ag+ films

Thickness dependent valence fluctuation of CeN film

Surface enhanced Raman spectroscopy for adsorption studies on semiconductor nanostructured films

Investigation of the mechanical properties of thin films by nanoindentation, considering the effects of thickness and different coating-substrate combinations

Analyses of monophase film thickness by energy dispersion X-ray diffraction - Application to nitridation

Quantitative analysis of electrodeposited tin film morphologies by atomic force microscopy

Optical response in nanostructured thin metal films with dielectric over-layers

A rapid approach to reproducible, atomically flat gold films on mica

The control of thin film morphology by the interplay of dewetting, phase separation and microphase separation

Cluster Metrics

Authors

li, y 5
chiang, tc 4
zhang, zy 3
zhang, y 3
wang, j 3
vogt, bd 3

tanaka, h 3
stamm, m 3
soles, cl 3
rao, cnr 3
mckenzie, dr 3
lin, ek 3
lee, hj 3
lakowicz, jr 3
kasrai, m 3

Sources

physical review b 27
thin solid films 23
applied physics letters 16
langmuir 15
journal of applied physics 12
surface science 11
applied surface science 11
polymer 9
nanotechnology 6
macromolecules 6
applied physics a-materials science & processing 6
applied optics 6
acta materialia 6
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surface & coatings technology 5

Keywords

materials science, multidisciplinary 68
chemistry, physical 59
physics, applied 56
physics, applied 52
physics, condensed matter 43
thin-films 40
physics, 40
growth 35
condensed matter 26
physics, condensed matter 26
polymer science 25
thin-films 22
engineering, electrical & electronic 22
surfaces 22
surface 21

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Country
usa 112
peoples r china 55
japan 54
germany 46
south korea 20
france 19
russia 15
india 14
canada 14
england 13
singapore 10
italy 9
ukraine 8
spain 8
taiwan 7

Institution
chinese acad sci 13
univ illinois 8
tsing hua univ 7
univ tokyo 6
univ calif berkeley 6
seoul natl univ 6
russian acad sci 6
natl inst stand & technol 6
natl acad sci ukraine 6
tokyo inst technol 5
csic 5
city univ hong kong 5
univ texas 4
oak ridge natl lab 4
natl univ singapore 4

DataBase
science citation index 411

- # CLUSTER 251
  Films, focusing on polymer and polyimide films, mechanical and optical properties (such as the refractive index), effects of irradiation, and conductivity (558 Records)

(Countries: USA, China, Japan. Institutions: CAS, Tohoku University, Tsing Hua University, Tokyo Institute of Technology. USA includes University of Illinois.)

Cluster Syntax Features

Descriptive Terms
film 50.5%, polym 1.4%, surfac 1.2%, optic 1.0%, irradi 0.8%, properti 0.6%, coat 0.6%, polyimid 0.5%, conduct 0.4%, silica 0.4%, laser 0.4%, forc 0.3%, layer 0.3%, light 0.3%, thin 0.3%

Discriminating Terms
film 39.9%, magnet 1.1%, carbon 0.9%, nanotub 0.9%, particl 0.8%, quantum 0.7%, dot 0.5%, nanoparticl 0.5%, cell 0.5%, polyimid 0.5%, crystal 0.5%, irradi 0.4%, oxid 0.4%, structur 0.4%, singl 0.4%

Single Word Terms
film 558, surfac 239, properti 214, structur 198, microscopi 166, electron 150, high 145, thin 144, polym 142, optic 135, temperatur 133, measur 124, solut 117, thick 116, atom 115

Double Word Terms
atomic.force 99, force.microscopy 91, thin.films 74, electron.microscopy 73, scanning.electron 63, film.surface 45, ray.diffraction 42, microscopy.afm 39, mechanical.properties 39, optical.properties 37, polymer.film 37, polymer.films 35, refractive.index 35, spin.coating 34, sol.gel 30

Triple Word Terms
atomic.force.microscopy 88, scanning.electron.microscopy 48, force.microscopy.afm 39, transmission.electron.microscopy 24, fourier.transform.infrared 23, ray.photoelectron.spectroscopy 18, low.dielectric.constant 14, differential.scanning.calorimetry 14, angle.ray.scattering 13, electron.microscopy.tem 12,

transform.infrared.spectroscopy 12, atomic.force.microscope 12, small.angle.ray 11, scanning.electron.microscope 11, photoelectron.spectroscopy.xps 11

Term Cliques
32.51% film irradi laser light thin
34.70% film optic laser light thin
32.83% film optic coat silica forc thin
34.92% film optic properti coat silica forc
37.43% film surfac coat forc layer thin
35.93% film surfac coat silica forc thin
36.41% film surfac coat conduct forc thin
39.52% film surfac properti coat forc layer
38.02% film surfac properti coat silica forc
38.50% film surfac properti coat conduct forc
45.47% film surfac irradi thin
32.44% film polym polyimid layer light
33.51% film polym coat conduct forc thin
37.24% film polym properti polyimid layer
35.60% film polym properti coat conduct forc
35.77% film polym irradi light thin
32.28% film polym optic coat layer light thin
33.05% film polym optic coat forc layer thin
34.84% film polym optic properti coat forc layer

Sample Cluster Record Titles

Refractive index of doped polymers modified by electrical field

Dielectric properties of doped polymethylmethacrylate

Engineering the chemistry and nanostructure of porous Silicon Fabry-Perot films for loading and release of a steroid

Modelling irradiation induced glass transition in thin films

Silica-based photorefractive sol-gel films for holography

Micromorphology and conductivity of the vacuum-deposited polyaniline films

Dielectric and dynamic mechanical properties of polylmide-clay nanocomposite films

Self-organization of isotropic droplets in smectic-C free-standing films

Temperature sensors based on nanostructured PbS films

Cluster Metrics

Authors
yang, sy 6
wu, jt 6
uehara, y 6
zhang, yh 5
zhang, l 5
ushioda, s 5
usami, k 5
stumpe, j 5
sakamoto, k 5
kim, jh 5
fu, sy 5
xu, y 4
wu, d 4
sun, tl 4
park, sm 4

Sources
thin solid films 26
journal of physical chemistry b 22
langmuir 21
macromolecules 19
synthetic metals 14
chemistry of materials 13
applied surface science 12
applied physics letters 12
polymer 10
molecular crystals and liquid crystals 10
journal of non-crystalline solids 10
journal of applied physics 9
japanese journal of applied physics part 1-regular papers short notes & review papers 9
japanese journal of applied physics part 1-regular papers brief communications & review papers 9
sensors and actuators b-chemical 8

Keywords
chemistry, physical 100
materials science, multidisciplinary 94
polymer science 79
thin-films 54
physics, applied 53
physics, applied 53
materials science, multidisciplinary 47

physics, 45
physics, condensed matter 37
polymers 33
films 33
thin-films 32
chemistry, multidisciplinary 29
morphology 27
condensed matter 26

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Country
usa 105
peoples r china 104
japan 91
south korea 42
germany 41
italy 23
france 20
england 19
taiwan 15
russia 12
netherlands 12
australia 12
singapore 11
canada 11
india 10

Institution
chinese acad sci 37
tohoku univ 9
tsing hua univ 8
tokyo inst technol 8
natl tsing hua univ 7
natl inst adv ind sci & technol 7
cnr 7
city univ hong kong 7
yonsei univ 6
univ illinois 6
riken 6
pohang univ sci & technol 6
osaka univ 6
natl inst mat sci 6

nagoya univ 6

DataBase
science citation index 558

- # CLUSTER 200
  Properties and fabrication by deposition of multilayer films, especially Langmuir-Blodgett, and polyelectrolyte films (231 Records)

(Countries: China, USA, Japan. Institutions: CAS, NE Normal University, Kyoto University. USA includes UCB.).

Cluster Syntax Features

Descriptive Terms
film 24.2%, multilay 9.0%, layer 4.8%, langmuir 3.4%, multilayer.films 3.3%, blodgett 3.0%, langmuir.blodgett 2.8%, monolay 1.9%, layer.layer 1.8%, assembl 1.8%, blodgett.films 1.5%, langmuir.blodgett.films 1.4%, polyelectrolyt 0.8%, self 0.8%, deposit 0.6%

Discriminating Terms
film 10.1%, multilay 7.3%, multilayer.films 3.0%, langmuir 3.0%, blodgett 2.8%, langmuir.blodgett 2.6%, layer.layer 1.6%, layer 1.5%, blodgett.films 1.4%, langmuir.blodgett.films 1.3%, monolay 1.1%, magnet 0.8%, nanotub 0.8%, particl 0.8%, carbon 0.7%

Single Word Terms
film 231, layer 150, multilay 113, surfac 110, assembl 98, substrat 94, deposit 94, structur 89, microscopi 82, forc 77, self 75, atom 74, fabric 70, langmuir 69, thick 67

Double Word Terms
layer.layer 75, atomic.force 70, langmuir.blodgett 65, force.microscopy 64, multilayer.films 58, self.assembled 41, blodgett.films 39, microscopy.afm 36,

self.assembly 33, thin.films 26, layer.lbl 22, multilayer.film 22, films.deposited 20, ray.diffraction 20, film.thickness 20

Triple Word Terms
atomic.force.microscopy 62, langmuir.blodgett.films 39, force.microscopy.afm 36, layer.layer.lbl 22, layer.layer.self 18, layer.self.assembly 16, air.water.interface 15, films.layer.layer 14, surface.pressure.area 12, layer.layer.assembly 12, electrostatic.layer.layer 11, scanning.electron.microscopy 11, self.assembled.monolayers 11, fourier.transform.infrared 10, layer.layer.deposition 10

Term Cliques
48.66% film monolay assembl self deposit
42.50% film langmuir blodgett langmuir.blodgett monolay deposit
35.44% film langmuir blodgett langmuir.blodgett monolay blodgett.films langmuir.blodgett.films
44.64% film multilay layer multilayer.films layer.layer assembl polyelectrolyt self deposit

Sample Cluster Record Titles

Investigation of ITO surface modified by NPB and arachidic acid LB films

Langmuir-Blodgett film fabricated with soluble imidized polyimide

Structural properties of sputter-deposited CNx/TiN multilayer films

Molecular-level control of the photoluminescence from PPV nanostructured films

Alkoxysulfonate-functionalized PEDOT polyelectrolyte multilayer films: Electrochromic and hole transport materials

A new Co(II)-metalloviologen-based electrochromic material integrated in thin multilayer films

Electrochemistry of cytochrome c incorporated in Langmuir-Blodgett films of Nafion (R) and Eastman AQ 55 (R)

Integrated circuits protection with the Langmuir-Blodgett films

Polar properties of Langmuir-Blodgett films of copper phthalocyanines

Cluster Metrics

Authors
oliveira, on 9
xu, l 6
song, yl 5
jiang, l 5
ito, s 5
wang, eb 4
ohkita, h 4
li, yl 4
knoll, w 4
fushimi, t 4
aroca, rf 4
zucolotto, v 3
yang, y 3
wang, zq 3
wang, wj 3

Sources
langmuir 30
thin solid films 17
journal of physical chemistry b 17
colloids and surfaces a-physicochemical and engineering aspects 14
journal of colloid and interface science 6
journal of the american chemical society 5
chemistry of materials 5
chemical journal of chinese universities-chinese 5
synthetic metals 4
japanese journal of applied physics part 1-regular papers brief communications & review papers 4
chemical communications 4
biomacromolecules 4
applied surface science 4
surface science 3
journal of nanoscience and nanotechnology 3

Keywords
chemistry, physical 92
materials science, multidisciplinary 35
thin-films 27
monolayers 24
chemistry, multidisciplinary 23
physics, 23
films 23
surface 22

physics, applied 21
adsorption 21
surfaces 19
condensed matter 17
spectroscopy 16
polymer science 15
materials science, multidisciplinary 15

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Country

peoples r china 55
usa 47
japan 45
germany 23
brazil 11
france 9
canada 8
south korea 7
israel 7
taiwan 6
singapore 6
italy 6
india 5
england 5
hungary 4

Institution

chinese acad sci 21
ne normal univ 9
kyoto univ 9
univ sao paulo 6
natl univ singapore 6
max planck inst polymer res 6
zhejiang univ 4
univ windsor 4
univ calif berkeley 4
natl inst adv ind sci & technol 4
jilin univ 4
japan sci & technol agcy 4
harbin inst technol 4
ben gurion univ negev 4
acad sinica 4

- # CLUSTER 8
  Preparation, characterization, and applications of layered double hydroxides (LDHs) (47 Records)

(Countries: China, Brazil. Institutions: Beijing University of Chemical Technology.).

Cluster Syntax Features

Descriptive Terms

ldh 32.2%, layered.double 9.8%, hydroxid 8.7%, double.hydroxides 5.1%, layered.double.hydroxides 4.7%, doubl 3.6%, intercal 3.6%, layer 2.4%, double.hydroxide 2.1%, anion 1.9%, layered.double.hydroxide 1.3%, mg 0.7%, smear.layer 0.7%, smear 0.6%, double.hydroxides.ldhs 0.6%

Discriminating Terms

ldh 19.7%, layered.double 6.0%, hydroxid 5.1%, double.hydroxides 3.1%, layered.double.hydroxides 2.9%, intercal 1.9%, film 1.8%, doubl 1.7%, double.hydroxide

1.3%, anion 0.9%, layered.double.hydroxide 0.8%, nanoparticl 0.6%, surfac 0.5%, nanotub 0.5%, carbon 0.5%

Single Word Terms

layer 46, hydroxid 41, doubl 38, ldh 36, rai 30, anion 26, diffract 24, structur 24, intercal 21, spectroscopi 19, surfac 18, powder 17, materi 16, thermal 15, xrd 15

Double Word Terms

layered.double 36, double.hydroxides 29, ray.diffraction 22, double.hydroxide 21, powder.ray 15, hydroxides.ldhs 12, hydroxide.ldh 11, infrared.spectroscopy 9, fourier.transform 8, transform.infrared 8, scanning.electron 6, anion.exchange 6, diffraction.fourier 5, thermal.decomposition 5, ion.exchange 5

Triple Word Terms

layered.double.hydroxides 28, layered.double.hydroxide 19, powder.ray.diffraction 13, double.hydroxides.ldhs 12, double.hydroxide.ldh 11, fourier.transform.infrared 8, transform.infrared.spectroscopy 7, diffraction.fourier.transform 5, ray.diffraction.fourier 5, ray.photoelectron.spectroscopy 4, aluminum.layered.double 4, photoelectron.spectroscopy.xps 4, double.hydroxides.ldh 3, mg.layered.double 3, ray.diffraction.infrared 3

Term Cliques

38.30% layer smear.layer smear
64.89% ldh layered.double hydroxid double.hydroxides doubl layer double.hydroxide anion layered.double.hydroxide mg
66.60% ldh layered.double hydroxid double.hydroxides doubl intercal layer double.hydroxide anion layered.double.hydroxide
64.89% ldh layered.double hydroxid double.hydroxides layered.double.hydroxides doubl layer anion mg double.hydroxides.ldhs
66.38% ldh layered.double hydroxid double.hydroxides layered.double.hydroxides doubl layer anion layered.double.hydroxide mg
66.60% ldh layered.double hydroxid double.hydroxides layered.double.hydroxides doubl intercal layer anion double.hydroxides.ldhs
68.09% ldh layered.double hydroxid double.hydroxides layered.double.hydroxides doubl intercal layer anion layered.double.hydroxide

Sample Cluster Record Titles

Synthesis of layered double hydroxides in an emulsion solution

Cationic ordering and second-staging structures in copper-chromium and zinc-chromium layered double hydroxides

Zn-Al layered double hydroxide pillared by different dicarboxylate anions

[Delamination of layered double hydroxides in water]

[In situ FT-IR, in situ HT-XRD and TPDE study of thermal decomposition of sulfated beta-cyclodextrin intercalated in layered double hydroxides]

[Study on fire-retardant nanocrystalline Mg-Al layered double hydroxides synthesized by microwave-crystallization method]

[Intercalation and functionalization of zinc hydroxide nitrate with mono- and dicarboxylic acids]

[Preferential intercalation of pyridinedicarboxylates into layered double hydroxides]

[Hydrothermal synthesis of layered double hydroxides (LDHs) from mixed MgO and Al2O3: LDH formation mechanism]

Cluster Metrics

Authors

evans, dg 8
duan, x 8
wypych, f 3
wei, m 3
rives, v 3
li, sp 3
chen, hy 3
zhao, g 2
yang, qz 2
xu, jj 2
tagaya, h 2
sampaio, jec 2
saber, o 2
nakagaki, s 2
martin, c 2

Sources

journal of colloid and interface science 5
journal of solid state chemistry 4
journal of materials chemistry 3
materials research bulletin 2
colloids and surfaces a-physicochemical and engineering aspects 2
chinese journal of chemistry 2
water research 1
solid state sciences 1

science in china series b-chemistry 1
russian journal of general chemistry 1
reviews on advanced materials science 1
quintessence international 1
progress in organic coatings 1
polymer degradation and stability 1
microporous and mesoporous materials 1

Keywords

chemistry, physical 15
intercalation 15
layered double hydroxides 10
hydrotalcite 8
chemistry, multidisciplinary 7
hydrotalcite-like compounds 6
hydrotalcite 6
chemistry, inorganic & nuclear 6
chemistry, physical 6
materials science, multidisciplinary 5
layered double hydroxide 5
layered double hydroxide 4
dentistry, oral surgery & medicine 4
materials science, multidisciplinary 4
layered double hydroxides 4

Publication Year

2005 40
2004 6
2006 1

Country

peoples r china 16
brazil 9
spain 4
japan 4
france 4
india 3
usa 2
south korea 2
portugal 2
germany 2
argentina 2
russia 1
norway 1
morocco 1
malaysia 1

Institution
beijing univ chem technol 6
chinese acad sci 4
univ salamanca 3
univ fed parana 3
univ clermont ferrand 3
nanjing univ 3
yamagata univ 2
univ sao paulo 2
univ aveiro 2
unesp 2
beijing inst chem technol 2
usn 1
univ szeged 1
univ queensland 1
univ putra malaysia 1

DataBase
science citation index 47

- # CLUSTER 16
  YBCO (YBa2Cu3O7-x) films, emphasizing YBCO conductors and growth of buffer layers, especially CeO2 (59 Records)

(Countries: Japan, China, USA. Institutions: National Institute of Advanced Industrial S&T, ISTEC. USA include USAF, ORNL, ANL, University of Houston, University of Dayton.).

Cluster Syntax Features

Descriptive Terms
ybco 36.0%, ybco.films 6.4%, film 6.0%, buffer 3.4%, ceo2 2.6%, yba2cu3o7 2.0%,

substrat 1.4%, deposit 1.2%, ybco.film 1.2%, critical.current 1.2%, layer 1.0%, critic 0.9%, mod 0.9%, conductor 0.9%, superconduct 0.8%

Discriminating Terms
ybco 23.9%, ybco.films 4.3%, buffer 1.9%, ceo2 1.6%, yba2cu3o7 1.3%, ybco.film 0.8%, critical.current 0.8%, particl 0.6%, nanoparticl 0.6%, surfac 0.6%, mod 0.6%, carbon 0.6%, structur 0.5%, nanotub 0.5%, conductor 0.5%

Single Word Terms
film 59, deposit 49, substrat 47, ybco 46, critic 33, layer 33, current 32, densiti 30, thick 30, high 30, buffer 29, temperatur 29, yba2cu3o7 26, surfac 25, puls 24

Double Word Terms
ybco.films 34, critical.current 28, pulsed.laser 22, current.density 21, laser.deposition 20, ybco.film 17, ray.diffraction 17, buffer.layer 16, ybco.coated 15, coated.conductors 15, buffer.layers 15, electron.microscopy 13, films.deposited 12, film.thickness 11, yba2cu3o7.ybco 11

Triple Word Terms
critical.current.density 20, pulsed.laser.deposition 20, ybco.coated.conductors 12, ybco.films.deposited 8, ceo2.buffer.layer 7, transmission.electron.microscopy 7, ybco.thin.films 7, atomic.force.microscopy 7, yba2cu3o7.delta.ybco 7, ceo2.buffer.layers 6, laser.deposition.pld 6, scanning.electron.microscopy 6, delta.ybco.films 6, ybco.films.grown 5, high.critical.current 5

Term Cliques
58.64% film deposit layer mod superconduct
62.43% film deposit critical.current layer critic superconduct
53.22% film deposit ybco.film mod superconduct
57.20% film buffer ceo2 substrat deposit layer mod conductor
53.81% film buffer ceo2 substrat deposit ybco.film mod conductor
58.31% film buffer ceo2 yba2cu3o7 substrat deposit critical.current layer critic conductor
57.87% ybco.films film deposit ybco.film critical.current critic superconduct
58.86% ybco ybco.films film buffer ceo2 substrat deposit ybco.film critical.current critic conductor
60.25% ybco ybco.films film buffer ceo2 yba2cu3o7 substrat deposit critical.current critic conductor

Sample Cluster Record Titles

Microstructural studies of YB2Cu3O7-delta/Nd2CuO4/YB2CU3O7-delta Josephson junctions with a Nd2CuO4 buffer layer grown on YSZ substrate

Evaluation of the lattice matching effect on critical current density for surface coated

YbBa2Cu3O7

The effect of Ag diffusion on properties of YBa2CU3O7-x thin films produced by electron beam deposition techniques

YBCO superconducting film coated on LaAlO3 substrate by TFA-MOD process

Microcrack-free epitaxy of thick YBa2Cu3O7-delta films on vicinal r-cut sapphire buffered with CeO2

Magnetic relaxation and flux pinning in YBCO films prepared by PLD from a nanocrystalline target

Thickness dependence of J(c) for YBCO thin films prepared by large-area pulsed laser deposition on CeO2-buffered sapphire substrates

Growth of epitaxial Y2O3 buffer layers on biaxially textured Ni-W substrates for YBCO coated conductors by MOD approach

Fast growth process of long-length YBCO coated conductor with high critical current density

Cluster Metrics

Authors

yamada, y 5
shiohara, y 5
yamasaki, h 4
watanabe, t 4
nie, jc 4
nakagawa, y 4
izumi, t 4
develos-bagarinao, k 4
barnes, pn 4
yamaguchi, i 3
yajima, a 3
tsukada, k 3
teranishi, r 3
sohma, m 3
obara, h 3

Sources

ieee transactions on applied superconductivity 15
physica c-superconductivity and its applications 13
superconductor science & technology 6

applied physics letters 4
journal of superconductivity 3
thin solid films 2
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 2
japanese journal of applied physics part 1-regular papers brief communications & review papers 2
rare metals 1
journal of the korean physical society 1
journal of the american ceramic society 1
journal of rare earths 1
journal of materials research 1
journal of electron spectroscopy and related phenomena 1
journal of crystal growth 1

Keywords
physics, applied 28
physics, applied 17
engineering, electrical & electronic 16
thin-films 10
physics, condensed matter 9
ybco 8
tapes 8
deposition 8
critical-current density 7
films 7
growth 6
fabrication 6
ybco films 5
ybco film 5
yba2cu3o7 5

Publication Year
2005 57
2004 2

Country
japan 20
peoples r china 14
usa 13
south korea 6
italy 4
turkey 2
germany 2
finland 2
taiwan 1

russia 1
romania 1
lithuania 1
israel 1
canada 1

Institution

natl inst adv ind sci & technol 7
istec 7
chinese acad sci 4
beijing normal univ 4
usaf 3
oak ridge natl lab 3
argonne natl lab 3
univ houston 2
univ hong kong 2
univ elect sci & technol china 2
univ dayton 2
panzhihua univ 2
natl inst mat sci 2
korea atom energy res inst 2
japan fine ceram ctr 2

DataBase

science citation index 59

- # CLUSTER 33
  Indium tin oxide (ITO) thin films, focusing on transparency, transmittance, and resistivity of ITO films (95 Records)

(Countries: Japan, China, USA, Taiwan, South Korea. Institutions: University of Hong Kong, Osaka University).

Cluster Syntax Features

Descriptive Terms
ito 32.1%, indium 5.8%, tin.oxide 5.0%, indium.tin.oxide 4.7%, film 4.6%, indium.tin 4.6%, tin 4.4%, ito.films 2.9%, oxide.ito 2.0%, oxid 1.6%, tin.oxide.ito 1.6%, transpar 0.9%, transmitt 0.8%, resist 0.7%, deposit 0.7%

Discriminating Terms
ito 22.2%, indium 3.8%, tin.oxide 3.3%, indium.tin.oxide 3.2%, indium.tin 3.2%, tin 2.6%, ito.films 2.0%, oxide.ito 1.4%, tin.oxide.ito 1.1%, carbon 0.6%, particl 0.6%, magnet 0.6%, nanotub 0.6%, structur 0.6%, nanoparticl 0.5%

Single Word Terms
oxid 83, film 81, indium 79, ito 76, tin 73, deposit 54, properti 53, optic 45, substrat 44, resist 40, structur 35, surfac 33, thin 33, electr 33, conduct 33

Double Word Terms
tin.oxide 70, indium.tin 67, oxide.ito 63, ito.films 33, thin.films 26, oxide.films 23, light.emitting 22, optical.properties 22, films.deposited 18, ray.diffraction 18, glass.substrates 17, ito.film 16, electrical.optical 16, ito.thin 15, room.temperature 14

Triple Word Terms
indium.tin.oxide 67, tin.oxide.ito 57, ito.thin.films 15, tin.oxide.films 14, organic.light.emitting 13, oxide.ito.films 13, light.emitting.diodes 12, oxide.ito.thin 11, atomic.force.microscopy 10, electrical.optical.properties 10, scanning.electron.microscopy 9, deposited.glass.substrates 8, doped.indium.oxide 8, thin.films.deposited 8, ray.photoelectron.spectroscopy 8

Term Cliques
59.89% ito indium film ito.films oxide.ito oxid transpar transmitt resist deposit
64.02% ito indium film tin ito.films oxide.ito oxid tin.oxide.ito transmitt resist deposit
67.85% ito indium tin.oxide film tin ito.films oxide.ito oxid tin.oxide.ito resist deposit
70.44% ito indium tin.oxide indium.tin.oxide film indium.tin tin ito.films oxide.ito oxid tin.oxide.ito deposit

Sample Cluster Record Titles

The properties of tin-doped indium oxide films prepared by pulsed magnetron sputtering from powder targets

Characterization of indium-tin-oxide films treated by different procedures: effect of treatment time in aqua regia solution

Molecularly thin polymer films that function to enhance charge injection efficiency in organic light-emitting diodes

Cytocompatibility of novel tin oxide thin films

A statistical parameter study of indium tin oxide thin films deposited by radio-frequency sputtering

Effect of aluminum doping on the high-temperature stability and piezoresistive response of indium tin oxide strain sensors

ITO as a diffusion barrier between Si and Cu

Preparation of indium-tin oxide (ITO) nano-aciculae by a simple precipitation near boiling point and post-calcination method

Microstructure of sputter deposited tin doped indium oxide films with silver additive

Cluster Metrics

Authors

djurisic, ab 3
you, t 2
yoshino, k 2
yeom, gy 2
yan, h 2
xiong, y 2
wang, rx 2
wang, h 2
vaidyan, vk 2
tsutsui, t 2
sung, gy 2
park, nm 2
nishihara, y 2
niklasson, ga 2
ling, cc 2

Sources

thin solid films 15
journal of applied physics 5
synthetic metals 4
journal of the korean physical society 4
japanese journal of applied physics part 1-regular papers short notes & review papers 4
rare metal materials and engineering 3
journal of vacuum science & technology a 3
applied physics letters 3
surface & coatings technology 2
materials science and engineering b-solid state materials for advanced technology 2
journal of physical chemistry b 2
applied surface science 2
applied physics a-materials science & processing 2
vacuum 1
surface and interface analysis 1

Keywords

materials science, multidisciplinary 35
physics, applied 26
physics, applied 17
physics, 17
condensed matter 15
thin-films 14
thin-films 10
chemistry, physical 10
physics, condensed matter 9
ito 8
ito 8
diodes 8
films 7
physics, multidisciplinary 6
materials science, coatings & films 6

Publication Year

2005 86
2004 7
2006 2

Country

japan 20
peoples r china 14
usa 11
taiwan 11
south korea 11

germany 5
india 4
france 4
sweden 3
portugal 3
italy 3
singapore 2
switzerland 1
slovakia 1
scotland 1

Institution
univ hong kong 3
osaka univ 3
uppsala univ 2
unl 2
univ tokyo 2
univ rhode isl 2
univ nantes 2
univ kerala 2
toyota cent res & dev labs inc 2
sungkyunkwan univ 2
natl sun yat sen univ 2
natl cheng kung univ 2
natl changhua univ educ 2
nagoya univ 2
nagoya inst technol 2

DataBase
science citation index 95

- # CLUSTER 209
  Oxide (especially WO3 and SnO2) films, emphasizing formation of anodic films, use as gas sensors, and electrochemical applications (238 Records)

(Countries: USA, China, Japan. Institutions: University of Mnachester, Keio University, Hokkaido University, Harbin Institute of Technology, CAS. USA includes Texas A&M.).

Cluster Syntax Features

Descriptive Terms
film 24.7%, oxid 14.8%, anod 4.5%, oxide.films 4.5%, oxide.film 2.1%, wo3 1.7%, sensor 1.1%, electrolyt 0.9%, thick 0.8%, sno2 0.8%, ga 0.7%, deposit 0.6%, alumina 0.5%, surfac 0.5%, electrochem 0.5%

Discriminating Terms
film 11.5%, oxid 9.6%, oxide.films 4.6%, anod 4.0%, oxide.film 2.1%, wo3 1.7%, magnet 0.9%, particl 0.8%, nanotub 0.7%, carbon 0.7%, quantum 0.6%, electrolyt 0.6%, sensor 0.6%, crystal 0.6%, sno2 0.6%

Single Word Terms
film 237, oxid 185, surfac 102, structur 98, rai 98, deposit 97, form 92, temperatur 91, thick 91, electron 84, thin 84, substrat 84, spectroscopi 81, properti 71, metal 66

Double Word Terms
oxide.films 76, ray.photoelectron 51, photoelectron.spectroscopy 50, oxide.film 44, ray.diffraction 40, electron.microscopy 39, thin.films 34, scanning.electron 30, spectroscopy.xps 28, films.deposited 25, films.formed 25, room.temperature 22, sol.gel 22, metal.oxide 21, diffraction.xrd 20

Triple Word Terms
ray.photoelectron.spectroscopy 49, photoelectron.spectroscopy.xps 26, scanning.electron.microscopy 25, ray.diffraction.xrd 19, oxide.thin.films 14, electrochemical.impedance.spectroscopy 13, electron.microscopy.sem 12, transmission.electron.microscopy 12, low.energy.electron 10, energy.electron.diffraction

10, atomic.force.microscopy 10, scanning.tunneling.microscopy 10, films.ray.diffraction 9, auger.electron.spectroscopy 8, impedance.spectroscopy.eis 7

Term Cliques
36.05% film sensor sno2 ga deposit
41.01% film sensor thick deposit alumina
41.85% film sensor thick ga deposit
44.68% film wo3 electrochem
36.30% film wo3 sensor ga deposit
46.22% film oxide.film surfac electrochem
42.12% film anod electrolyt electrochem
39.29% film anod electrolyt thick deposit alumina
64.08% film oxid thick deposit
58.51% film oxid oxide.film thick
50.35% film oxid oxide.films sno2 deposit surfac
54.12% film oxid oxide.films oxide.film surface

Sample Cluster Record Titles

The effects of cathodic and anodic voltages on the characteristics of porous nanocrystalline titania coatings fabricated by microarc oxidation

Laser assisted cleaning of oxide films on SUS409 stainless steel

Characterization of anodic films formed on AZ91D magnesium alloy

An ellipsometric study of manganese oxide films - In situ characterization of the deposition and electroreduction of MnO2

Determination of the optical constants of porous anodic aluminum oxide films

Electrical and transport properties of europium-indium oxide films prepared on Si(100) substrates

Thin fluorine-doped tin oxide films prepared using an electric field-modified spray pyrolysis deposition technique

Si-supported mesoporous and microporous oxide interconnects as electrophoretic gates for application in microfluidic devices

Epitaxial growth of well-ordered ultra-thin Al2O3 film on NiA1 (110) by a single-step oxidation

Cluster Metrics

Authors
ivanova, t 5
dakhel, aa 5
zhao, lc 4
wang, fp 4
thompson, ge 4
shimizu, t 4
montemor, mf 4
llobet, e 4
liu, f 4
igarashi, k 4
granqvist, cg 4
batzill, m 4
agnihotry, sa 4
zhou, j 3
skeldon, p 3

Sources
sensors and actuators b-chemical 18
thin solid films 12
journal of the electrochemical society 12
surface & coatings technology 10
surface science 9
electrochimica acta 9
journal of physical chemistry b 8
applied surface science 7
corrosion science 6
applied physics letters 6
langmuir 5
japanese journal of applied physics part 1-regular papers brief communications & review papers 5
transactions of nonferrous metals society of china 4
solid state ionics 4
journal of materials science 4

Keywords
materials science, multidisciplinary 56
chemistry, physical 40
electrochemistry 36
thin-films 27
oxidation 27
growth 27
physics, applied 26
materials science, coatings & films 24

chemistry, analytical 22
physics, 22
physics, condensed matter 19
instruments & instrumentation 18
thin-films 17
physics, applied 17
electrochemistry 14

Publication Year
2005 215
2004 20
2006 3

Country
usa 42
peoples r china 41
japan 41
south korea 13
italy 13
germany 13
england 12
taiwan 10
india 8
spain 7
russia 7
canada 7
france 6
bulgaria 6
portugal 5

Institution
univ manchester 5
keio univ 5
hokkaido univ 5
harbin inst technol 5
chinese acad sci 5
uppsala univ 4
univ rovira & virgili 4
univ bahrain 4
tsing hua univ 4
texas a&m univ 4
natl phys lab 4
inst super tecn 4
chiba inst technol 4
bulgarian acad sci 4
yonsei univ 3

DataBase
science citation index 238

- # CLUSTER 172
  Preparation of films by magnetron sputtering, especially titanium (Ti), titanium nitride (TiN), and aluminium nitride (AlN) films (230 Records)

(Countries: China, USA, followed by South Korea, Japan, followed by Taiwan, Germany, France. Institutions: CAS, Sungyunkwan University, Shanghai Jiao Tong University, National Cheng Kung University).

Cluster Syntax Features

Descriptive Terms
film 25.2%, sputter 16.7%, magnetron 5.3%, magnetron.sputtering 3.8%, deposit 2.2%, ti 1.8%, reactiv 1.2%, ar 0.9%, films.deposited 0.9%, substrat 0.8%, reactive.magnetron 0.7%, target 0.7%, reactive.magnetron.sputtering 0.7%, aln 0.6%, tin 0.6%

Discriminating Terms
sputter 14.3%, film 10.8%, magnetron 4.6%, magnetron.sputtering 3.3%, ti 1.1%, reactiv 0.8%, magnet 0.8%, nanotub 0.8%, nanoparticl 0.8%, particl 0.7%, ar 0.7%, carbon 0.6%, reactive.magnetron 0.6%, reactive.magnetron.sputtering 0.6%, films.deposited 0.6%

Single Word Terms
film 228, sputter 216, deposit 164, magnetron 153, rai 125, substrat 123, structur 112, properti 105, thin 103, diffract 101, reactiv 93, surfac 92, electron 86, composit 81, temperatur 79

Double Word Terms
magnetron.sputtering 133, ray.diffraction 97, films.deposited 85, thin.films 82, electron.microscopy 56, reactive.magnetron 50, photoelectron.spectroscopy 35,

atomic.force 35, diffraction.xrd 33, scanning.electron 33, ray.photoelectron 33, transmission.electron 30, films.ray 29, force.microscopy 27, reactive.sputtering 26

Triple Word Terms
reactive.magnetron.sputtering 49, ray.diffraction.xrd 33, ray.photoelectron.spectroscopy 33, atomic.force.microscopy 27, scanning.electron.microscopy 27, transmission.electron.microscopy 26, films.ray.diffraction 17, photoelectron.spectroscopy.xps 14, films.magnetron.sputtering 12, radio.frequency.magnetron 12, frequency.magnetron.sputtering 12, thin.films.deposited 12, deposited.magnetron.sputtering 11, films.reactive.magnetron 11, ion.beam.sputtering 11

Term Cliques
40.60% film magnetron magnetron.sputtering reactiv reactive.magnetron reactive.magnetron.sputtering aln tin
45.99% film magnetron magnetron.sputtering deposit reactiv ar reactive.magnetron reactive.magnetron.sputtering tin
43.53% film magnetron magnetron.sputtering deposit ti ar reactive.magnetron reactive.magnetron.sputtering tin
45.61% film magnetron magnetron.sputtering deposit ti ar films.deposited substrat reactive.magnetron target reactive.magnetron.sputtering
51.09% film sputter magnetron magnetron.sputtering reactiv reactive.magnetron reactive.magnetron.sputtering aln
51.49% film sputter magnetron magnetron.sputtering deposit reactiv ar films.deposited substrat reactive.magnetron target reactive.magnetron.sputtering

Sample Cluster Record Titles

Properties of Si-rich SiO2 films by RF magnetron sputtering

Relationship between oxygen contents and lubrication properties of MoSOfilms onto rollers prepared by reactive sputtering method

Studies of structure and morphology of sputter-deposited stainless steel-nitrogen films

Growth dynamics of reactive-sputtering-deposited AlN films

Effect of annealing on DC sputtered aluminum nitride films

Preparation of monolithic AlN and composite TiN-AlN powders and films from precursors synthesized by electrolysis

Growth and characterization of TixNi1-x shape memory thin films using simultaneous sputter deposition from separate elemental targets

[Optical models for radio-frequency-magnetron reactively sputtered AlN films]

[Dynamic scaling phenomena and universality classes in growth of iron nitride thin films deposited by direct current magnetron sputtering]

Cluster Metrics

Authors
han, jg 7
sun, h 4
nam, kh 4
musil, j 4
li, gy 4
leng, yx 4
lee, hy 4
huang, n 4
chen, jy 4
cavaleiro, a 4
zhao, zb 3
yang, p 3
yalisove, sm 3
vlcek, j 3
sanjabi, s 3

Sources
thin solid films 36
surface & coatings technology 21
journal of vacuum science & technology a 13
journal of applied physics 10
journal of vacuum science & technology b 9
vacuum 5
materials letters 5
applied surface science 5
solar energy materials and solar cells 4
nuclear instruments & methods in physics research section b-beam interactions with materials and atoms 4
journal of materials research 4
chinese physics letters 4
asbm6: advanced biomaterials vi 4
applied physics letters 4
reviews on advanced materials science 3

Keywords
materials science, multidisciplinary 85

physics, applied 76
physics, 42
thin-films 38
materials science, coatings & films 37
condensed matter 37
physics, applied 25
growth 25
microstructure 24
thin-films 23
sputtering 23
deposition 21
physics, condensed matter 19
engineering, electrical & electronic 16
titanium 16

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2005 208
2004 18
2006 4

Country
peoples r china 54
usa 30
south korea 22
japan 22
taiwan 18
germany 17
france 15
spain 8
india 8
ukraine 6
sweden 6
singapore 6
portugal 6
poland 6
italy 5

Institution
chinese acad sci 10
sungkyunkwan univ 7
shanghai jiao tong univ 7
natl cheng kung univ 7
univ coimbra 5
tohoku univ 5
nanyang technol univ 5
univ w bohemia 4

sw jiaotong univ 4
polish acad sci 4
wuhan univ 3
univ paisley 3
univ michigan 3
univ illinois 3
univ franche comte 3

DataBase
science citation index 230

- CLUSTER 231
  Growth and characterization of films, focusing on effects of annealing, deposition, and copper, silicon, and gallium nitride films (382 Records)

(Countries: China, USA, Japan. CAS dominant, Yonsei University, University of Tokyo, Kyoto University, Indian Institute of Technology, Bulgarian Academy of Sciences. USA presence not shown.).

Cluster Syntax Features

Descriptive Terms
film 35.1%, anneal 9.4%, deposit 2.6%, substrat 2.1%, cu 1.5%, temperatur 1.3%, grown 0.8%, si 0.8%, oxygen 0.7%, films.grown 0.7%, gan 0.7%, optic 0.7%, annealing.temperature 0.5%, thick 0.5%, grain 0.5%

Discriminating Terms
film 21.8%, anneal 8.1%, carbon 1.0%, magnet 1.0%, nanotub 1.0%, particl 0.9%, nanoparticl 0.8%, cu 0.7%, deposit 0.7%, substrat 0.7%, quantum 0.7%, films.grown 0.6%, polym 0.6%, surfac 0.6%, annealing.temperature 0.5%

Single Word Terms
film 381, deposit 220, temperatur 210, rai 207, anneal 198, structur 196, substrat 195, diffract 174, electron 166, thin 146, properti 138, microscopi 136, surfac 132, thick 112, high 112

Double Word Terms

ray.diffraction 158, electron.microscopy 91, thin.films 91, films.grown 74, films.deposited 73, diffraction.xrd 71, annealing.temperature 61, scanning.electron 57, transmission.electron 55, room.temperature 46, atomic.force 44, ray.photoelectron 43, optical.properties 43, photoelectron.spectroscopy 43, force.microscopy 40

Triple Word Terms

ray.diffraction.xrd 70, scanning.electron.microscopy 48, transmission.electron.microscopy 44, ray.photoelectron.spectroscopy 40, atomic.force.microscopy 40, electron.microscopy.sem 29, force.microscopy.afm 23, photoelectron.spectroscopy.xps 22, films.ray.diffraction 22, electron.microscopy.tem 16, fourier.transform.infrared 15, molecular.beam.epitaxy 15, auger.electron.spectroscopy 13, diffraction.xrd.scanning 13, xrd.scanning.electron 13

Term Cliques

44.24% film substrat temperatur gan optic thick
38.61% film substrat temperatur grown oxygen films.grown gan thick
47.77% film deposit cu grain
52.09% film deposit substrat temperatur thick grain
52.79% film deposit substrat temperatur optic thick
45.03% film deposit substrat temperatur grown oxygen films.grown thick
45.06% film deposit substrat temperatur grown si films.grown thick
47.05% film anneal deposit temperatur annealing.temperature thick grain
47.64% film anneal deposit temperatur optic annealing.temperature thick
47.01% film anneal deposit temperatur oxygen annealing.temperature thick
47.05% film anneal deposit temperatur si annealing.temperature thick

Sample Cluster Record Titles

Electrical properties and crystal structures of nitrogen-doped Ge2Sb2Te5 thin film for phase change memory

The role of hcp-AlN on hardness behavior of Ti1-xAlxN nanocomposite during annealing

Structural characteristics and interfacial reactions of low dielectric constant porous polysilazane for Cu metallization

CdTe polycrystalline films for X-ray digital imaging applications

The growth of ultra-thin epitaxial CeO2 films on r-plane sapphire

Optical properties of sol-gel SiO2 films containing nickel

[Effect of annealing on the characteristics of Au/Ni80Fe20 and Au/Ni30Fe70 bilayer films grown on glass]

[Evolution of internal stress and microstructure in Ti50CU50 alloy films: influence of substrate temperature and composition]

[Effect of in-situ cleaning temperature on the structural quality of homoepitaxial film on Si substrate]

Cluster Metrics

Authors

lin, j 6
yu, m 5
shi, y 5
zhang, r 4
wang, h 4
saito, k 4
liu, b 4
chen, zh 4
yoshida, y 3
yang, y 3
wu, p 3
watanabe, t 3
wang, y 3
wang, fp 3
trodahl, hj 3

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journal of applied physics 13
japanese journal of applied physics part 1-regular papers brief communications & review papers 9
surface & coatings technology 8
journal of optoelectronics and advanced materials 8
applied physics a-materials science & processing 8
surface science 7
journal of the electrochemical society 7
journal of materials research 7
physical review b 6
materials science and engineering b-solid state materials for advanced technology 6

materials chemistry and physics 6

Keywords
materials science, multidisciplinary 115
physics, applied 85
physics, 64
thin-films 62
physics, applied 60
physics, condensed matter 46
thin-films 45
condensed matter 43
chemistry, physical 41
growth 37
materials science, coatings & films 25
engineering, electrical & electronic 25
deposition 25
silicon 24
chemical-vapor-deposition 22

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2005 344
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peoples r china 78
usa 64
japan 62
south korea 29
germany 29
india 26
taiwan 20
france 16
italy 11
england 11
spain 10
singapore 10
bulgaria 8
ukraine 7
turkey 5

Institution
chinese acad sci 27
yonsei univ 8
univ tokyo 8
kyoto univ 8

indian inst technol 8
bulgarian acad sci 8
natl inst mat sci 7
nanyang technol univ 6
nanjing univ 6
feng chia univ 6
cnr 6
univ sci & technol china 5
univ padua 5
silicon storage technol inc 5
natl univ singapore 5

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CATEGORY 6 - 508B1b ***(7 leaf clusters)***

Applications of Thin Films (2509 REC)

THRUST
()

- Thin film transistors (TFTs), especially pentacene and organic thin film transistors (OTFTs) (93 Records) Cluster 28
- Thin films, emphasizing fabrication by deposition, sensor and device applications, and optical properties (395 Records) Cluster 222

- Thin films, focusing on optical and band gap properties, absorption, and preparation by deposition, annealing, and evaporation (329 Records) Cluster 180
- Thin films, emphasizing orientation of films, silicon films, and preparation by deposition, magnetron sputtering, and annealing (959 Records) Cluster 217
- Ferroelectric thin films (including platinum [Pt], BST, BLT, and silica [SiO2] films), with emphasis on polarization, orientation, and dielectric/ ferroelectric properties (258 Records) Cluster 132
- Pb(ZrTi)O-3 (PZT) thin films, emphasizing ferroelectric properties and orientation control (122 Records) Cluster 10
- Characterization of thin films grown by pulsed laser deposition (PLD), especially SrTiO3 films (353 Records) Cluster 137

- CLUSTER 28
  Thin film transistors (TFTs), especially pentacene and organic thin film transistors (OTFTs) (93 Records)

(Countries: USA, South Korea, Japan. Institutions: Yonsie University, Tokyo Institute of Technology, Xerox Research Center Canada, University of Minnesota. Other USA include University of Kentucky, Stanford University, RPI, Oregon State University, Northwestern University.).

Cluster Syntax Features

Descriptive Terms

pentacen 11.6%, transistor 10.0%, thin.film.transistors 7.2%, film.transistors 7.2%, thin.film 5.2%, organic.thin 4.8%, tft 4.3%, organic.thin.film 4.1%, thin 4.1%, organ 3.7%, film 3.4%, otft 2.9%, mobil 2.5%, gate 1.6%, dielectr 1.0%

Discriminating Terms

pentacen 7.9%, transistor 6.2%, thin.film.transistors 4.9%, film.transistors 4.9%, organic.thin 3.3%, tft 2.9%, thin.film 2.9%, organic.thin.film 2.8%, otft 2.0%, organ 1.5%, mobil 1.4%, thin 1.3%, gate 0.7%, surfac 0.7%, particl 0.6%

Single Word Terms

thin 91, film 90, transistor 78, organ 63, mobil 56, field 45, devic 44, fabric 44, layer 42, pentacen 39, high 36, gate 36, structur 35, ratio 35, current 34

Double Word Terms

thin.film 79, film.transistors 63, organic.thin 43, thin.films 26, ray.diffraction 20, field.mobility 20, current.ratio 19, gate.dielectric 19, film.transistor 17, pentacene.thin 16, atomic.force 16, transistors.otfts 16, field.transistors 15, transistors.tfts 14, force.microscopy 13

Triple Word Terms

thin.film.transistors 63, organic.thin.film 38, thin.film.transistor 17, film.transistors.otfts 16, film.transistors.tfts 14, atomic.force.microscopy 13, pentacene.thin.film 12, mobility.current.ratio 10, organic.field.transistors 8, organic.thin.films 7, film.transistors.high 6, scanning.electron.microscopy 5, film.transistors.fabricated 5, self.assembled.monolayers 5, film.transistor.tft 4

Term Cliques

69.77% pentacen transistor thin.film.transistors film.transistors thin.film tft thin film mobil
60.46% pentacen transistor thin.film.transistors film.transistors thin.film organic.thin organic.thin.film thin organ film otft gate dielectr
62.94% pentacen transistor thin.film.transistors film.transistors thin.film organic.thin organic.thin.film thin organ film otft mobil gate

Sample Cluster Record Titles

Nanotransfer printing by use of noncovalent surface forces: Applications to thin-film transistors that use single-walled carbon nanotube networks and semiconducting polymers

Organic thin film transistors based on N-alkyl perylene diimides: Charge transport kinetics as a function of gate voltage and temperature

An organic thin-film transistor of high mobility by dielectric surface modification with organic molecule

Nanoscale chemical sensor based on organic thin-film transistors

Low-temperature non-metal-induced crystallization of germanium for fabrication of thin-film transistors

Simulated operation and properties of source-gated thin-film transistors

Supramolecular organization in ultra-thin films of alpha-sexithiophene on silicon dioxide

Electrical properties of shadow-mask patterned organic thin film transistor fabricated on plastic substrate

Indolo[3,2-b]carbazole-based thin-film transistors with high mobility and stability

Cluster Metrics

Authors

ong, bs 5
wu, yl 4
liu, p 4
lee, j 4
im, s 4
cho, k 4
zan, hw 3
yoon, mh 3
yoo, kh 3
yi, mh 3
yang, hc 3
wu, yc 3
whang, cn 3
tu, ch 3
tsukagoshi, k 3

Sources

applied physics letters 27
journal of the american chemical society 6
advanced materials 5
advanced functional materials 5
journal of applied physics 4
ieee transactions on electron devices 4
electrochemical and solid state letters 4
synthetic metals 2
solid-state electronics 2
microelectronic engineering 2
journal of the korean physical society 2
journal of physical chemistry b 2
applied surface science 2
thin solid films 1
surface and interface analysis 1

Keywords
physics, applied 33
field-effect transistors 30
materials science, multidisciplinary 16
chemistry, physical 15
transport 15
engineering, electrical & electronic 14
physics, applied 14
mobility 13
physics, 12
thin-film transistors 11
physics, condensed matter 11
high-mobility 11
pentacene 10
applied 8
materials science, multidisciplinary 8

Publication Year
2005 83
2004 8
2006 2

Country
usa 27
south korea 20
japan 18
canada 9
peoples r china 6
germany 6
taiwan 5

italy 3
austria 2
spain 1
russia 1
mexico 1
iran 1
france 1
england 1

Institution
yonsei univ 7
tokyo inst technol 7
xerox res ctr canada ltd 5
univ minnesota 5
pohang univ sci & technol 4
chinese acad sci 4
univ kentucky 3
stanford univ 3
riken 3
rensselaer polytech inst 3
oregon state univ 3
northwestern univ 3
natl sun yat sen univ 3
natl chiao tung univ 3
korea res inst chem technol 3

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- # CLUSTER 222
  Thin films, emphasizing fabrication by deposition, sensor and device applications, and optical properties (395 Records)

(Countries: USA, Japan, China, followed by South Korea, Germany. Institutions: CAS, Osaka University, Nagoya University, Korea Institute of S&T. USA include Stanford University, Penn State University.).

Cluster Syntax Features

Descriptive Terms
thin.film 27.3%, thin 22.1%, film 18.4%, substrat 0.8%, thin.films 0.7%, deposit 0.6%, thick 0.6%, sensor 0.5%, layer 0.4%, surfac 0.4%, temperatur 0.3%, devic 0.3%, fabric 0.3%, optic 0.3%, electrod 0.3%

Discriminating Terms
thin.film 26.4%, thin 17.2%, film 7.2%, nanoparticl 0.8%, particl 0.7%, carbon 0.7%, nanotub 0.7%, magnet 0.5%, quantum 0.5%, crystal 0.4%, structur 0.4%, surfac 0.4%, dot 0.3%, electron 0.3%, size 0.3%

Single Word Terms
thin 395, film 389, surfac 138, structur 136, deposit 134, substrat 133, high 111, temperatur 111, thick 103, layer 103, properti 99, electron 98, fabric 85, measur 84, rai 82

Double Word Terms
thin.film 360, thin.films 137, ray.diffraction 55, electron.microscopy 34, room.temperature 29, film.thickness 28, atomic.force 25, force.microscopy 23, scanning.electron 22, diffraction.xrd 21, film.deposited 21, ray.photoelectron 20, magnetron.sputtering 19, transmission.electron 17, sol.gel 17

Triple Word Terms
atomic.force.microscopy 22, ray.diffraction.xrd 20, thin.film.deposited 19, ray.photoelectron.spectroscopy 17, transmission.electron.microscopy 16, scanning.electron.microscopy 15, thin.film.thickness 14, photoelectron.spectroscopy.xps 13, thin.film.electrodes 11, electron.microscopy.sem 10, fourier.transform.infrared 10, thin.film.surface 10, force.microscopy.afm 10, oxide.thin.film 9, thin.film.silicon 9

Term Cliques
43.77% thin.film thin film deposit thick sensor layer devic fabric optic
44.94% thin.film thin film deposit thick sensor layer temperatur devic fabric

46.18% thin.film thin film thin.films deposit layer temperatur devic fabric electrod
45.80% thin.film thin film thin.films deposit sensor layer temperatur devic fabric
50.72% thin.film thin film thin.films deposit sensor layer surfac temperatur
51.00% thin.film thin film substrat deposit thick layer temperatur fabric
48.05% thin.film thin film substrat thin.films deposit layer temperatur fabric electrod
53.45% thin.film thin film substrat thin.films deposit layer surfac temperature

Sample Cluster Record Titles

Fabrication and characterization of SnO2-RuO2 composite anode thin film for lithium ion batteries

The electrochemical capacities and cycle retention of electrochemically deposited Cu2O thin film toward lithium

Tilt-modulated chiral sculptured thin films: an alternative to quarter-wave stacks

A round robin characterisation of the thickness and composition of thin to ultra-thin AlNO films

A mathematical model of the removal of gold thin film on polymer surface by laser ablation

Electrical properties of V2O5 thin films obtained by atomic layer deposition (ALD)

Evaluation of experimental stress-strain dependence in thermally cycled Al thin film on Si(100)

Electrochemical mechanisms during lithium insertion into TiO0.6S2.8 thin film positive electrode in lithium microbatteries

High-throughput craze studies in gradient thin films using ductile copper grids

Cluster Metrics

Authors
wang, j 4
zhu, w 3
zhang, hd 3
yoon, ys 3
yang, jy 3
shukla, s 3

seal, s 3
park, kw 3
park, jh 3
naito, m 3
mitsuya, y 3
ludwig, l 3
liu, y 3
lee, yh 3
kim, jh 3

Sources

applied physics letters 21
thin solid films 14
journal of applied physics 10
journal of physical chemistry b 8
electrochimica acta 8
microelectronic engineering 7
journal of the korean physical society 7
surface & coatings technology 6
sensors and actuators b-chemical 6
review of scientific instruments 6
journal of optoelectronics and advanced materials 6
electrochemical and solid state letters 6
applied surface science 6
rare metal materials and engineering 5
microsystem technologies-micro-and nanosystems-information storage and processing systems 5

Keywords

materials science, multidisciplinary 70
physics, applied 62
physics, applied 52
engineering, electrical & electronic 50
chemistry, physical 42
thin film 37
physics, 27
electrochemistry 23
physics, condensed matter 22
growth 22
physics, multidisciplinary 21
optics 21
instruments & instrumentation 20
silicon 17
materials science, multidisciplinary 17

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2005 341
2004 50
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Country
usa 85
japan 69
peoples r china 58
south korea 39
germany 32
taiwan 19
france 18
india 11
canada 10
netherlands 9
england 9
austria 7
slovakia 6
singapore 6
russia 6

Institution
chinese acad sci 12
osaka univ 8
nagoya univ 8
korea inst sci & technol 8
tokyo inst technol 7
kyoto univ 6
zhejiang univ 5
stanford univ 5
penn state univ 5
natl chiao tung univ 5
natl cheng kung univ 5
yonsei univ 4
univ paris 06 4
tsing hua univ 4
riken 4

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science citation index 395

- # CLUSTER 180

  Thin films, focusing on optical and band gap properties, absorption, and preparation by deposition, annealing, and evaporation (329 Records)

(Countries: India, followed by China, followed by USA, South korea, France. Institutions: Shivaji University, CAS, University National Autonoma Mexico, Bharathiar University. USA include Northwestern University.).

Cluster Syntax Features

Descriptive Terms

film 20.3%, thin.films 13.3%, thin 10.7%, optic 4.6%, deposit 2.7%, gap 1.3%, absorpt 1.1%, substrat 1.1%, band 1.1%, band.gap 1.0%, anneal 0.9%, glass 0.8%, optical.properties 0.8%, evapor 0.7%, electr 0.6%

Discriminating Terms

thin.films 10.1%, film 7.9%, thin 6.7%, optic 2.0%, surfac 0.9%, carbon 0.8%, gap 0.8%, nanoparticl 0.8%, magnet 0.8%, nanotub 0.8%, band.gap 0.8%, particl 0.8%, deposit 0.6%, quantum 0.5%, optical.properties 0.5%

Single Word Terms

thin 329, film 328, optic 241, deposit 211, properti 209, structur 196, substrat 187, rai 171, diffract 156, temperatur 154, band 150, gap 146, glass 131, energi 125, absorpt 119

Double Word Terms

thin.films 326, ray.diffraction 147, band.gap 110, optical.properties 101, films.deposited 93, glass.substrates 79, thin.film 63, optical.band 60, scanning.electron 53, optical.absorption 52, electron.microscopy 50, diffraction.xrd 49, electrical.properties 47, refractive.index 43, structural.optical 41

Triple Word Terms

thin.films.deposited 73, optical.band.gap 53, ray.diffraction.xrd 48, scanning.electron.microscopy 38, thin.films.grown 35, oxide.thin.films 31, films.ray.diffraction 28, atomic.force.microscopy 26, optical.electrical.properties 24, chemical.bath.deposition 24, structural.optical.properties 22, band.gap.energy 21, thin.films.optical 18, deposited.glass.substrates 18, indium.tin.oxide 18

Term Cliques

57.89% film thin.films thin optic gap absorpt substrat band anneal optical.properties evapor
58.75% film thin.films thin optic gap absorpt substrat band band.gap anneal optical.properties
59.37% film thin.films thin optic deposit gap substrat band band.gap anneal glass electr
59.17% film thin.films thin optic deposit gap absorpt substrat band anneal glass evapor
59.95% film thin.films thin optic deposit gap absorpt substrat band band.gap anneal glass

Sample Cluster Record Titles

Self-assembled electrooptic thin films with remarkably blue-shifted optical absorption based on an X-shaped chromophore

Synthesis and characterization of copper doped zinc telluride thin films

Aerosol-assisted chemical vapour deposition of sodium fluoride thin films

Growth and characterisation of Eu doped GaN thin films

Influence of annealing on the optical and the electrical properties of ITO thin films prepared by using a sol-gel spin method

Preparation and properties of CdS thin films grown by ILGAR method

The microstructure effect on the electrical and optical properties of undoped and Sr-doped SmCoO3 thin films

The effects of composition and heat treatment on the structural and optical properties of Ge15Te85-xCux thin films

Structural and optical properties of homogeneous Cu(In,Ga)Se-2 thin films prepared by thermal reaction of InSe/Cu/GaSe alloys with elemental Se vapour

Cluster Metrics

Authors

lokhande, cd 8

rezig, b 7
narayandass, sk 7
mangalaraj, d 7
rusu, gi 6
kanzari, m 6
wang, h 5
nair, pk 5
marks, tj 5
el-nahass, mm 5
zribi, m 4
yi, j 4
yang, y 4
yan, h 4
xu, hy 4

Sources
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materials letters 12
materials chemistry and physics 11
applied surface science 11
semiconductor science and technology 9
materials science and engineering b-solid state materials for advanced technology 9
journal of applied physics 9
applied physics letters 9
solar energy materials and solar cells 7
journal of materials science 6
physica b-condensed matter 5
surface & coatings technology 4
optical materials 4

Keywords
materials science, multidisciplinary 131
physics, applied 85
physics, 55
physics, condensed matter 48
condensed matter 42
physics, applied 34
optical properties 34
growth 32
thin films 31
optics 26
optical-properties 23
deposition 23
chemistry, physical 22

physics, condensed matter 19
optical-properties 19

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Country
india 71
peoples r china 49
usa 31
south korea 25
france 23
japan 19
mexico 18
romania 14
tunisia 12
egypt 12
taiwan 11
italy 11
turkey 8
germany 8
bulgaria 8

Institution
shivaji univ 12
chinese acad sci 11
univ nacl autonoma mexico 8
bharathiar univ 8
sungkyunkwan univ 7
ain shams univ 6
northwestern univ 5
korea inst sci & technol 5
jadavpur univ 5
hanyang univ 5
enit 5
bulgarian acad sci 5
alagappa univ 5
al i cuza univ 5
zhejiang univ 4

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science citation index 329

- # CLUSTER 217

  Thin films, emphasizing orientation of films, silicon films, and preparation by deposition, magnetron sputtering, and annealing (959 Records)

(Countries: USA, China, Japan. Institutions: CAS dominant, Nanyang Technological University, National Tsing Hua University, National Institute of Advanced Industrial S&T. USA includes Penn State University.).

Cluster Syntax Features

Descriptive Terms
film 27.1%, thin.films 20.8%, thin 18.7%, deposit 1.5%, substrat 1.5%, sputter 1.0%, temperatur 0.5%, thin.film 0.4%, si 0.4%, anneal 0.4%, thick 0.4%, orient 0.3%, surfac 0.3%, layer 0.3%, properti 0.3%

Discriminating Terms
thin.films 19.4%, thin 15.3%, film 14.4%, particl 0.9%, nanoparticl 0.9%, nanotub 0.8%, carbon 0.8%, sputter 0.7%, quantum 0.6%, dot 0.4%, surfac 0.4%, cell 0.4%, structur 0.3%, electron 0.3%, polym 0.3%

Single Word Terms
thin 959, film 958, deposit 477, substrat 476, temperatur 400, structur 400, surfac 361, rai 361, properti 331, microscopi 301, diffract 298, electron 281, high 255, thick 248, sputter 242

Double Word Terms
thin.films 940, ray.diffraction 274, thin.film 228, electron.microscopy 167, films.deposited 166, atomic.force 157, force.microscopy 135, magnetron.sputtering 123, films.grown 106, transmission.electron 103, scanning.electron 92, room.temperature 82, diffraction.xrd 76, sol.gel 75, ray.photoelectron 64

Triple Word Terms
atomic.force.microscopy 129, thin.films.deposited 126, transmission.electron.microscopy 97, thin.films.grown 85, scanning.electron.microscopy 80, ray.diffraction.xrd 75, ray.photoelectron.spectroscopy 57, force.microscopy.afm 56, films.ray.diffraction 36, oxide.thin.films 32, electron.microscopy.tem 32, electron.microscopy.sem 29, thin.films.thin 29, thin.films.high 28, films.thin.films 28

Term Cliques
44.28% film thin.films thin deposit substrat sputter thin.film si anneal thick orient surfac layer properti
44.57% film thin.films thin deposit substrat sputter temperatur thin.film si anneal thick orient layer properti

Sample Cluster Record Titles

The effect of substrate materials on orientation degree of lanthanum-substituted bismuth titanate thin films

Deposition of SrFeO3-delta-dispersed SrMoO4 oxide thin films on Si (100) surface for spintronic applications

Low temperature synthesis of AlN films by ICP-assisted metalorganic chemical vapor deposition method

Crystalline thin films formed by supramolecular assembly for ultrahigh-density data storage

Electronic structure of UH3 thin films prepared by sputter deposition

Study on the etch characteristics of BST thin films by using inductively coupled plasma

Stress behavior related to the boron and nitrogen concentration of W-B-N thin films on Si substrate

Growth of ferromagnetic Zn1-xMnxO thin films on Al2O3 (0001) by reactive RF magnetron sputtering

[Fluorescence spectra characters of nanostructured gold thin-film]

Cluster Metrics

Authors
brett, mj 8
wang, j 7
xu, kw 6
xi, xx 6
wang, y 6
kim, j 6
kim, dy 6
goudeau, p 6
fu, yq 6
yi, xj 5
yamamoto, h 5
wu, js 5
varela, ja 5
tanaka, h 5
longo, e 5

Sources
thin solid films 72
journal of applied physics 52
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surface & coatings technology 28
physical review b 28
applied surface science 26
journal of crystal growth 22
macromolecules 18
journal of vacuum science & technology a 18
japanese journal of applied physics part 1-regular papers brief communications & review papers 15
applied physics a-materials science & processing 15
chemical vapor deposition 13
journal of the electrochemical society 12
journal of optoelectronics and advanced materials 12
journal of the korean physical society 11

Keywords
materials science, multidisciplinary 232
physics, applied 173
physics, applied 150

physics, 110
chemistry, physical 96
growth 90
physics, condensed matter 80
condensed matter 77
thin films 72
materials science, coatings & films 71
deposition 64
physics, condensed matter 59
materials science, multidisciplinary 50
thin film 48
engineering, electrical & electronic 47

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2004 107
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Country

usa 193
peoples r china 157
japan 116
south korea 86
germany 79
france 68
england 49
italy 38
taiwan 36
singapore 31
india 29
spain 24
canada 23
brazil 18
switzerland 16

Institution

chinese acad sci 42
nanyang technol univ 20
natl tsing hua univ 15
natl inst adv ind sci & technol 15
cnrs 14
cnr 14
xian jiaotong univ 12
univ cambridge 12
tohoku univ 12
univ alberta 10

penn state univ 10
osaka univ 10
natl univ singapore 10
korea adv inst sci & technol 10
hanyang univ 10

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- CLUSTER 132
  Ferroelectric thin films (including platinum [Pt], BST, BLT, and silica [SiO2] films), with emphasis on polarization, orientation, and dielectric/ ferroelectric properties (258 Records)

(Countries: South Korea, Japan, China, followed by USA. Tokyo Institute of Technology, Hynix Semiconductor, Inc., National Institute of Advanced Industrial S&T, Korea Advanced Institute S&T. USA includes Caltech.).

Cluster Syntax Features

Descriptive Terms
ferroelectr 17.4%, film 14.2%, thin 5.0%, thin.films 4.7%, dielectr 4.2%, pt 2.2%, polar 1.2%, orient 1.2%, ferroelectric.properties 1.1%, bst 1.0%, blt 1.0%, sio2.si 0.9%, dielectric.constant 0.8%, properti 0.7%, deposit 0.7%

Discriminating Terms

ferroelectr 13.5%, film 3.7%, thin.films 2.5%, dielectr 2.4%, thin 2.1%, pt 1.1%, ferroelectric.properties 0.8%, blt 0.8%, surfac 0.8%, nanoparticl 0.8%, bst 0.8%, carbon 0.7%, particl 0.7%, sio2.si 0.7%, nanotub 0.6%

Single Word Terms
film 250, thin 220, ferroelectr 168, properti 168, substrat 147, deposit 128, structur 122, dielectr 114, polar 111, si 109, pt 108, temperatur 102, electr 94, rai 89, orient 88

Double Word Terms
thin.films 195, sio2.si 81, ray.diffraction 73, dielectric.constant 67, films.deposited 59, thin.film 58, ferroelectric.properties 57, sol.gel 54, si.substrates 52, electrical.properties 52, ti.sio2 51, dielectric.properties 45, pt.ti 45, remanent.polarization 40, electron.microscopy 39

Triple Word Terms
ti.sio2.si 51, pt.ti.sio2 43, sio2.si.substrates 42, ferroelectric.thin.films 35, thin.films.deposited 33, atomic.force.microscopy 26, scanning.electron.microscopy 23, chemical.solution.deposition 23, leakage.current.density 21, substrates.sol.gel 20, remanent.polarization.coercive 18, transmission.electron.microscopy 18, sio2.si.substrate 18, thin.films.fabricated 18, ray.diffraction.xrd 18

Term Cliques
54.44% film thin thin.films pt orient blt sio2.si properti deposit
52.48% film thin thin.films dielectr pt bst sio2.si dielectric.constant properti deposit
51.87% ferroelectr film thin thin.films pt polar orient ferroelectric.properties blt sio2.si properti

Sample Cluster Record Titles

Growth of biaxially textured BaxPb1-xTiO3 ferroelectric thin films on amorphous Si3N4

Characteristics of constrained ferroelectricity in PbZrO3/BaZrO3 superlattice films

Ferroelectric domain morphologies of (001)PbZr1-xTixO3 epitaxial thin films

Mechanism of polarization enhancement in la-doped Bi4Ti3O12 films

Th4+ donor/Mg2+ acceptor-cosubstituted (Bi,Nd)(4)Ti3O12 films with excellent ferroelectric properties

Growth and dielectric properties of ferroelectric BaTiO3 thin films for cantilever-type microsensors

[Selective reaction and chemical anisotropy in epitaxial bismuth layer-structured ferroelectric thin films]

[Growth and characterizations of relaxor-based Pb(Mg1/3Nb2/3)O-3-PbTiO3 thin films by sol-gel method]

[Preparation of SrBi2Ta2O9 ferroelectric thin films by liquid source misted chemical vapor deposition method using inorganic salt solution]

Cluster Metrics

Authors
hong, sk 9
waser, r 8
wang, j 6
suzuki, k 6
kim, kt 6
kim, ci 6
kato, k 6
song, tk 5
scott, jf 5
nishizawa, k 5
miki, t 5
kim, ss 5
ishiwara, h 5
yao, k 4
yang, cr 4

Sources
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journal of the european ceramic society 10
journal of crystal growth 9
materials science and engineering b-solid state materials for advanced technology 8
journal of the korean physical society 8
journal of electroceramics 7
ferroelectrics 7
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Keywords
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physics, applied 67
materials science, multidisciplinary 63
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condensed matter 42
chemical-vapor-deposition 35
engineering, electrical & electronic 32
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materials science, ceramics 24
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ceramics 22
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memories 21
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taiwan 12
england 8
singapore 7
israel 7
switzerland 6
spain 5
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russia 4
romania 4
portugal 4

Institution
tokyo inst technol 10
hynix semicond inc 10
natl inst adv ind sci & technol 8
korea adv inst sci & technol 8
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univ elect sci & technol china 6
tohoku univ 6
chung ang univ 6
chinese acad sci 6
changwon natl univ 6
technion israel inst technol 5
shandong univ 5
seoul natl univ 5
nanjing univ 5
caltech 5

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science citation index 258

- CLUSTER 10
  Pb(ZrTi)O-3 (PZT) thin films, emphasizing ferroelectric properties and orientation control (122 Records)

(Countries: Japan, South Korea, China. Institutions: CAS, Tokyo Institute of Technology, National Institute of Advanced Industrial S&T.).

Cluster Syntax Features

Descriptive Terms
pzt 45.3%, film 5.5%, pzt.films 3.9%, pzt.thin 3.6%, ferroelectr 2.8%, pzt.thin.films

2.1%, pb 2.0%, thin 1.7%, thin.films 1.4%, ti 1.1%, zr.ti 1.0%, zr 0.9%, pb.zr0 0.7%, orient 0.7%, pb.zr.ti 0.7%

Discriminating Terms
pzt 30.0%, pzt.films 2.6%, pzt.thin 2.4%, ferroelectr 1.6%, pzt.thin.films 1.4%, pb 1.1%, surfac 0.8%, nanoparticl 0.6%, zr.ti 0.6%, carbon 0.6%, particl 0.6%, magnet 0.6%, nanotub 0.5%, pb.zr0 0.5%, pb.zr.ti 0.4%

Single Word Terms
pzt 121, film 119, thin 100, pb 86, deposit 80, ferroelectr 79, properti 79, substrat 74, ti 64, structur 59, polar 55, orient 52, si 52, rai 49, zr 48

Double Word Terms
thin.films 90, pzt.thin 70, pzt.films 64, zr.ti 43, pb.zr0 41, pb.zr 39, ray.diffraction 37, zirconate.titanate 34, lead.zirconate 34, thin.film 33, sol.gel 32, sio2.si 31, films.deposited 30, ferroelectric.properties 26, titanate.pzt 25

Triple Word Terms
pzt.thin.films 58, pb.zr.ti 39, lead.zirconate.titanate 34, zirconate.titanate.pzt 24, zr.ti.pzt 21, ti.sio2.si 21, pt.ti.sio2 19, pb.zr0.52ti0 18, pulsed.laser.deposition 18, pzt.thin.film 18, thin.films.deposited 17, zr.ti.thin 16, ti.thin.films 15, sio2.si.substrates 14, zr0.52ti0.pzt 13

Term Cliques
66.89% pzt film pzt.thin ferroelectr pzt.thin.films pb thin thin.films pb.zr0 orient
68.77% pzt film pzt.thin ferroelectr pzt.thin.films pb thin thin.films ti orient
61.82% pzt film pzt.films ferroelectr pb thin thin.films ti zr.ti zr orient pb.zr.ti
66.39% pzt film pzt.films ferroelectr pzt.thin.films pb thin thin.films pb.zr0 orient
65.65% pzt film pzt.films ferroelectr pzt.thin.films pb thin thin.films ti zr orient

Sample Cluster Record Titles

True Young modulus of Pb(Zr,Ti)O-3 films measured by nanoindentation

A study of UV-photolysis effects on ferroelectricity in PZT thin films

Comparison study of (001)-/(100)-oriented epitaxial and fiber-textured Pb(Zr,Ti)O-3 thick films prepared by MOCVD

Pb(Zr,Ti)O-3 thin film deposited using AIN buffer layer and its ferroelectric properties

Analysis of the switching characteristics of PZT films by first order reversal curve diagrams

Ferroelectric properties of PbZrO3/PbTiO3 artificial superlattices by scanning probe microscopy

Electrical properties of PZT/Mg2TiO4 thin films made by low pressure MOCVD

Thickness dependent characteristics in the growth of Pb(Zr0.4Ti0.6)O-3 thin films on LaNiO3 electrode by MOCVD

Fabrication of planar and three-dimensional PZT capacitors with Ir-based electrodes solely by low-temperature MOCVD using a novel liquid Ir precursor

Cluster Metrics

Authors

funakubo, h 6
yokoyama, s 4
shimizu, m 4
saito, k 4
remiens, d 4
okamoto, s 4
morioka, h 4
maeda, r 4
zhu, xh 3
zeng, hr 3
yu, hf 3
yin, qr 3
wang, gs 3
soyer, c 3
son, yg 3

Sources

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applied physics a-materials science & processing 5
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journal of the korean physical society 4
journal of crystal growth 4
microsystem technologies-micro-and nanosystems-information storage and processing systems 3
applied surface science 3

acta physica sinica 3
sensors and actuators a-physical 2
journal of the european ceramic society 2
japanese journal of applied physics part 1-regular papers short notes & review papers 2

Keywords
physics, applied 36
physics, applied 30
engineering, electrical & electronic 27
physics, 26
condensed matter 23
materials science, multidisciplinary 22
chemical-vapor-deposition 19
pzt 17
growth 13
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polarization 12
physics, condensed matter 11
capacitors 11
materials science, ceramics 10
electrical-properties 10

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Country
japan 30
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peoples r china 24
usa 11
germany 8
taiwan 6
france 6
singapore 5
england 5
romania 2
czech republic 2
switzerland 1
russia 1
portugal 1
north ireland 1

Institution
chinese acad sci 9

tokyo inst technol 7
natl inst adv ind sci & technol 6
univ elect sci & technol china 5
tohoku univ 5
tsing hua univ 4
samsung adv inst technol 4
pusan natl univ 4
natl tsing hua univ 4
cnrs 4
univ hyogo 3
natl univ singapore 3
korea adv inst sci & technol 3
hitachi ltd 3
yonsei univ 2

DataBase
science citation index 122

- CLUSTER 137
  Characterization of thin films grown by pulsed laser deposition (PLD), especially SrTiO3 films (353 Records)

(Countries: China, USA, Japan, followed by South korea, Germany, France. Institutions: CAS dominant, Nanjing University, Tokyo Institute of Technology, Hong Kong Polytechnical University. USA include USN, UCB, USAF.).

Cluster Syntax Features

Descriptive Terms
film 12.9%, pulsed.laser 7.4%, laser.deposition 7.1%, pulsed.laser.deposition 6.8%, laser 5.1%, puls 5.0%, thin 4.7%, thin.films 4.3%, deposit 3.9%, srtio3 3.4%, substrat 2.3%, epitaxi 1.3%, pld 1.1%, grown 1.0%, 001 1.0%

Discriminating Terms
pulsed.laser 6.0%, laser.deposition 5.9%, pulsed.laser.deposition 5.7%, film 3.2%, puls 3.2%, srtio3 2.7%, laser 2.5%, thin.films 2.4%, thin 2.0%, deposit 1.1%, pld 0.9%, particl 0.8%, carbon 0.7%, nanoparticl 0.7%, nanotub 0.7%

Single Word Terms
film 347, thin 322, deposit 309, laser 298, puls 286, substrat 255, temperatur 187, grown 181, rai 176, diffract 172, properti 168, structur 157, electron 139, microscopi 137, growth 130

Double Word Terms
thin.films 284, pulsed.laser 275, laser.deposition 266, ray.diffraction 152, films.grown 110, electron.microscopy 80, thin.film 80, atomic.force 74, deposition.pld 74, substrates.pulsed 74, force.microscopy 70, films.deposited 60, transmission.electron 56, room.temperature 55, single.crystal 51

Triple Word Terms
pulsed.laser.deposition 261, substrates.pulsed.laser 73, laser.deposition.pld 73, thin.films.grown 70, atomic.force.microscopy 67, films.pulsed.laser 50, transmission.electron.microscopy 50, grown.pulsed.laser 42, thin.films.pulsed 41, ray.diffraction.xrd 32, films.grown.pulsed 30, scanning.electron.microscopy 29, thin.films.deposited 28, films.ray.diffraction 27, force.microscopy.afm 25

Term Cliques
57.14% film thin srtio3 substrat epitaxi grown 001
73.69% film thin thin.films deposit substrat epitaxi grown
79.42% film pulsed.laser laser.deposition pulsed.laser.deposition laser puls thin thin.films deposit substrat grown
76.85% film pulsed.laser laser.deposition pulsed.laser.deposition laser puls thin thin.films deposit substrat pld

Sample Cluster Record Titles

Characteristics of perovskite (Li0.5La0.5)TiO3 solid electrolyte thin films grown by pulsed laser deposition for rechargeable lithium microbattery

[X-ray, absorption and photocurrent properties of thin-film GaAs on glass formed by pulsed-laser deposition]

[Elastic anomaly for SrTiO3 thin films grown on Si(001)]

[Growth dynamics of pulsed laser deposited Pt nanoparticles on highly oriented pyrolitic graphite substrates]

[In situ composition monitoring using reflection high-energy electron diffraction for SrTiO3 thin films grown by reactive coevaporation]

[Barium ferrite (BaFe12O19) thin films prepared by pulsed laser deposition on MgO buffered Si substrates]

[Crystalline growth of cubic (Eu, Nd): Y2O3 thin films on alpha-Al2O3 by pulsed laser deposition]

[Switch performance and electronic nature of photonic laser digitizing through thin GaAs films on glass]

[Pulsed laser deposition of LiNbO3 thin films from Li-rich targets]

Cluster Metrics

Authors

kim, jh 11
lu, hb 10
chen, zh 10
zhou, yl 8
yang, gz 8
wong, kh 8
li, xm 8
chan, hlw 8
yi, ss 7
socol, g 7
koinuma, h 7
jeong, jh 7
chen, tl 7
bae, js 7
wang, xl 6

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ieee transactions on applied superconductivity 8
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journal of the korean physical society 6
journal of materials research 6
japanese journal of applied physics part 1-regular papers short notes & review papers 6
japanese journal of applied physics part 1-regular papers brief communications & review papers 6
superlattices and microstructures 5

Keywords
materials science, multidisciplinary 102
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physics, applied 93
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physics, condensed matter 49
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growth 37
pulsed laser deposition 33
pulsed-laser deposition 32
chemistry, physical 29
engineering, electrical & electronic 26
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physics, condensed matter 25
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materials science, coatings & films 22

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2005 308
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Country
peoples r china 80
usa 70
japan 54
south korea 31
germany 29
france 28
romania 17

italy 14
canada 12
spain 9
india 8
england 7
switzerland 6
singapore 6
sweden 5

Institution

chinese acad sci 32
nanjing univ 15
tokyo inst technol 12
hong kong polytech univ 11
silla univ 7
pukyong natl univ 7
kyoto univ 7
city univ hong kong 7
usn 6
univ elect sci & technol china 6
univ calif berkeley 6
natl inst mat sci 6
dong eui univ 6
usaf 5
suzhou univ 5

DataBase

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CATEGORY 7 - 508B2a ***(6 leaf clusters)***

Deposition of Thin Films (1752 REC)

THRUST

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- Studies on silicon, especially porous and amorphous silicon, silicon nanocrystals, silicon nitride materials, and silicon wafers (222 Records) Cluster 176
- Silicon films (some hydrogenated and/or amorphous) prepared primarily by chemical vapor deposition (405 Records) Cluster 170
- Chemical vapor deposition (CVD), focusing on techniques (such as metal organic CVD), growth of films from certain precursors, and properties of deposited films (461 Records) Cluster 216
- Plasma polymerization, treatment, and ion implantation and deposition (242 Records) Cluster 156
- Carbon thin films, focusing on preparation by deposition and sputtering, amorphous carbon and carbon nitride films, and characterization, especially of bonding properties (297 Records) Cluster 163

- Diamond-like carbon (DLC) coatings, emphasizing preparation by deposition and/or plasma ion implantation and Raman studies (125 Records) Cluster 17

- CLUSTER 176
  Studies on silicon, especially porous and amorphous silicon, silicon nanocrystals, silicon nitride materials, and silicon wafers (222 Records)

Countries: USA, China, followed by Japan, Germany, France, South Korea, Russia. Institutions: CNRS, CAS, RAS. USA includes NREL.).

Cluster Syntax Features

Descriptive Terms
silicon 46.7%, si 5.4%, porous.silicon 5.3%, porou 3.0%, layer 1.4%, amorphous.silicon 1.2%, nanocryst 1.1%, oxid 1.0%, silicon.nanocrystals 0.9%, hydrogen 0.8%, amorph 0.7%, silicon.nitride 0.6%, wafer 0.6%, nitrid 0.5%, anneal 0.5%

Discriminating Terms
silicon 34.3%, porous.silicon 4.4%, si 2.1%, porou 1.9%, film 1.7%, amorphous.silicon 0.9%, magnet 0.7%, silicon.nanocrystals 0.7%, nanotub 0.7%, carbon 0.7%, particl 0.6%, nanoparticl 0.6%, silicon.nitride 0.5%, quantum 0.4%, polym 0.4%

Single Word Terms
silicon 220, si 142, layer 93, temperatur 87, structur 84, electron 81, surfac 81, oxid 75, high 73, deposit 67, chemic 59, porou 58, form 58, microscopi 58, substrat 53

Double Word Terms
porous.silicon 54, electron.microscopy 40, amorphous.silicon 35, silicon.si 29, chemical.vapor 29, vapor.deposition 26, silicon.oxide 26, transmission.electron 25, plasma.chemical 24, silicon.nanocrystals 23, silicon.nitride 22, photoelectron.spectroscopy 21, ray.photoelectron 21, silicon.dioxide 19, scanning.electron 19

Triple Word Terms
chemical.vapor.deposition 26, ray.photoelectron.spectroscopy 20, transmission.electron.microscopy 20, plasma.chemical.vapor 19, scanning.electron.microscopy 16, amorphous.silicon.si 15, atomic.force.microscopy 14, hydrogenated.amorphous.silicon 12, photoelectron.spectroscopy.xps 11, high.resolution.transmission 11, resolution.transmission.electron 11, silicon.nanocrystals.embedded 10, silicon.solar.cells 10, porous.silicon.layers 9, vch.verlag.gmbh 9

Term Cliques
29.88% silicon nanocryst amorph silicon.nitride nitrid anneal
27.85% silicon nanocryst silicon.nanocrystals silicon.nitride nitrid anneal
35.95% silicon nanocryst oxid silicon.nanocrystals anneal
37.58% silicon si layer silicon.nitride wafer nitrid anneal
37.77% silicon si layer hydrogen silicon.nitride wafer nitrid
36.68% silicon si layer silicon.nanocrystals silicon.nitride nitrid anneal
45.95% silicon si layer oxid wafer anneal
44.89% silicon si layer oxid silicon.nanocrystals anneal
35.59% silicon si layer amorphous.silicon amorph silicon.nitride nitrid anneal
35.75% silicon si layer amorphous.silicon hydrogen amorph silicon.nitride nitrid
51.08% silicon si porous.silicon porou layer

Sample Cluster Record Titles

Probing structural transitions of nanosize silicon clusters via anion photoelectron spectroscopy at 7.9 eV

Optimisation of a silicon/silicon dioxide substrate for a fluorescence DNA microarray

Observation of metastable self-organised structure during porous silicon formation

Hydrogen annealing effects on epitaxy of SOI wafer

[Surface plasmon enhancement of an optical anisotropy in porous silicon/metal composite]

[Nanopores in macroporous silicon]

[Optical switching in hydrogenated amorphous silicon-sulfur alloy prepared by glow discharge]

[Formation of silicon-on-aluminum nitride using ion-cut and theoretical investigation of self-heating effects]

[Femtosecond laser-induced formation of submicrometer spikes on silicon in water]

Cluster Metrics

Authors
wang, q 4
timoshenko, vy 4
renna, l 4
reina, s 4
liu, wl 4
lin, cl 4
kashkarov, pk 4
galati, c 4
du, xw 4
cerofolini, gf 4
zhu, m 3
zhao, y 3
yang, dr 3
sun, j 3
osminkina, la 3

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physica status solidi a-applications and materials science 9
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journal of applied physics 8
journal of the electrochemical society 7
materials science and engineering b-solid state materials for advanced technology 6
applied surface science 6
applied physics a-materials science & processing 6
materials letters 5
electrochemical and solid state letters 5
semiconductor science and technology 4
physics of the solid state 4

optical materials 4
nanotechnology 4

Keywords
materials science, multidisciplinary 58
physics, applied 47
physics, applied 35
physics, condensed matter 30
films 28
si 27
physics, 21
physics, condensed matter 20
photoluminescence 19
porous silicon 17
silicon 17
engineering, electrical & electronic 16
growth 16
condensed matter 14
chemistry, physical 14

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japan 24
germany 24
france 24
south korea 20
russia 18
italy 11
spain 6
netherlands 6
belgium 6
singapore 5
india 5
england 5
ukraine 4

Institution
cnrs 10
chinese acad sci 10

russian acad sci 8
moscow mv lomonosov state univ 5
tokyo inst technol 4
tianjin univ 4
stmicroelect 4
samsung adv inst technol 4
cnr 4
city univ hong kong 4
cea 4
zhejiang univ 3
univ lyon 1 3
univ autonoma madrid 3
natl renewable energy lab 3

DataBase
science citation index 222

- # CLUSTER 170
  Silicon films (some hydrogenated and/or amorphous) prepared primarily by chemical vapor deposition (405 Records)

(Countries: China, USA, Japan. Institutions: CAS, Sungyunkwan University, Nankai University. USA include MIT, NREL.).

Cluster Syntax Features

Descriptive Terms
film 13.7%, silicon 9.9%, si 7.7%, deposit 7.0%, plasma 3.3%, plasma.chemical 2.1%,

hydrogen 1.8%, pecvd 1.7%, plasma.chemical.vapor 1.6%, amorphous.silicon 1.5%, amorph 1.4%, chemical.vapor 1.3%, chemical.vapor.deposition 1.1%, thin 1.1%, vapor.deposition 1.1%

Discriminating Terms
silicon 6.6%, film 4.0%, si 4.0%, deposit 3.2%, plasma 1.9%, plasma.chemical 1.8%, pecvd 1.6%, plasma.chemical.vapor 1.4%, amorphous.silicon 1.3%, si.films 0.9%, silicon.films 0.9%, surfac 0.8%, chemical.vapor 0.8%, nanoparticl 0.8%, particl 0.8%

Single Word Terms
film 391, deposit 357, silicon 302, chemic 262, plasma 249, si 240, vapor 199, thin 199, temperatur 185, amorph 172, high 163, structur 159, substrat 158, hydrogen 152, properti 152

Double Word Terms
chemical.vapor 194, plasma.chemical 190, vapor.deposition 180, films.deposited 141, thin.films 137, amorphous.silicon 107, deposition.pecvd 72, thin.film 72, si.films 68, silicon.films 63, low.temperature 52, hydrogenated.amorphous 51, si.si 50, silicon.nitride 49, deposition.rate 49

Triple Word Terms
chemical.vapor.deposition 180, plasma.chemical.vapor 152, vapor.deposition.pecvd 49, thin.films.deposited 47, hydrogenated.amorphous.silicon 46, chemical.vapour.deposition 42, fourier.transform.infrared 38, plasma.chemical.vapour 38, ray.photoelectron.spectroscopy 36, films.plasma.chemical 32, silicon.thin.films 32, electron.cyclotron.resonance 25, deposited.plasma.chemical 25, amorphous.silicon.si 24, vapour.deposition.pecvd 23

Term Cliques
57.21% film silicon deposit plasma.chemical hydrogen amorph chemical.vapor chemical.vapor.deposition thin vapor.deposition
54.55% film silicon deposit plasma plasma.chemical hydrogen pecvd plasma.chemical.vapor chemical.vapor chemical.vapor.deposition thin vapor.deposition
55.53% film silicon si deposit hydrogen amorphous.silicon amorph chemical.vapor chemical.vapor.deposition thin vapor.deposition
60.35% film silicon si deposit plasma hydrogen chemical.vapor chemical.vapor.deposition thin vapor.deposition

Sample Cluster Record Titles

Suppression of photo-induced dilation in cyanide treated hydrogenated amorphous silicon films

[Electrical transport properties of microcrystalline silicon grown by plasma enhanced chemical vapor deposition]

[Control on the formation of Si nanodots fabricated by thermal annealing/oxidation of hydrogenated amorphous silicon]

[Structure and mechanical properties of Ti-Si-N films deposited by combined DC/RF reactive unbalanced magnetron sputtering]

[Structure characterization and photon absorption analysis of carbon-doped beta-FeSi2 film]

[Structural and optical characterization of amorphous As40S60 and As40Se60 films prepared by plasma-enhanced chemical vapor deposition]

[Novel polymeric thin film deposition system: Injector-apparatus/PECVD reactor]

[Study on crystallization of amorphous silicon using CeO2 seed layer patterned on the plastic substrate]

[Chemical bonding structure of low dielectric constant Si : O : C : H films characterized by solid-state NMR]

Cluster Metrics

Authors
geng, xh 7
zhang, xd 6
zhang, s 6
wuu, ds 6
wei, cc 6
van de sanden, mcm 6
martins, r 6
gleason, kk 6
fortunato, e 6
chen, gh 6
zhu, xh 5
zhao, y 5
xiong, sz 5
raniero, l 5
mataras, d 5

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journal of optoelectronics and advanced materials 11
japanese journal of applied physics part 1-regular papers short notes & review papers 11
solar energy materials and solar cells 10
journal of non-crystalline solids 8
journal of the electrochemical society 7
electrochemical and solid state letters 7
materials science and engineering b-solid state materials for advanced technology 6

Keywords
materials science, multidisciplinary 113
physics, applied 97
chemical-vapor-deposition 86
physics, applied 84
physics, 64
condensed matter 47
thin-films 42
physics, multidisciplinary 39
materials science, coatings & films 36
growth 35
physics, condensed matter 33
engineering, electrical & electronic 32
plasma 32
amorphous-silicon 31
silicon 30

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taiwan 25
france 22
italy 20
germany 19

netherlands 17
singapore 13
canada 13
india 12
england 12
spain 10
russia 10

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chinese acad sci 11
sungkyunkwan univ 9
nankai univ 9
nanyang technol univ 8
eindhoven univ technol 8
ecole polytech 8
univ cambridge 7
russian acad sci 7
mit 7
univ nova lisboa 6
osaka univ 6
natl renewable energy lab 6
natl chung hsing univ 6
natl chiao tung univ 6
cnr 6

DataBase
science citation index 405

- CLUSTER 216
  Chemical vapor deposition (CVD), focusing on techniques (such as

metal organic CVD), growth of films from certain precursors, and properties of deposited films (461 Records)

(Countries: USA, Japan, followed by China, South Korea. Institutions: Tokyo Institute of Technology, RAS, University of Illinois, University of Shizuoka, Tohoku University. Other USA include University of Maryland, Penn State University.).

Cluster Syntax Features

Descriptive Terms

deposit 25.6%, film 12.8%, vapor 4.0%, vapor.deposition 3.9%, chemical.vapor 3.4%, chemical.vapor.deposition 3.3%, chemic 2.2%, cvd 1.8%, precursor 1.2%, mocvd 1.1%, substrat 1.0%, temperatur 0.8%, thin 0.8%, growth 0.7%, ga 0.6%

Discriminating Terms

deposit 18.9%, film 3.9%, vapor.deposition 3.3%, vapor 3.1%, chemical.vapor 2.9%, chemical.vapor.deposition 2.9%, cvd 1.5%, mocvd 1.0%, chemic 0.9%, nanoparticl 0.9%, magnet 0.8%, particl 0.8%, nanotub 0.8%, precursor 0.7%, surfac 0.6%

Single Word Terms

deposit 456, film 416, chemic 315, vapor 292, temperatur 222, substrat 210, thin 179, structur 158, surfac 157, low 150, high 143, rai 138, metal 135, growth 134, properti 133

Double Word Terms

vapor.deposition 271, chemical.vapor 260, thin.films 122, films.deposited 105, ray.diffraction 86, films.grown 73, metal.organic 65, deposition.mocvd 62, electron.microscopy 60, organic.chemical 58, ray.photoelectron 57, deposition.temperature 55, photoelectron.spectroscopy 53, thin.film 52, deposition.cvd 49

Triple Word Terms

chemical.vapor.deposition 256, metal.organic.chemical 58, vapor.deposition.mocvd 56, ray.photoelectron.spectroscopy 53, organic.chemical.vapor 50, vapor.deposition.cvd 44, metalorganic.chemical.vapor 43, scanning.electron.microscopy 37, photoelectron.spectroscopy.xps 31, chemical.vapour.deposition 29, ray.diffraction.xrd 27, thin.films.deposited 25, transmission.electron.microscopy 23, pressure.chemical.vapor 22, electron.microscopy.sem 20

Term Cliques

51.47% deposit film vapor vapor.deposition chemical.vapor chemical.vapor.deposition chemic precursor mocvd substrat temperatur thin growth ga
51.78% deposit film vapor vapor.deposition chemical.vapor chemical.vapor.deposition chemic cvd precursor substrat temperatur thin growth ga

Sample Cluster Record Titles

Chemical vapor deposition of niobium disulfide thin films

Improvement of electrochemical properties in LiCoO2 cathode films grown on Pt/TiO2/SiO2/Si substrates by liquid-delivery metalorganic chemical vapor deposition

Characteristics of organic film deposited by plasma-enhanced chemical-vapor deposition using a benzocyclobutene resin

Crystal quality, electrical and optical properties of single crystal pyrite films prepared by chemical vapor deposition under atmospheric pressure

Development of TiSiN CVD process using TiCl4/SiH4/NH3 chemistry for ULSI anti-oxidation barrier applications

Effect of carrier gas on the structure and electrical properties of low dielectric constant SiCOH film using trimethylsilane prepared by plasma enhanced chemical vapor deposition

Evaluation of young modulus of CVD coatings by different techniques

NbS2 thin films by atmospheric pressure chemical vapour deposition and the formation of a new 1T polytype

Root growth of multi-wall carbon nanotubes by MPCVD

Cluster Metrics

Authors
parkin, ip 9
lee, jh 8
funakubo, h 8
nakamura, t 7
kim, hj 7
carmalt, cj 7
shimogaki, y 6
matsumura, h 6
masuda, a 6
fragala, il 6
zheng, yd 5
zhang, r 5
temmyo, j 5

shi, y 5
park, y 5

Sources

thin solid films 36
journal of the electrochemical society 20
chemical vapor deposition 17
journal of crystal growth 16
journal of applied physics 16
applied surface science 16
electrochemical and solid state letters 14
japanese journal of applied physics part 2-letters & express letters 12
japanese journal of applied physics part 1-regular papers short notes & review papers 12
materials science and engineering b-solid state materials for advanced technology 10
journal of vacuum science & technology b 10
journal of the korean physical society 9
journal of physical chemistry b 9
applied physics letters 9
surface & coatings technology 8

Keywords

materials science, multidisciplinary 101
physics, applied 88
chemical-vapor-deposition 86
thin-films 79
physics, 68
physics, condensed matter 63
growth 60
physics, applied 57
materials science, coatings & films 57
engineering, electrical & electronic 53
chemistry, physical 52
condensed matter 49
films 43
mocvd 39
cvd 37

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2003 1

Country

usa 98
japan 95

peoples r china 51
south korea 50
germany 28
italy 25
england 25
taiwan 22
france 20
russia 15
spain 13
netherlands 9
australia 7
mexico 6
india 6

Institution

tokyo inst technol 12
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univ illinois 10
univ shizuoka 9
tohoku univ 9
univ tokyo 7
osaka univ 7
nanjing univ 7
csic 7
cnr 7
chinese acad sci 7
univ maryland 6
seoul natl univ 6
penn state univ 6
natl inst adv ind sci & technol 6

DataBase

science citation index 461

- # CLUSTER 156
  Plasma polymerization, treatment, and ion implantation and deposition (242 Records)

(Countries: USA, Japan, South Korea, China, Germany. Institutions: Sungyungwan University, National University of Singapore, Nanyang Technological University. USA include USAF, University of Michigan.).

Cluster Syntax Features

Descriptive Terms
plasma 39.9%, film 12.8%, deposit 4.9%, discharg 0.9%, surfac 0.9%, thin 0.6%, plasma.polymerization 0.6%, ion 0.5%, chemic 0.5%, treatment 0.5%, polymer 0.5%, plasma.treatment 0.5%, substrat 0.5%, ga 0.4%, etch 0.4%

Discriminating Terms
plasma 32.1%, film 3.3%, deposit 1.7%, magnet 0.7%, crystal 0.7%, nanoparticl 0.7%, discharg 0.6%, structur 0.6%, nanotub 0.6%, quantum 0.5%, particl 0.5%, plasma.polymerization 0.5%, size 0.5%, phase 0.4%, plasma.treatment 0.4%

Single Word Terms
plasma 236, film 228, deposit 186, surfac 134, spectroscopi 112, chemic 105, thin 102, rai 91, substrat 89, electron 81, low 78, properti 78, high 74, structur 74, ga 69

Double Word Terms
ray.photoelectron 63, photoelectron.spectroscopy 61, thin.films 58, films.deposited 55, vapor.deposition 53, plasma.chemical 52, chemical.vapor 52, spectroscopy.xps 39, atomic.force 36, fourier.transform 35, transform.infrared 34, electron.microscopy 33, scanning.electron 33, contact.angle 32, plasma.treatment 31

Triple Word Terms
ray.photoelectron.spectroscopy 59, chemical.vapor.deposition 51, plasma.chemical.vapor 44, photoelectron.spectroscopy.xps 38, fourier.transform.infrared 34, atomic.force.microscopy 29, scanning.electron.microscopy 26, force.microscopy.afm 22, inductively.coupled.plasma 21, optical.emission.spectroscopy 20, transform.infrared.spectroscopy 15, vapor.deposition.pecvd 12, electron.microscopy.sem 11, secondary.ion.mass 11, contact.angle.measurements 11

Term Cliques
47.77% plasma film treatment plasma.treatment etch
51.82% plasma film ion ga etch
59.34% plasma film surfac plasma.treatment substrat
56.61% plasma film surfac treatment plasma.treatment
55.65% plasma film discharg surfac chemic treatment
53.67% plasma film deposit surfac plasma.polymerization chemic polymer substrat
54.34% plasma film deposit surfac thin plasma.polymerization chemic polymer
53.40% plasma film deposit discharg surfac ion chemic substrat ga
52.11% plasma film deposit discharg surfac ion chemic polymer substrat
53.99% plasma film deposit discharg surfac thin ion chemic ga
52.71% plasma film deposit discharg surfac thin ion chemic polymer

Sample Cluster Record Titles

Deuterium emission in laser plasma induced by transversely excited atmospheric pressure CO2 laser in low-pressure of helium surrounding gas

Structure and optical properties of Au-polyimide nanocomposite films prepared by ion implantation

Thin polymer films prepared by plasma immersion ion implantation and deposition

Electrochemical stability of magnetron-sputtered Ti films on sintered and sintered/plasma nitrided Fe-1.5% Mo alloy

Surface characteristics of polypropylene film treated by an atmospheric pressure plasma

Plasma polymer films rf sputtered from PTFE under various argon pressures

Composition of the plasma during the arc extinction and study of soot deposition in a low voltage circuit breaker with vapors coming from the erosion of walls and contacts.

Plasma deposition and surface characterization of oligoglyme, dioxane, and crown ether nonfouling films

B-C-N hybrid synthesis by high-temperature ion implantation

Cluster Metrics

Authors
shimada, m 5
bodas, ds 5

kim, jh 4
gangal, sa 4
yang, p 3
xu, s 3
wolden, ca 3
tullis, s 3
tran, nd 3
samukawa, s 3
palumbo, f 3
ostrikov, k 3
ono, t 3
okigawa, m 3
nastase, f 3

Sources

surface & coatings technology 29
thin solid films 23
journal of vacuum science & technology a 19
journal of applied physics 13
plasma processes and polymers 11
applied surface science 9
journal of vacuum science & technology b 7
applied physics letters 7
electrochemical and solid state letters 5
diamond and related materials 4
vacuum 3
microelectronic engineering 3
materials science and engineering b-solid state materials for advanced technology 3
journal of the electrochemical society 3
journal of optoelectronics and advanced materials 3

Keywords

physics, applied 62
materials science, multidisciplinary 53
materials science, coatings & films 52
chemical-vapor-deposition 46
physics, 32
physics, applied 28
thin-films 24
films 24
condensed matter 23
deposition 20
chemistry, physical 19
growth 18
xps 17
plasma 16

surface 15

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Country
usa 39
japan 31
south korea 28
peoples r china 21
germany 20
france 18
italy 14
singapore 13
taiwan 12
india 8
australia 8
romania 6
switzerland 5
czech republic 5
canada 5

Institution
sungkyunkwan univ 7
natl univ singapore 6
nanyang technol univ 6
cnr 5
univ sydney 4
univ paris 06 4
univ bari 4
natl cheng kung univ 4
ecole polytech 4
usaf 3
univ trent 3
univ s australia 3
univ poona 3
univ padua 3
univ michigan 3

DataBase
science citation index 242

- # CLUSTER 163
  Carbon thin films, focusing on preparation by deposition and sputtering, amorphous carbon and carbon nitride films, and characterization, especially of bonding properties (297 Records)

(Countries: Japan, China. Institutions: Nagoya Institute of Technology dominant, CAS, Chubu University. No USA presence shown.).

Cluster Syntax Features

Descriptive Terms
film 17.4%, carbon 9.9%, deposit 5.9%, carbon.films 3.9%, amorphous.carbon 3.8%, amorph 2.4%, nitrid 2.1%, carbon.nitride 1.5%, nitrogen 1.2%, plasma 1.2%, cnx 1.2%, films.deposited 1.1%, sputter 1.0%, bond 1.0%, substrat 0.9%

Discriminating Terms
film 6.2%, carbon 4.8%, carbon.films 3.7%, amorphous.carbon 3.5%, deposit 2.5%, carbon.nitride 1.4%, nitrid 1.4%, amorph 1.4%, cnx 1.1%, films.deposited 0.8%, particl 0.8%, nanoparticl 0.8%, nitrogen 0.7%, magnet 0.7%, amorphous.carbon.films 0.7%

Single Word Terms
film 293, deposit 258, carbon 239, properti 156, spectroscopi 148, amorph 148, substrat 146, structur 139, chemic 135, plasma 133, electron 112, thin 104, vapor 100, raman 100, surfac 98

Double Word Terms
films.deposited 121, amorphous.carbon 112, carbon.films 104, chemical.vapor 92, vapor.deposition 92, plasma.chemical 78, thin.films 76, photoelectron.spectroscopy 61, ray.photoelectron 59, magnetron.sputtering 58, carbon.nitride 56, raman.spectroscopy 52, field.emission 47, electron.microscopy 47, nitride.films 43

Triple Word Terms
chemical.vapor.deposition 90, plasma.chemical.vapor 68, ray.photoelectron.spectroscopy 55, amorphous.carbon.films 47, photoelectron.spectroscopy.xps 35, carbon.films.deposited 32, scanning.electron.microscopy 31, atomic.force.microscopy 30, carbon.nitride.films 29, carbon.thin.films 25, thin.films.deposited 23, fourier.transform.infrared 23, hydrogenated.amorphous.carbon 22, field.emission.properties 21, pulsed.laser.deposition 20

Term Cliques
51.76% film deposit nitrid nitrogen films.deposited sputter substrat
46.18% film deposit nitrid nitrogen cnx films.deposited sputter
42.93% film deposit nitrid carbon.nitride nitrogen cnx films.deposited bond
49.54% film deposit nitrid carbon.nitride nitrogen plasma films.deposited substrat
47.26% film deposit nitrid carbon.nitride nitrogen plasma films.deposited bond
48.73% film deposit amorph nitrogen cnx films.deposited sputter
55.60% film carbon deposit carbon.nitride nitrogen plasma films.deposited substrat
47.95% film carbon deposit amorphous.carbon amorph carbon.nitride nitrogen cnx films.deposited bond
51.41% film carbon deposit amorphous.carbon amorph carbon.nitride nitrogen plasma films.deposited bond
56.12% film carbon deposit carbon.films amorphous.carbon amorph plasma films.deposited bond

Sample Cluster Record Titles

Structure and chemical bonds of CNx films deposited by alternating irradiations of mass-separated ion beams of C+ and N+

Optical properties of hydrogenated amorphous carbon thin films prepared by dc saddle field plasma-enhanced chemical vapor deposition

Characteristics of phosphorus-doped amorphous carbon films grown by rf plasma-enhanced CVD with a novel phosphorus solid target

Mechanical properties of carbon-doped TIN films by ion beam irradiation in ethylene gas atmosphere

The bonding properties of amorphous carbon nitride films by the means of X-ray photoelectron spectroscopy studies

Nanoindentation and nanowear of extremely thin protective layers of C-N and B-C-N

Study in hydrogen ion irradiation of N+-ion-implanted SiC-C films

In vitro endothelialization on CNx films deposited on PTFE

Growth of Ni/Co-catalyzed crystalline CNx thin films by nitrogen-plasma-assisted pulsed laser deposition

Cluster Metrics

Authors
soga, t 21
rusop, m 20
jimbo, t 20
umeno, m 10
omer, amm 9
adhikary, s 9
uchida, h 8
adhikari, s 8
papakonstantinou, p 7
mclaughlin, ja 7
roy, ss 6
xu, t 5
silva, srp 4
park, ys 4
ossi, pm 4

Sources
thin solid films 42
diamond and related materials 26
surface & coatings technology 19
journal of applied physics 19
applied surface science 17
carbon 11
applied physics letters 11
japanese journal of applied physics part 1-regular papers short notes & review papers 9
surface review and letters 8
applied physics a-materials science & processing 7
journal of the korean physical society 6
journal of non-crystalline solids 6
japanese journal of applied physics part 1-regular papers brief communications & review papers 6
vacuum 5
new diamond and frontier carbon technology 5

Keywords
materials science, multidisciplinary 108
physics, applied 65

thin-films 63
physics, 61
physics, applied 53
condensed matter 43
growth 37
chemical-vapor-deposition 36
chemistry, physical 34
physics, condensed matter 34
materials science, coatings & films 32
diamond-like carbon 32
coatings 30
deposition 24
materials science, multidisciplinary 21

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2005 258
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Country
japan 80
peoples r china 55
usa 25
italy 22
south korea 19
germany 17
france 16
taiwan 12
russia 12
singapore 10
england 10
north ireland 8
india 8
spain 7
brazil 7

Institution
nagoya inst technol 24
chinese acad sci 12
chubu univ 11
univ ulster 8
univ trent 8
osaka univ 8
sungkyunkwan univ 7
nanyang technol univ 6
cnrs 6

univ surrey 5
russian acad sci 5
politecn milan 5
natl tsing hua univ 5
nagoya univ 5
moscow mv lomonosov state univ 5

DataBase
science citation index 297

- # CLUSTER 17
  Diamond-like carbon (DLC) coatings, emphasizing preparation by deposition and/or plasma ion implantation and Raman studies (125 Records)

(Countries: Japan, China. Institutions: CAS, Sungyunkwan University, Chuba University. No USA presence shown.).

Cluster Syntax Features

Descriptive Terms
dlc 33.4%, dlc.films 8.8%, diamond.carbon 8.6%, film 7.6%, diamond 5.8%, carbon 3.5%, carbon.dlc 2.2%, diamond.carbon.dlc 2.0%, deposit 1.5%, carbon.films 1.5%, dlc.film 1.3%, diamond.carbon.films 1.2%, carbon.dlc.films 0.9%, plasma 0.8%, raman 0.7%

Discriminating Terms
dlc 23.3%, dlc.films 6.2%, diamond.carbon 6.0%, diamond 3.2%, carbon.dlc 1.5%, diamond.carbon.dlc 1.4%, carbon.films 1.0%, dlc.film 0.9%, diamond.carbon.films 0.8%, film 0.8%, nanoparticl 0.7%, carbon.dlc.films 0.7%, carbon 0.6%, particl 0.6%, surfac 0.5%

Single Word Terms
film 123, carbon 123, diamond 120, dlc 110, deposit 99, properti 70, plasma 60,

spectroscopi 60, structur 60, chemic 58, substrat 57, raman 53, surfac 52, coat 41, amorph 41

Double Word Terms
diamond.carbon 112, carbon.dlc 91, dlc.films 79, carbon.films 64, films.deposited 47, raman.spectroscopy 39, plasma.chemical 34, dlc.film 31, vapor.deposition 30, chemical.vapor 30, atomic.force 27, ray.photoelectron 24, thin.films 23, photoelectron.spectroscopy 22, properties.diamond 21

Triple Word Terms
diamond.carbon.dlc 83, carbon.dlc.films 54, diamond.carbon.films 50, dlc.films.deposited 29, chemical.vapor.deposition 29, plasma.chemical.vapor 25, ray.photoelectron.spectroscopy 22, properties.diamond.carbon 20, atomic.force.microscopy 18, dlc.thin.films 13, photoelectron.spectroscopy.xps 12, transmission.electron.microscopy 12, carbon.thin.films 11, carbon.films.deposited 10, radio.frequency.plasma 10

Term Cliques
69.80% dlc dlc.films diamond.carbon film diamond carbon deposit carbon.films diamond.carbon.films carbon.dlc.films plasma raman
71.07% dlc dlc.films diamond.carbon film diamond carbon diamond.carbon.dlc deposit diamond.carbon.films carbon.dlc.films plasma raman
73.80% dlc dlc.films diamond.carbon film diamond carbon carbon.dlc diamond.carbon.dlc deposit carbon.dlc.films plasma raman
72.33% dlc dlc.films diamond.carbon film diamond carbon carbon.dlc diamond.carbon.dlc deposit dlc.film carbon.dlc.films plasma

Sample Cluster Record Titles

Micro-Raman studies on DLC coatings

The ultrasmoothness of diamond-like carbon surfaces

Thermal stability of diamondlike carbon buried layer fabricated by plasma immersion ion implantation and deposition in silicon on insulator

Structure evolution of fluorinated diamond-like carbon films prepared at varying source gas flow ratios

Low voltage electrodeposition of diamond like carbon (DLC)

Femtosecond pulsed laser ablation of diamond-like carbon films on silicon

Plasma study and deposition of DLC/TiC/Ti multilayer structures using technique combining pulsed laser deposition and magnetron sputtering

[Properties of DLC thin films produced by RF PE-CVD from pyrrole monomer]

[Interfaces and temperature stability of stepwise graded DLC films studied by nanoindentation and Raman spectroscopy]

Cluster Metrics

Authors
xu, t 5
umeno, m 5
hong, b 5
robertson, j 4
pascual, e 4
fu, rky 4
ferrari, ac 4
corbella, c 4
chu, pk 4
casiraghi, c 4
bertran, e 4
andujar, jl 4
adhikary, s 4
zhou, hd 3
yang, wj 3

Sources
diamond and related materials 24
thin solid films 20
surface & coatings technology 13
applied surface science 12
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 4
acta physica sinica 4
new diamond and frontier carbon technology 3
journal of vacuum science & technology b 3
journal of physics d-applied physics 3
journal of applied physics 3
journal of materials processing technology 2
journal of inorganic materials 2
journal of ceramic processing research 2
applied physics letters 2
zeitschrift fur metallkunde 1

Keywords
materials science, multidisciplinary 52

diamond-like carbon 41
physics, 32
physics, applied 25
coatings 24
amorphous-carbon 23
deposition 22
condensed matter 20
thin-films 18
materials science, coatings & films 17
amorphous-carbon 15
chemistry, physical 14
plasma 14
dlc 13
applied 12

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2005 114
2004 10
2006 1

Country
japan 33
peoples r china 23
south korea 14
usa 13
germany 10
taiwan 8
england 7
spain 5
singapore 5
india 5
france 3
czech republic 3
romania 2
ireland 2
greece 2

Institution
chinese acad sci 11
sungkyunkwan univ 7
chubu univ 5
univ cambridge 4
univ barcelona 4
nanyang technol univ 4
tokyo denki univ 3
natl cheng kung univ 3

korea inst sci & technol 3
keio univ 3
hanyang univ 3
city univ hong kong 3
yonsei univ 2
univ surrey 2
univ st etienne 2

DataBase
science citation index 125

CATEGORY 8 - 508B2b ***(2 leaf clusters)***

Diamond films (394 REC)

THRUST

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- Diamond films, emphasizing chemical vapor deposition (CVD), nanocrystalline, and boron-doped diamond films (219 Records) Cluster 26
- Chemical vapor deposition (CVD) diamond films, emphasizing plasma CVD, growth, and interactions with silicon (175 Records) Cluster 138

- # CLUSTER 26
  Diamond films, emphasizing chemical vapor deposition (CVD), nanocrystalline, and boron-doped diamond films (219 Records)

(Countries: China, followed by Japan, USA. Institutions: Shanghai University, RAS, CAS. USA includes Michigan State University.).

Cluster Syntax Features

Descriptive Terms
diamond 52.4%, diamond.films 10.6%, film 5.8%, diamond.film 1.8%, deposit 1.6%, cvd 1.3%, cvd.diamond 1.3%, substrat 0.8%, nanocrystalline.diamond 0.6%, growth 0.5%, plasma 0.5%, cvd.diamond.films 0.5%, chemical.vapor 0.5%, boron 0.4%, microwav 0.4%

Discriminating Terms
diamond 34.9%, diamond.films 7.4%, diamond.film 1.2%, cvd.diamond 0.9%, nanoparticl 0.7%, cvd 0.7%, magnet 0.6%, structur 0.6%, surfac 0.5%, nanotub 0.5%, particl 0.5%, nanocrystalline.diamond 0.4%, oxid 0.4%, crystal 0.4%, layer 0.4%

Single Word Terms
diamond 219, film 216, deposit 172, chemic 139, substrat 112, vapor 101, high 100, growth 95, surfac 91, electron 88, plasma 88, temperatur 86, cvd 82, properti 77, raman 69

Double Word Terms
diamond.films 148, chemical.vapor 100, vapor.deposition 96, diamond.film 80, cvd.diamond 53, microwave.plasma 49, plasma.chemical 48, raman.spectroscopy 45, hot.filament 44, filament.chemical 38, electron.microscopy 36, scanning.electron 36, films.grown 35, films.deposited 31, nanocrystalline.diamond 31

Triple Word Terms
chemical.vapor.deposition 96, hot.filament.chemical 38, microwave.plasma.chemical 38, plasma.chemical.vapor 36, cvd.diamond.films 31, scanning.electron.microscopy 31, filament.chemical.vapor 30, diamond.films.grown 25, chemical.vapour.deposition 25, diamond.thin.films 22, electron.microscopy.sem 21, boron.doped.diamond 21, vapor.deposition.cvd 21, nanocrystalline.diamond.films 18, vapor.deposition.hfcvd 17

Term Cliques
55.18% diamond film growth chemical.vapor boron microwav
53.82% diamond film diamond.film cvd growth chemical.vapor boron
55.38% diamond diamond.films film cvd cvd.diamond cvd.diamond.films

chemical.vapor
56.76% diamond diamond.films film deposit substrat nanocrystalline.diamond growth plasma chemical.vapor microwav
63.14% diamond diamond.films film deposit cvd cvd.diamond.films chemical.vapor
56.68% diamond diamond.films film diamond.film cvd cvd.diamond growth chemical.vapor
62.40% diamond diamond.films film diamond.film deposit substrat growth plasma chemical.vapor
63.47% diamond diamond.films film diamond.film deposit cvd growth chemical.vapor

Sample Cluster Record Titles

Quantitative analysis of hydrogen in chemical vapor deposited diamond films

{111}-oriented diamond films and p/n junctions grown on B-doped type Ib substrates

Optical properties of diamond-like carbon and nanocrystalline diamond films

Synthetic diamond electrodes: The effect of surface microroughnesson the electrochemical properties of CVD diamond thin films on titanium

Off-diagonal elastic constant and sp(2)-bonded graphitic grain boundary in nanocrystalline-diamond thin films

High rate growth of thick diamond films by high-current hot-cathode PCVD

Growth of Pt clusters electrodeposited onto boron-doped diamond films

A study of diamond synthesis by hot filament chemical vapour deposition on nanocomposite coatings

Photochemical oxidation of hydrogenated boron-doped diamond surfaces

Cluster Metrics

Authors
xia, yb 10
wang, lj 10
ferreira, ng 8
zhang, ml 7
lu, fx 7
gu, bb 7
trava-airoldi, vj 6

teraji, t 6
silva, f 6
li, cm 6
ito, t 6
hirose, a 6
hassouni, k 6
yang, q 5
xiao, c 5

Sources

diamond and related materials 50
thin solid films 17
journal of applied physics 9
applied physics letters 9
physica status solidi a-applications and materials science 7
carbon 5
surface & coatings technology 4
plasma science & technology 4
journal of crystal growth 4
acta metallurgica sinica 4
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 3
plasma sources science & technology 3
new diamond and frontier carbon technology 3
journal of vacuum science & technology b 3
applied surface science 3

Keywords

materials science, multidisciplinary 89
chemical-vapor-deposition 65
growth 50
diamond 33
thin-films 30
physics, applied 29
cvd 27
physics, applied 25
physics, 22
films 21
diamond film 19
nucleation 19
condensed matter 18
diamond 18
deposition 18

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Country
peoples r china 60
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usa 31
france 20
italy 16
russia 12
germany 12
brazil 12
england 10
taiwan 8
portugal 8
canada 8
israel 6
india 6
belgium 5

Institution
shanghai univ 10
russian acad sci 10
chinese acad sci 10
univ sci & technol beijing 8
univ aveiro 8
osaka univ 8
univ saskatchewan 7
univ paris 13 7
univ roma tor vergata 6
technion israel inst technol 6
natl inst mat sci 6
michigan state univ 6
jilin univ 6
inst nacl pesquisas espaciais 5
univ kassel 4

DataBase
science citation index 219

- # CLUSTER 138
  Chemical vapor deposition (CVD) diamond films, emphasizing plasma CVD, growth, and interactions with silicon (175 Records)

(Countries: USA, followed by China, Japan. Institutions: RAS, CAS, National Chiao Tung University. USA include Ohio State university, UCLA.).

Cluster Syntax Features

Descriptive Terms
diamond 53.3%, cvd 4.1%, deposit 1.6%, plasma 1.4%, chemical.vapor 1.3%, vapor 1.2%, vapor.deposition 1.1%, chemical.vapor.deposition 1.1%, chemic 1.0%, cvd.diamond 0.8%, pressur 0.7%, surfac 0.6%, growth 0.6%, silicon 0.5%, carbon 0.5%

Discriminating Terms
diamond 39.8%, cvd 2.8%, film 1.8%, nanoparticl 0.7%, chemical.vapor 0.7%, chemical.vapor.deposition 0.6%, vapor.deposition 0.6%, magnet 0.6%, cvd.diamond 0.6%, structur 0.5%, vapor 0.5%, plasma 0.5%, quantum 0.5%, particl 0.4%, polym 0.4%

Single Word Terms
diamond 115, deposit 113, chemic 105, vapor 85, high 81, cvd 70, surfac 66, electron 64, temperatur 61, plasma 57, substrat 56, growth 55, properti 50, pressur 46, carbon 43

Double Word Terms
chemical.vapor 83, vapor.deposition 78, plasma.chemical 35, deposition.cvd 31, cvd.diamond 30, high.temperature 22, electron.microscopy 20, microwave.plasma 18, single.crystal 18, high.pressure 18, polycrystalline.diamond 17, scanning.electron 16, diamond.surface 15, chemical.vapour 13, diamond.nucleation 13

Triple Word Terms
chemical.vapor.deposition 77, plasma.chemical.vapor 33, vapor.deposition.cvd 24, microwave.plasma.chemical 15, scanning.electron.microscopy 15, single.crystal.diamond 11, chemical.vapour.deposition 11, high.pressure.high 9, pressure.high.temperature 8, high.temperature.high 7, transmission.electron.microscopy 7, atomic.force.microscopy 7, vapour.deposition.cvd 7, hot.filament.chemical 7, vapor.deposition.diamond 6

Term Cliques
38.14% chemic surfac growth silicon
34.57% chemic cvd.diamond surfac silicon
37.00% deposit plasma pressur carbon
40.86% deposit plasma chemical.vapor chemic cvd.diamond silicon
42.11% deposit plasma chemical.vapor vapor vapor.deposition chemical.vapor.deposition chemic growth silicon carbon
42.29% cvd chemic surfac growth
38.71% cvd chemic cvd.diamond surfac
36.11% cvd deposit plasma cvd.diamond pressur
43.62% cvd deposit plasma chemical.vapor chemic cvd.diamond
45.90% cvd deposit plasma chemical.vapor vapor vapor.deposition chemical.vapor.deposition chemic growth
39.57% diamond surfac growth silicon
36.00% diamond cvd.diamond surfac silicon
43.71% diamond cvd surfac growth
40.14% diamond cvd cvd.diamond surface

Sample Cluster Record Titles

The vacuum-annealed undoped polycrystalline CVD diamond electrodes: the impedance-spectroscopy and photoelectrochemical studies

High-order stokes and anti-stokes Raman generation in CVD diamond

Characterization of cascade arc assisted CVD diamond coating technology - Part I. Plasma processing parameters

Model of carrier dynamics in chemical vapor deposition diamond detectors

Oxidization process of CVD diamond (100): H 2 x 1 surfaces

Low temperature growth of nanostructured diamond on quartz spheres

Studies on nano-diamond prepared by explosive detonation by Raman and infrared spectroscopy

Diamond growth on faceted sapphire and the charged cluster model

Diamond CVD by microwave plasmas in argon-diluted methane without or with 2% hydrogen additive

Cluster Metrics

Authors
kagan, h 4
zhang, fq 3
yamasaki, s 3
verona-rinati, g 3
vanecek, m 3
tallaire, a 3
ralchenko, vg 3
pucella, g 3
lee, st 3
kawarada, h 3
kato, h 3
goto, t 3
achard, j 3
zhang, yf 2
zhang, rq 2

Sources
diamond and related materials 24
applied physics letters 10
journal of applied physics 9
nuclear instruments & methods in physics research section a-accelerators spectrometers detectors and associated equipment 6
surface & coatings technology 5
physica status solidi a-applications and materials science 4
new diamond and frontier carbon technology 4
journal of crystal growth 4
thin solid films 3
physical review b 3
materials chemistry and physics 3
journal of the electrochemical society 3
journal of physical chemistry b 3
vacuum 2
surface science 2

Keywords
materials science, multidisciplinary 42
chemical-vapor-deposition 36
films 36
physics, applied 27
growth 21
materials science, coatings & films 14
chemistry, physical 14
diamond 13

physics, applied 13
spectroscopy 12
physics, condensed matter 11
engineering, electrical & electronic 11
thin-films 9
nucleation 9
instruments & instrumentation 9

Publication Year
2005 155
2004 17
2006 3

Country
usa 51
peoples r china 28
japan 27
france 15
england 13
russia 11
germany 11
taiwan 9
south korea 8
italy 8
australia 5
belgium 4
hungary 3
czech republic 3
brazil 3

Institution
russian acad sci 8
chinese acad sci 6
natl chiao tung univ 5
zhengzhou univ 4
waseda univ 4
univ roma tor vergata 4
univ florence 4
tohoku univ 4
osaka univ 4
ohio state univ 4
city univ hong kong 4
univ surrey 3
univ shizuoka 3
univ london kings coll 3
univ calif los angeles 3

DataBase
science citation index 175

CATEGORY 9 - 509A1a ***(1 leaf cluster)***

Applications of Carbon Nanotubes (474 REC)

THRUST

()

- Carbon nanotubes (CNTs), especially application to electrodes and catalysts, CNT composites, and preparation of aligned CNTs (474 Records) Cluster 37

- # CLUSTER 37
  Carbon nanotubes (CNTs), especially application to electrodes and catalysts, CNT composites, and preparation of aligned CNTs (474 Records)

(Countries: China, followed by USA, South korea, followed by japan. Institutions: CAS dominant, followed by Sungyunkwan University. USA includes PNNL.).

Cluster Syntax Features

Descriptive Terms

cnt 66.5%, nanotub 7.1%, carbon 5.4%, carbon.nanotubes 3.6%, nanotubes.cnts 1.4%, carbon.nanotubes.cnts 1.4%, carbon.nanotube 1.1%, catalyst 0.5%, electrod 0.3%, carbon.nanotube.cnt 0.3%, nanotube.cnt 0.3%, composit 0.3%, wall 0.2%, align 0.2%, ni 0.2%

Discriminating Terms

cnt 46.0%, nanotub 2.4%, film 1.7%, carbon.nanotubes 1.6%, carbon 1.4%, nanotubes.cnts 0.9%, carbon.nanotubes.cnts 0.9%, surfac 0.6%, structur 0.6%, magnet 0.6%, carbon.nanotube 0.5%, crystal 0.5%, layer 0.5%, nanoparticl 0.4%, temperatur 0.4%

Single Word Terms

cnt 474, carbon 472, nanotub 471, electron 158, high 152, surfac 142, properti 136, deposit 131, structur 124, wall 122, chemic 121, composit 110, catalyst 109, mechan 103, microscopi 102

Double Word Terms

carbon.nanotubes 374, nanotubes.cnts 252, carbon.nanotube 200, nanotube.cnt 103, electron.microscopy 81, transmission.electron 76, vapor.deposition 68, chemical.vapor 68, scanning.electron 49, walled.carbon 45, field.emission 44, nanotubes.cnt 41, multi.walled 37, multiwalled.carbon 35, aligned.carbon 33

Triple Word Terms
carbon.nanotubes.cnts 250, carbon.nanotube.cnt 103, chemical.vapor.deposition 68, transmission.electron.microscopy 61, carbon.nanotubes.cnt 40, scanning.electron.microscopy 35, walled.carbon.nanotubes 34, electron.microscopy.tem 33, multiwalled.carbon.nanotubes 31, multi.walled.carbon 25, aligned.carbon.nanotubes 23, growth.carbon.nanotubes 22, ray.photoelectron.spectroscopy 20, nanotubes.cnts.synthesized 19, synthesis.carbon.nanotubes 17

Term Cliques
65.01% cnt nanotub carbon carbon.nanotube composit wall
56.87% cnt nanotub carbon carbon.nanotube nanotube.cnt carbon.nanotube.cnt align
58.26% cnt nanotub carbon carbon.nanotube nanotube.cnt carbon.nanotube.cnt composit
57.29% cnt nanotub carbon carbon.nanotube electrod nanotube.cnt carbon.nanotube.cnt
67.44% cnt nanotub carbon carbon.nanotubes electrod ni
60.34% cnt nanotub carbon carbon.nanotubes nanotubes.cnts carbon.nanotubes.cnts composit wall ni
58.95% cnt nanotub carbon carbon.nanotubes nanotubes.cnts carbon.nanotubes.cnts catalyst align ni
60.31% cnt nanotub carbon carbon.nanotubes nanotubes.cnts carbon.nanotubes.cnts catalyst wall ni

Sample Cluster Record Titles

Deposition and electrocatalytic properties of platinum on well-aligned carbon nanotube (CNT) arrays for methanol oxidation

CO2 detection using carbon nanotube networks and micromachined resonant transducers

An electrochemical biosensor with cholesterol oxidase/sol-gel film on a nanoplatinum/carbon nanotube electrode

Nickel oxide/carbon nanotubes nanocomposite for electrochemical capacitance

Deformation-morphology correlations in electrically conductive carbon nanotube thermoplastic polyurethane nanocomposites

A study on nano tube-substrate interaction effect for fullerene-shuttle-memory based on nanopeapod

IR and NMR spectroscopic characterization of graphitization process occurring in the pores of mesoporous silicates in formation of carbon nanotubes

Synthesis of vertically aligned carbon nanotube films on macroporous alumina substrates

Extraordinary strengthening effect of carbon nanotubes in metal-matrix nanocomposites processed by molecular-level mixing

Cluster Metrics

Authors

yoo, jb 11
park, jh 10
park, cy 9
wang, j 8
lin, yh 8
liew, km 7
liang, j 7
kim, jm 7
zhang, xb 6
yao, sz 6
nam, jw 6
lim, sh 6
kang, jw 6
hwang, hj 6
choe, dh 6

Sources

diamond and related materials 27
applied physics letters 21
carbon 19
journal of physical chemistry b 18
chemical physics letters 14
physical review b 13
nanotechnology 13
langmuir 8
journal of vacuum science & technology b 7
nano letters 6
materials letters 6
journal of nanoscience and nanotechnology 6
electroanalysis 6
applied surface science 6
analytical chemistry 6

Keywords

carbon nanotubes 114
chemistry, physical 82
materials science, multidisciplinary 81
materials science, multidisciplinary 63
growth 62
physics, applied 54
chemical-vapor-deposition 46

carbon nanotube 46
carbon nanotubes 39
chemistry, multidisciplinary 32
chemistry, analytical 30
composites 29
films 27
physics, applied 25
carbon nanotube 25

Publication Year
2005 421
2004 40
2006 13

Country
peoples r china 153
usa 93
south korea 77
japan 43
taiwan 25
france 21
germany 16
italy 14
singapore 12
india 12
canada 10
switzerland 8
england 8
belgium 8
spain 6

Institution
chinese acad sci 45
sungkyunkwan univ 16
seoul natl univ 14
tsing hua univ 13
hunan univ 12
zhejiang univ 11
natl tsing hua univ 9
pacific nw natl lab 8
natl univ singapore 7
korea adv inst sci & technol 7
city univ hong kong 7
peking univ 6
natl chiao tung univ 6
korea univ 6

chung ang univ 6

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CATEGORY 10 - 509A1b ***(6 leaf clusters)***

Multi-walled Nanotubes (1876 REC)

THRUST

()

- Multi-walled (carbon) nanotubes (MWNTs), including composites and surface, magnetic, and structural properties (240 Records) Cluster 14
- Nanotubes, emphasizing template synthesis, especially of titanium dioxide (TiO2), titania, and titanate nanotubes; nanowires; and nanotube arrays (517 Records) Cluster 183
- Boron nitride nanotubes (BNNTs) and nanohorns, emphasizing electronic properties (59 Records) Cluster 5
- Multi-walled carbon nanotubes (MWCNTs), focusing on electronic, mechanical, and structural properties (140 Records) Cluster 32
- Carbon nanotubes, including composites, nanotube bundles, conductance, and application to electrodes and transistors (283 Records) Cluster 96
- Carbon nanotubes (CNTs), including single-walled and multi-walled CNTs and emphasizing electronic and structural properties (637 Records) Cluster 105

- # CLUSTER 14
  Multi-walled (carbon) nanotubes (MWNTs), including composites and surface, magnetic, and structural properties (240 Records)

(Countries: China very dominant, USA, South Korea. Institutions: CAS dominant, Zhejiang University, Nanjing University.).

Cluster Syntax Features

Descriptive Terms

mwnt 63.0%, nanotub 6.0%, carbon 3.3%, carbon.nanotubes 3.1%, nanotubes.mwnts 1.7%, multiwal 1.6%, carbon.nanotubes.mwnts 1.6%, multi.walled 1.6%, multi.walled.carbon 1.5%, multi 1.1%, multiwalled.carbon 1.0%, walled.carbon 0.9%, wall 0.8%, walled.carbon.nanotubes 0.6%, multiwalled.carbon.nanotubes 0.6%

Discriminating Terms

mwnt 41.1%, nanotub 1.7%, film 1.4%, carbon.nanotubes 1.3%, nanotubes.mwnts 1.1%, carbon.nanotubes.mwnts 1.0%, multi.walled 1.0%, multiwal 1.0%, multi.walled.carbon 1.0%, surfac 0.6%, structur 0.6%, multiwalled.carbon 0.6%, multi 0.6%, carbon 0.5%, magnet 0.5%

Single Word Terms

mwnt 240, nanotub 239, carbon 236, wall 140, multi 128, multiwal 111, composit 82, surfac 80, electron 79, properti 78, electrod 61, dispers 58, oxid 57, acid 52, high 50

Double Word Terms

carbon.nanotubes 209, nanotubes.mwnts 152, walled.carbon 108, multi.walled 107, multiwalled.carbon 81, carbon.nanotube 80, electron.microscopy 41, transmission.electron 39, nanotubes.mwnt 33, nanotube.mwnt 33, multiwall.carbon 30, scanning.electron 26, glassy.carbon 23, wall.carbon 22, multi.wall 21

Triple Word Terms
carbon.nanotubes.mwnts 144, multi.walled.carbon 103, walled.carbon.nanotubes 91, multiwalled.carbon.nanotubes 69, transmission.electron.microscopy 32, carbon.nanotubes.mwnt 32, carbon.nanotube.mwnt 31, multiwall.carbon.nanotubes 29, walled.carbon.nanotube 25, multi.wall.carbon 21, glassy.carbon.electrode 19, scanning.electron.microscopy 19, multiwalled.carbon.nanotube 19, wall.carbon.nanotubes 16, electron.microscopy.tem 16

Term Cliques
65.87% mwnt nanotub carbon carbon.nanotubes nanotubes.mwnts carbon.nanotubes.mwnts multi.walled multi.walled.carbon multi walled.carbon wall walled.carbon.nanotubes
68.56% mwnt nanotub carbon carbon.nanotubes nanotubes.mwnts multiwal carbon.nanotubes.mwnts multiwalled.carbon multiwalled.carbon.nanotubes

Sample Cluster Record Titles

On the origin of the high performance of MWNT-supported PtPd catalysts for the hydrogenation of aromatics

Surfactant functionalization of carbon nanotubes (CNTs) for layer-by-layer assembling of CNT multi-layer films and fabrication of gold nanoparticle/CNT nanohybrid

Bending of multiwalled carbon nanotubes over gold lines

Deposition of gold nanoparticles onto thiol-functionalized multiwalled carbon nanotubes

Buckling of multiwalled carbon nanotubes under axial compression and bending via a molecular mechanics model

Axisymmetric and beamlike vibrations of multiwall carbon nanotubes

Mechanical cutting of bamboo-shaped multiwalled carbon nanotubes by an atomic force microscope tip

Light-scattering and dispersion behavior of multiwalled carbon nanotubes

Reinforcement of alumina matrix with multi-walled carbon nanotubes

Cluster Metrics

Authors
gao, l 8
wei, xw 7
potschke, p 7
zhao, gc 6
zhang, wd 5
park, sj 5
janke, a 5
feng, w 5
choi, hj 5
zhao, f 4
yoshino, k 4
wang, cy 4
sheu, fs 4
ozaki, m 4
liu, y 4

Sources
carbon 15
polymer 9
applied physics letters 8
nanotechnology 7
electroanalysis 7
chemical physics letters 6
physical review b 5
materials chemistry and physics 5
macromolecular rapid communications 5
journal of physical chemistry b 5
journal of applied physics 5
fullerenes nanotubes and carbon nanostructures 5
diamond and related materials 5
chinese chemical letters 5
microchimica acta 4

Keywords
carbon nanotubes 50
chemistry, physical 42
materials science, multidisciplinary 36
polymer science 29
physics, applied 28
materials science, multidisciplinary 27
carbon nanotubes 26
chemistry, analytical 24
chemistry, multidisciplinary 21

films 21
composites 19
oxidation 16
nanocomposites 16
functionalization 15
behavior 15

Publication Year

2005 214
2004 20
2006 6

Country

peoples r china 120
usa 30
south korea 29
japan 17
germany 14
taiwan 11
england 11
france 10
singapore 8
italy 6
russia 5
spain 4
poland 4
portugal 3
india 3

Institution

chinese acad sci 26
zhejiang univ 10
nanjing univ 8
inha univ 7
e china normal univ 7
anhui normal univ 7
wuhan univ 6
peking univ 6
korea univ 6
hunan univ 6
tsing hua univ 5
tianjin univ 5
osaka univ 5
natl univ singapore 5
natl tsing hua univ 5

DataBase
science citation index 240

- # CLUSTER 183
  Nanotubes, emphasizing template synthesis, especially of titanium dioxide (TiO2), titania, and titanate nanotubes; nanowires; and nanotube arrays (517 Records)

(Countries: China, followed by USA, followed by Japan. Institutions: CAS, followed by RAS, Tsing Hua University, Nanjing University. USA include CUNY Hunter College, University of Florida.).

Cluster Syntax Features

Descriptive Terms
nanotub 72.6%, tube 1.4%, templat 0.9%, tio2 0.7%, titan 0.6%, nanowir 0.6%, diamet 0.5%, tio2.nanotubes 0.4%, wall 0.4%, arrai 0.4%, titanate.nanotubes 0.3%, tubular 0.3%, nanotube.arrays 0.3%, synthesi 0.3%, length 0.3%

Discriminating Terms
nanotub 49.4%, film 2.0%, tube 0.8%, surfac 0.7%, particl 0.6%, magnet 0.5%, deposit 0.4%, quantum 0.4%, nanoparticl 0.4%, crystal 0.4%, phase 0.4%, temperatur 0.4%, titan 0.4%, si 0.4%, templat 0.4%

Single Word Terms
nanotub 515, structur 208, diamet 152, electron 149, templat 120, synthesi 119, properti 115, high 112, wall 110, length 110, temperatur 105, format 103, synthes 103, surfac 102,

form 99

Double Word Terms
transmission.electron 71, electron.microscopy 66, carbon.nanotubes 47, ray.diffraction 44, scanning.electron 41, carbon.nanotube 33, nanotube.arrays 32, nanotubes.synthesized 30, tio2.nanotubes 29, high.resolution 25, wall.thickness 25, room.temperature 24, one.dimensional 24, titanate.nanotubes 24, nanotubes.high 23

Triple Word Terms
transmission.electron.microscopy 53, scanning.electron.microscopy 27, electron.microscopy.tem 21, high.resolution.transmission 15, ray.diffraction.xrd 15, resolution.transmission.electron 15, scanning.electron.microscope 14, electron.microscopy.sem 13, density.functional.theory 13, transmission.electron.microscope 13, anodic.aluminum.oxide 12, energy.dispersive.ray 11, area.electron.diffraction 11, high.aspect.ratio 9, sem.transmission.electron 9

Term Cliques
33.85% nanotub diamet wall tubular synthesi length
29.01% nanotub titan nanowir diamet titanate.nanotubes synthesi
25.49% nanotub tio2 diamet tio2.nanotubes wall arrai nanotube.arrays synthesi length
29.11% nanotub tio2 titan diamet titanate.nanotubes synthesi
29.27% nanotub tio2 titan diamet tio2.nanotubes synthesi
29.55% nanotub templat diamet wall arrai nanotube.arrays synthesi length
31.28% nanotub templat nanowir diamet arrai synthesi length
33.17% nanotub tube diamet wall tubular length
32.69% nanotub tube diamet tio2.nanotubes wall length
35.86% nanotub tube nanowir diamet length

Sample Cluster Record Titles

Gold nanotubes by template-directed synthesis

High activity of novel Pd/TiO2 nanotube catalysts for methanol electro-oxidation

Synthesis and characterization of TiO2 nanotube

Synthesis of copper sulfide nanotube in the hydrogel system

TiO2-based composite nanotube arrays prepared via layer-by-layer assembly

The effect of electrolyte composition on the fabrication of self-organized titanium oxide nanotube arrays by anodic oxidation

Large-scale synthesis of amorphous phosphorus nitride imide nanotubes with high luminescent properties

[Structural characterization of the fullerene nanotubes prepared by the liquid-liquid interfacial precipitation method]

[Synthesis of Au nanoclusters supported upon a TiO2 nanotube array]

Cluster Metrics

Authors
bando, y 13
schmuki, p 10
macak, jm 10
golberg, d 10
tsuchiya, h 9
shimizu, t 7
matsui, h 7
ivanovskii, al 7
guo, xy 7
du, zl 7
zhang, zt 6
taveira, l 6
tang, zl 6
martin, cr 6
li, jr 6

Sources
journal of the american chemical society 31
nanotechnology 23
physical review b 22
advanced materials 19
chemistry of materials 17
journal of physical chemistry b 16
chemical physics letters 13
applied physics letters 13
angewandte chemie-international edition 12
nano letters 11
journal of nanoscience and nanotechnology 11
chemical communications 11
physica e-low-dimensional systems & nanostructures 10
electrochemistry communications 10
solid state communications 8

Keywords
chemistry, multidisciplinary 105
materials science, multidisciplinary 80

materials science, multidisciplinary 78
chemistry, physical 64
nanowires 58
nanotubes 54
growth 54
carbon nanotubes 52
physics, applied 50
physics, condensed matter 47
films 47
fabrication 43
arrays 42
nanotube 40
nanostructures 33

Publication Year

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2004 45
2006 4

Country

peoples r china 174
usa 130
japan 61
germany 37
south korea 27
russia 25
france 18
italy 14
england 14
canada 11
taiwan 10
singapore 10
india 9
israel 7
sweden 6

Institution

chinese acad sci 35
russian acad sci 19
tsing hua univ 18
nanjing univ 17
natl inst mat sci 15
univ sci & technol china 14
henan univ 14
nankai univ 12
univ erlangen nurnberg 10

peking univ 10
univ tokyo 9
natl inst adv ind sci & technol 9
cuny hunter coll 9
univ florida 8
shandong univ 8

DataBase
science citation index 517

- CLUSTER 5
  Boron nitride nanotubes (BNNTs) and nanohorns, emphasizing electronic properties (59 Records)

(Countries: USA, China, Japan. Institutions: Osaka University, University S&T China, UCB, National Institute of Materials Science. Other USA include University of Illinois, Clemson University.).

Cluster Syntax Features

Descriptive Terms
boron 18.7%, boron.nitride 17.9%, nanotub 14.2%, nitrid 10.8%, nitride.nanotubes 9.7%, boron.nitride.nanotubes 7.5%, bnnt 2.7%, nanohorn 0.9%, boron.nitride.nanotube 0.7%, nitride.nanotube 0.6%, tube 0.4%, carbon 0.4%, wall 0.4%, multiwal 0.3%, carbon.nitride.nanotubes 0.3%

Discriminating Terms
boron.nitride 11.0%, boron 11.0%, nitride.nanotubes 6.0%, nitrid 5.9%, nanotub 5.2%, boron.nitride.nanotubes 4.7%, film 1.8%, bnnt 1.7%, surfac 0.8%, nanoparticl 0.6%,

nanohorn 0.5%, particl 0.5%, layer 0.5%, temperatur 0.4%, boron.nitride.nanotube 0.4%

Single Word Terms

nanotub 57, boron 56, nitrid 55, structur 33, electron 32, carbon 24, energi 19, wall 16, synthes 16, mechan 15, properti 15, atom 14, high 14, two 13, powder 13

Double Word Terms

boron.nitride 52, nitride.nanotubes 34, nitride.nanotube 12, electron.microscopy 12, carbon.nanotubes 8, resolution.electron 8, high.resolution 8, electronic.properties 8, nanotubes.boron 7, transmission.electron 7, structure.models 6, walled.boron 6, nanotubes.bnnts 6, single.wall 6, density.functional 6

Triple Word Terms

boron.nitride.nanotubes 31, boron.nitride.nanotube 12, high.resolution.electron 8, resolution.electron.microscopy 7, nanotubes.boron.nitride 7, nitride.nanotubes.bnnts 6, transmission.electron.microscopy 6, walled.boron.nitride 6, synthesized.arc.melting 5, chemical.vapor.deposition 4, boron.nitride.nanohorns 4, atomic.structure.models 4, wall.carbon.nanotubes 3, single.wall.nanotubes 3, single.walled.boron 3

Term Cliques

51.19% nanotub nitrid tube carbon carbon.nitride.nanotubes
54.58% nanotub nitrid nitride.nanotubes tube carbon.nitride.nanotubes
47.83% boron nanotub nitrid bnnt boron.nitride.nanotube nitride.nanotube tube carbon wall
55.08% boron boron.nitride nitrid nanohorn wall multiwal
56.99% boron boron.nitride nanotub nitrid bnnt tube wall multiwal
53.11% boron boron.nitride nanotub nitrid bnnt boron.nitride.nanotube nitride.nanotube tube wall
59.89% boron boron.nitride nanotub nitrid nitride.nanotubes boron.nitride.nanotubes bnnt tube multiwal

Sample Cluster Record Titles

Synthesis, atomic structures, and electronic states of boron nitride nanocage clusters and nanotubes

Formation and atomic structures of boron nitride nanohoms

Synthesis of carbon nitride nanotubes via a catalytic-assembly solvothermal route

Electronic, structural, and thermal properties of a nanocable consisting of carbon and BN nanotubes

Constricted boron nanotubes

[Bulk quantity and physical properties of boron nitride nanocapsules with a narrow size distribution]

[Optical transitions in single-wall boron nitride nanotubes]

[Formation and structure of boron nitride nanotubes]

[A theoretical study on the conductivity of carbon doped BNNT]

Cluster Metrics

Authors
oku, t 8
nishiwaki, a 6
bando, y 6
tang, cc 4
golberg, d 4
zhang, j 3
zettl, a 3
han, wq 3
zuo, jm 2
zhu, qs 2
zhi, cy 2
zhao, jx 2
yang, jl 2
xie, rg 2
xiang, hj 2

Sources
applied physics letters 6
solid state communications 5
physical review b 4
journal of chemical physics 3
physical review letters 2
journal of the american chemical society 2
diamond and related materials 2
chemistry of materials 2
chemical physics letters 2
synthetic metals 1
small 1
science and technology of advanced materials 1
revista de chimie 1
proceedings of the national academy of sciences of the united states of america 1
physical chemistry chemical physics 1

Keywords
carbon nanotubes 11
physics, condensed matter 10
nanotubes 10
materials science, multidisciplinary 9
chemistry, physical 9
carbon nanotubes 8
physics, atomic, molecular & chemical 7
physics, applied 7
growth 7
c-60 7
bn nanotubes 7
chemistry, multidisciplinary 6
boron nitride 6
bn nanotubes 6
nanowires 6

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2005 56
2004 3

Country
usa 16
peoples r china 16
japan 15
germany 6
south korea 4
russia 3
australia 3
poland 2
england 2
singapore 1
romania 1
israel 1
india 1
france 1

Institution
osaka univ 8
univ sci & technol china 4
univ calif berkeley 4
natl inst mat sci 4
russian acad sci 3
zhejiang univ 2
univ sydney 2

univ illinois 2
univ greifswald 2
tech univ szczecin 2
tech univ dresden 2
natl inst res inorgan mat 2
korea res inst stand & sci 2
harbin normal univ 2
clemson univ 2

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science citation index 59

- CLUSTER 32
  Multi-walled carbon nanotubes (MWCNTs), focusing on electronic, mechanical, and structural properties (140 Records)

(Countries: China, USA. Institutions: CAS dominant, Tsing Hua University, Sungyunkwan University, National University of Singapore. Other USA include UNC, RPI, ORNL, MIT).

Cluster Syntax Features

Descriptive Terms

mwcnt 26.3%, multiwal 12.9%, nanotub 12.7%, multiwalled.carbon 8.8%, multiwalled.carbon.nanotubes 6.6%, carbon 6.5%, carbon.nanotubes 6.5%, nanotubes.mwcnts 1.1%, carbon.nanotubes.mwcnts 1.1%, multiwall.carbon 0.8%, carbon.nanotube 0.8%, wall 0.6%, multiwall.carbon.nanotubes 0.5%, multi 0.4%, multi.walled.carbon 0.3%

Discriminating Terms

mwcnt 18.1%, multiwal 8.6%, multiwalled.carbon 6.0%, nanotub 5.0%, multiwalled.carbon.nanotubes 4.4%, carbon.nanotubes 3.2%, carbon 1.8%, film 1.7%, nanotubes.mwcnts 0.8%, surfac 0.8%, carbon.nanotubes.mwcnts 0.7%, particl 0.6%, structur 0.6%, multiwall.carbon 0.5%, crystal 0.5%

Single Word Terms

carbon 140, nanotub 140, multiwal 110, mwcnt 76, electron 53, wall 51, temperatur 35, multi 31, mechan 30, chemic 29, surfac 29, high 29, microscopi 29, structur 28, properti 27

Double Word Terms

carbon.nanotubes 130, multiwalled.carbon 87, nanotubes.mwcnts 55, carbon.nanotube 53, walled.carbon 25, multiwall.carbon 25, electron.microscopy 23, transmission.electron 21, multi.walled 20, vapor.deposition 15, chemical.vapor 15, carbon.electrode 10, multi.wall 10, wall.carbon 9, room.temperature 9

Triple Word Terms

multiwalled.carbon.nanotubes 84, carbon.nanotubes.mwcnts 55, multiwalled.carbon.nanotube 20, multi.walled.carbon 20, multiwall.carbon.nanotubes 20, walled.carbon.nanotubes 19, transmission.electron.microscopy 18, chemical.vapor.deposition 15, walled.carbon.nanotube 12, multi.wall.carbon 9, glassy.carbon.electrode 8, wall.carbon.nanotubes 8, electron.microscopy.tem 8, van.der.waals 8, carbon.nanotube.mwcnt 8

Term Cliques

57.65% nanotub carbon carbon.nanotubes nanotubes.mwcnts carbon.nanotubes.mwcnts multiwall.carbon multiwall.carbon.nanotubes

58.10% multiwal nanotub carbon multiwall.carbon carbon.nanotube multiwall.carbon.nanotubes

67.26% multiwal nanotub carbon carbon.nanotubes multiwall.carbon multiwall.carbon.nanotubes

82.26% multiwal nanotub multiwalled.carbon multiwalled.carbon.nanotubes carbon carbon.nanotubes

61.29% mwcnt nanotub carbon carbon.nanotube multiwall.carbon.nanotubes

52.14% mwcnt nanotub carbon carbon.nanotube wall multi multi.walled.carbon

62.86% mwcnt nanotub carbon carbon.nanotubes nanotubes.mwcnts carbon.nanotubes.mwcnts multiwall.carbon.nanotubes
55.40% mwcnt nanotub carbon carbon.nanotubes nanotubes.mwcnts carbon.nanotubes.mwcnts wall multi multi.walled.carbon

Sample Cluster Record Titles

Small-scale effects on buckling of multiwalled carbon nanotubes under axial compression

Mossbauer transmission and back scattered conversion electron study of Fe nanowires encapsulated in multiwalled carbon nanotubes

Collective phenomena in multiwall carbon nanotubes

Multi-walled carbon nanotubes experiencing electrical breakdown as gas sensors

Caged multiwalled carbon nanotubes as the adsorbents for affinity-based elimination of ionic dyes

A study of field emission of an array of multi-walled carbon nanotubes

Carbon-nanotube-reinforeed polymer-derived ceramic composites

A mediatorless biosensor for putrescine using multiwalled carbon nanotubes

Breakdown of 2mm symmetry in electron diffraction from multiwalled carbon nanotubes

Cluster Metrics

Authors

kim, hs 5
wildgoose, gg 4
lee, yh 4
jones, tgj 4
compton, rg 4
wang, y 3
qin, lc 3
potschke, p 3
liu, zj 3
li, j 3
lee, jy 3
kang, jk 3
jiang, l 3

huang, y 3
han, ks 3

Sources
applied physics letters 17
physical review b 9
nanotechnology 7
carbon 7
journal of applied physics 6
physical review letters 4
journal of physical chemistry b 4
chemical physics letters 4
advanced materials 4
sensors and actuators b-chemical 3
polymer 3
electroanalysis 3
chemical communications 3
analytical biochemistry 3
acta physica sinica 3

Keywords
physics, applied 33
materials science, multidisciplinary 20
chemistry, physical 19
chemistry, analytical 16
carbon nanotubes 16
materials science, multidisciplinary 14
chemistry, multidisciplinary 11
physics, multidisciplinary 10
growth 10
electrochemistry 10
physics, condensed matter 9
carbon nanotubes 9
chemical-vapor-deposition 8
functionalization 8
films 8

Publication Year
2005 131
2004 9

Country
peoples r china 45
usa 37
japan 12
south korea 11

germany 8
england 7
singapore 6
switzerland 5
poland 5
france 5
taiwan 4
spain 3
italy 3
israel 2
iran 2

Institution

chinese acad sci 11
tsing hua univ 5
sungkyunkwan univ 5
natl univ singapore 5
univ oxford 4
schlumberger cambridge res ltd 4
nanjing univ aeronaut & astronaut 4
ecole polytech fed lausanne 4
cent china normal univ 4
univ n carolina 3
samsung adv inst technol 3
rensselaer polytech inst 3
peking univ 3
oak ridge natl lab 3
mit 3

DataBase

science citation index 140

- # CLUSTER 96
  Carbon nanotubes, including composites, nanotube bundles, conductance, and application to electrodes and transistors (283 Records)

(Countries: USA dominant, China, South Korea. Institutions: CAS dominant, Tsing Hua University, RPI, Osaka University, NASA, Chung Ang University. Other USA include UCSD, Georgia Institute of Technology, University of Texas.).

Cluster Syntax Features

Descriptive Terms

nanotub 43.5%, carbon.nanotube 21.1%, carbon 15.7%, carbon.nanotubes 1.6%, wall 0.5%, composit 0.4%, bundl 0.4%, conduct 0.3%, field 0.3%, electr 0.2%, align 0.2%, electrod 0.2%, transistor 0.2%, tube 0.2%, wall.carbon 0.2%

Discriminating Terms

nanotub 25.7%, carbon.nanotube 15.2%, carbon 7.1%, film 1.7%, surfac 0.6%, particl 0.6%, nanoparticl 0.6%, layer 0.6%, carbon.nanotubes 0.6%, magnet 0.6%, crystal 0.5%, structur 0.5%, phase 0.5%, temperatur 0.5%, oxid 0.5%

Single Word Terms

carbon 283, nanotub 283, wall 90, electron 82, properti 77, structur 77, singl 75, high 65, surfac 65, conduct 58, field 58, electr 57, mechan 54, composit 54, function 52

Double Word Terms

carbon.nanotube 272, carbon.nanotubes 155, walled.carbon 39, wall.carbon 36, single.walled 34, single.wall 27, properties.carbon 23, chemical.vapor 20, nanotube.bundles 19, nanotube.field 18, molecular.dynamics 18, vapor.deposition 18, electron.microscopy 17, nanotube.composites 15, transmission.electron 14

Triple Word Terms

single.walled.carbon 29, single.wall.carbon 26, walled.carbon.nanotube 23, wall.carbon.nanotube 22, wall.carbon.nanotubes 18, chemical.vapor.deposition 18, walled.carbon.nanotubes 17, carbon.nanotube.field 17, carbon.nanotube.bundles 15, properties.carbon.nanotube 14, carbon.nanotube.composites 14, transmission.electron.microscopy 12, carbon.nanotube.arrays 12, molecular.dynamics.simulations 10, nanotube.field.transistors 10

Term Cliques

52.92% nanotub carbon.nanotube carbon carbon.nanotubes wall field transistor tube
48.65% nanotub carbon.nanotube carbon carbon.nanotubes wall field align tube wall.carbon
49.39% nanotub carbon.nanotube carbon carbon.nanotubes wall field electr electrod transistor
49.59% nanotub carbon.nanotube carbon carbon.nanotubes wall field electr align electrod
50.22% nanotub carbon.nanotube carbon carbon.nanotubes wall conduct field electr transistor
46.64% nanotub carbon.nanotube carbon carbon.nanotubes wall conduct field electr align wall.carbon
51.77% nanotub carbon.nanotube carbon carbon.nanotubes wall bundl align tube
46.50% nanotub carbon.nanotube carbon carbon.nanotubes wall composit conduct electr align wall.carbon
49.04% nanotub carbon.nanotube carbon carbon.nanotubes wall composit bundl electr align

Sample Cluster Record Titles

Neon adsorbed in carbon nanotube bundles

Polyaniline/carbon nanotube composites: starting with phenylamino functionalized carbon nanotubes

Raman spectral imaging of a carbon nanotube intramolecular junction

Carbon nanotube thin films with ordered structures

Supported coordination polymerization: a unique way to potent polyolefin carbon nanotube nanocomposites

Chemical optimization of self-assembled carbon nanotube transistors

Photocurrent imaging of charge transport barriers in carbon nanotube devices

Carbon nanotube inner phase chemistry: The Cl- exchange S(N)2 reaction

A self-supporting electrode for supercapacitors prepared by one-step pyrolysis of carbon nanotube/polyacrylonitrile blends

Cluster Metrics

Authors

kang, jw 6

hwang, hj 6
matsumoto, k 5
kiricsi, i 5
biro, lp 5
qin, lc 4
konya, z 4
fan, ss 4
zhang, q 3
wang, j 3
sandler, si 3
sainz, r 3
poulin, p 3
maser, wk 3
martinez, mt 3

Sources

applied physics letters 25
physical review b 20
nano letters 16
journal of the american chemical society 14
physical review letters 10
nanotechnology 10
journal of applied physics 8
carbon 7
journal of physical chemistry b 6
chemical communications 6
physica e-low-dimensional systems & nanostructures 5
langmuir 4
journal of chemical physics 4
japanese journal of applied physics part 1-regular papers short notes & review papers 4
chemistry of materials 4

Keywords

physics, applied 53
chemistry, multidisciplinary 50
materials science, multidisciplinary 50
chemistry, physical 36
carbon nanotubes 30
physics, condensed matter 27
carbon nanotube 26
physics, multidisciplinary 21
materials science, multidisciplinary 21
carbon nanotube 19
growth 17
films 16
composites 14

field-effect transistors 13
engineering, multidisciplinary 13

Publication Year
2005 252
2004 28
2006 3

Country
usa 117
peoples r china 48
south korea 28
japan 20
germany 17
france 17
england 14
italy 9
hungary 9
spain 7
singapore 7
australia 7
russia 5
belgium 5
taiwan 4

Institution
chinese acad sci 14
tsing hua univ 7
rensselaer polytech inst 6
osaka univ 6
nasa 6
chung ang univ 6
univ szeged 5
univ calif san diego 5
seoul natl univ 5
samsung adv inst technol 5
georgia inst technol 5
csic 5
cnrs 5
zhejiang univ 4
univ texas 4

DataBase
science citation index 283

- # CLUSTER 105
  Carbon nanotubes (CNTs), including single-walled and multi-walled CNTs and emphasizing electronic and structural properties (637 Records)

(Countries: USA, followed by China. Institutions: CAS, RAS, Tsing Hua University. USA include University of Illinois, NASA, ORNL, MIT.).

Cluster Syntax Features

Descriptive Terms
nanotub 42.0%, carbon.nanotubes 22.1%, carbon 17.6%, wall 1.4%, wall.carbon 0.5%, wall.carbon.nanotubes 0.4%, tube 0.4%, single.wall 0.4%, single.wall.carbon 0.3%, walled.carbon 0.3%, walled.carbon.nanotubes 0.2%, electron 0.2%, singl 0.2%, multi 0.2%, carbon.nanotube 0.2%

Discriminating Terms
nanotub 25.9%, carbon.nanotubes 15.2%, carbon 8.8%, film 2.0%, surfac 0.7%, particl 0.6%, wall 0.6%, crystal 0.5%, layer 0.5%, structur 0.5%, magnet 0.5%, temperatur 0.5%, quantum 0.4%, phase 0.4%, si 0.4%

Single Word Terms
carbon 637, nanotub 637, wall 273, electron 239, singl 208, structur 191, properti 165, surfac 153, high 151, function 143, energi 130, chemic 116, diamet 115, mechan 109, temperatur 109

Double Word Terms
carbon.nanotubes 615, carbon.nanotube 122, wall.carbon 118, single.wall 105, walled.carbon 101, single.walled 63, multi.walled 60, electron.microscopy 56, transmission.electron 55, nanotubes.carbon 47, chemical.vapor 42, vapor.deposition 41,

density.functional 34, molecular.dynamics 33, one.dimensional 33

Triple Word Terms
wall.carbon.nanotubes 111, walled.carbon.nanotubes 98, single.wall.carbon 86, multi.walled.carbon 53, single.walled.carbon 42, chemical.vapor.deposition 41, transmission.electron.microscopy 40, carbon.nanotubes.carbon 34, nanotubes.carbon.nanotubes 28, properties.carbon.nanotubes 28, multi.wall.carbon 26, growth.carbon.nanotubes 25, multiwalled.carbon.nanotubes 25, synthesis.carbon.nanotubes 23, density.functional.theory 20

Term Cliques
45.20% nanotub carbon.nanotubes carbon wall tube walled.carbon walled.carbon.nanotubes singl multi carbon.nanotube
45.67% nanotub carbon.nanotubes carbon wall wall.carbon wall.carbon.nanotubes tube singl multi carbon.nanotube
42.46% nanotub carbon.nanotubes carbon wall wall.carbon wall.carbon.nanotubes tube single.wall single.wall.carbon electron singl carbon.nanotube

Sample Cluster Record Titles

The preparation of nitrogen-doped carbon nanotubes from pyridine

Nickel formate route to the growth of carbon nanotubes

Grow your own carbon nanotubes

Biomimetic engineering of carbon nanotubes by using cell surface mucin mimics

Progress in preparation methods and applications of aligned carbon nanotubes

Electromagnetic wave propagation in single-wall carbon nanotubes

The morphology of pyrolytic carbon nanotubes with a small number of walls

Measurement of the elastic moduli of dense layers of oriented carbon nanotubes by a scanning force microscope

Finite-size effect and wall polarization in a carbon nanotube channel

Cluster Metrics

Authors

terrones, m 6
liang, j 6
qian, yt 5
nagy, jb 5
li, y 5
kyotani, t 5
krasheninnikov, av 5
ihm, j 5
hayashi, t 5
fonseca, a 5
endo, m 5
dresselhaus, ms 5
dai, lm 5
wang, y 4
wang, x 4

Sources

physical review b 72
carbon 34
journal of physical chemistry b 22
physical review letters 20
nanotechnology 17
applied physics letters 17
nano letters 15
chemical physics letters 15
journal of nanoscience and nanotechnology 13
fullerenes nanotubes and carbon nanostructures 13
journal of the american chemical society 12
advanced materials 10
journal of applied physics 9
diamond and related materials 9
physica e-low-dimensional systems & nanostructures 7

Keywords

carbon nanotubes 121
chemistry, physical 111
materials science, multidisciplinary 106
physics, condensed matter 96
chemistry, multidisciplinary 76
growth 72
materials science, multidisciplinary 70
physics, applied 63
physics, multidisciplinary 40
carbon nanotubes 38
chemical-vapor-deposition 33
physics, atomic, molecular & chemical 32

films 32
composites 31
carbon nanotube 27

Publication Year

2005 574
2004 57
2006 6

Country

usa 188
peoples r china 128
japan 55
france 46
germany 42
england 38
russia 33
south korea 25
italy 23
spain 21
belgium 20
india 19
brazil 16
taiwan 13
mexico 11

Institution

chinese acad sci 30
russian acad sci 20
tsing hua univ 18
univ cambridge 13
tohoku univ 12
univ illinois 11
nasa 11
cnrs 11
fac univ notre dame paix 10
zhejiang univ 9
seoul natl univ 9
peking univ 9
univ sci & technol china 8
oak ridge natl lab 7
mit 7

DataBase

science citation index 637

CATEGORY 11 - 509A2a ***(2 leaf clusters)***

Single and Double-walled Nanotubes (447 REC)

THRUST

()

- Single-walled carbon nanotubes (SWCNTs), including surface/ structural properties and Raman studies (139 Records) Cluster 30
- Single- and double-walled carbon nanotubes, including nanotube films, integration of nanoparticles into nanotubes, and electronic/ structural properties (308 Records) Cluster 31

- # CLUSTER 30

  Single-walled carbon nanotubes (SWCNTs), including surface/ structural properties and Raman studies (139 Records)

(Countries: USA, Japan. Institutions: University of Vienna, Tohoku University. USA include University of Notre Dame, University of Texas, New Jersey Institute of Technology.).

Cluster Syntax Features

Descriptive Terms

swcnt 31.5%, nanotub 6.9%, wall 6.5%, wall.carbon 6.0%, single.wall.carbon 5.3%, single.wall 5.2%, carbon 4.9%, carbon.nanotubes 3.8%, tube 3.4%, wall.carbon.nanotubes 2.8%, singl 2.1%, single.walled.carbon 1.5%, single.walled 1.4%, walled.carbon 1.3%, walled.carbon.nanotubes 0.9%

Discriminating Terms

swcnt 21.5%, wall.carbon 3.9%, single.wall.carbon 3.5%, single.wall 3.4%, wall 3.3%, nanotub 2.1%, tube 1.9%, film 1.9%, wall.carbon.nanotubes 1.8%, carbon.nanotubes 1.7%, carbon 1.1%, single.walled.carbon 0.8%, single.walled 0.8%, surfac 0.7%, walled.carbon 0.7%

Single Word Terms

wall 136, carbon 135, singl 128, nanotub 127, swcnt 80, tube 40, structur 37, raman 35, diamet 33, electron 31, function 29, surfac 28, on 27, energi 26, two 25

Double Word Terms

carbon.nanotubes 109, wall.carbon 77, single.wall 70, walled.carbon 62, single.walled 60, nanotubes.swcnts 48, carbon.nanotube 40, radial.breathing 13, electron.microscopy 13, raman.spectroscopy 12, nanotube.swcnt 11, double.wall 11, raman.spectra 10, nanotubes.swcnt 10, scanning.electron 9

Triple Word Terms

single.wall.carbon 69, single.walled.carbon 60, wall.carbon.nanotubes 57, walled.carbon.nanotubes 53, carbon.nanotubes.swcnts 48, wall.carbon.nanotube 17, walled.carbon.nanotube 17, carbon.nanotube.swcnt 11, double.wall.carbon 11, carbon.nanotubes.swcnt 10, scanning.electron.microscopy 8, radial.breathing.mode 7, radial.breathing.modes 7, transmission.electron.microscopy 6, wall.carbon.nanohorns 5

Term Cliques

72.58% nanotub wall wall.carbon single.wall.carbon single.wall carbon carbon.nanotubes wall.carbon.nanotubes singl

65.55% nanotub wall wall.carbon single.wall.carbon single.wall carbon carbon.nanotubes tube wall.carbon.nanotubes

68.35% swcnt nanotub wall carbon carbon.nanotubes singl single.walled.carbon single.walled walled.carbon walled.carbon.nanotubes

Sample Cluster Record Titles

Atomic-step-templated formation of single wall carbon nanotube patterns

Family behavior of the optical transition energies in single-wall carbon nanotubes of smaller diameters

Electrochemical and conductivity measurements of single-wall carbon nanotube network electrodes

Theoretical study of atomic chemisorption, on single-walled carbon nanotubes. Application of Anderson-Newns model

Ab initio study of magnetic and electronic properties of Fe-filled single-walled carbon nanotubes

Chirality dependence of the radial breathing mode: a simple model

Fundamental properties of single-wall carbon nanotubes

Spontaneous dissolution of a single-wall carbon nanotube salt

Systematic inclusion of defects in pure carbon single-wall nanotubes and their effect on the Raman D-band

Cluster Metrics

Authors

kuzmany, h 8
simon, f 7
iijima, s 7
yudasaka, m 6
pfeiffer, r 6
kataura, h 6
lee, yh 5
yang, cm 4
tohji, k 4
takahashi, t 4
sauvajol, jl 4
sato, y 4
sano, m 4
miyawaki, j 4
an, kh 4

Sources

physical review b 13
journal of physical chemistry b 10
journal of the american chemical society 8
chemical physics letters 7
physical review letters 6
nanotechnology 6
langmuir 5
nano letters 4
carbon 4
applied physics letters 4
journal of nanoscience and nanotechnology 3
advanced materials 3
acta physica sinica 3
synthetic metals 2
sensors and actuators b-chemical 2

Keywords

chemistry, physical 26
materials science, multidisciplinary 24
chemistry, multidisciplinary 20
physics, condensed matter 18
physics, multidisciplinary 15
carbon nanotubes 15
physics, applied 14
physics, atomic, molecular & chemical 12
materials science, multidisciplinary 11
adsorption 9
purification 8
growth 8
graphite 8
bundles 8
engineering, multidisciplinary 7

Publication Year

2005 125
2004 10
2006 4

Country

usa 41
japan 38
peoples r china 14
germany 14
italy 12

france 12
austria 9
south korea 6
russia 5
england 5
hungary 4
singapore 3
czech republic 3
taiwan 2
sweden 2

Institution

univ vienna 8
tohoku univ 8
univ montpellier 2 6
nec corp ltd 6
meijo univ 6
univ notre dame 5
sungkyunkwan univ 5
yamagata univ 4
osaka univ 4
enea 4
univ toulouse 3 3
univ texas 3
univ szeged 3
univ roma tor vergata 3
new jersey inst technol 3

DataBase

science citation index 139

- # CLUSTER 31

  Single- and double-walled carbon nanotubes, including nanotube films, integration of nanoparticles into nanotubes, and electronic/ structural properties (308 Records)

(Countries: USA dominant, China, followed by japan. Institutions: Rice University, University of Montpellier, University of Illinois. Other USA include University of Pennsylvania, University of Deleware, MIT.).

Cluster Syntax Features

Descriptive Terms

nanotub 15.4%, walled.carbon 12.9%, single.walled 11.9%, single.walled.carbon 10.9%, wall 10.7%, walled.carbon.nanotubes 7.5%, carbon 6.5%, carbon.nanotubes 5.6%, singl 2.5%, tube 1.2%, walled.carbon.nanotube 1.0%, carbon.nanotube 0.8%, double.walled.carbon 0.7%, double.walled 0.7%, swnt 0.5%

Discriminating Terms

walled.carbon 8.5%, single.walled 8.0%, single.walled.carbon 7.3%, nanotub 6.8%, wall 6.1%, walled.carbon.nanotubes 5.0%, carbon.nanotubes 2.8%, carbon 1.9%, film 1.8%, surfac 0.8%, walled.carbon.nanotube 0.7%, singl 0.6%, nanoparticl 0.6%, tube 0.6%, particl 0.6%

Single Word Terms

wall 308, nanotub 299, carbon 293, singl 272, electron 99, tube 90, structur 89, diamet 76, function 74, swnt 71, high 71, two 67, temperatur 64, spectroscopi 63, properti 62

Double Word Terms

walled.carbon 288, single.walled 269, carbon.nanotubes 245, carbon.nanotube 95, double.walled 44, nanotubes.swnts 34, raman.spectroscopy 30, electron.microscopy 28, transmission.electron 22, density.functional 17, properties.single 17, molecular.dynamics 15, radial.breathing 15, walled.nanotubes 14, raman.scattering 14

Triple Word Terms

single.walled.carbon 254, walled.carbon.nanotubes 240, walled.carbon.nanotube 82, double.walled.carbon 42, carbon.nanotubes.swnts 32, transmission.electron.microscopy 17, properties.single.walled 16, van.der.waals 13, semiconducting.single.walled 13, density.functional.theory 13, carbon.nanotubes.dwnts 13, single.walled.nanotubes 12, carbon.nanotube.swnt 12, scanning.electron.microscopy 11, carbon.nanotubes.swcnts 11

Term Cliques
58.89% nanotub walled.carbon wall carbon walled.carbon.nanotube carbon.nanotube double.walled.carbon double.walled
59.21% nanotub walled.carbon wall carbon tube carbon.nanotube double.walled.carbon double.walled
66.70% nanotub walled.carbon wall walled.carbon.nanotubes carbon carbon.nanotubes tube double.walled.carbon double.walled
77.68% nanotub walled.carbon single.walled wall carbon singl tube carbon.nanotube
83.12% nanotub walled.carbon single.walled wall walled.carbon.nanotubes carbon carbon.nanotubes singl tube
72.44% nanotub walled.carbon single.walled single.walled.carbon wall carbon singl walled.carbon.nanotube carbon.nanotube swnt
82.44% nanotub walled.carbon single.walled single.walled.carbon wall walled.carbon.nanotubes carbon carbon.nanotubes singl swnt

Sample Cluster Record Titles

Ultrafast carrier dynamics in purified and as-grown single-walled carbon nanotube films

Electronic structures of semiconducting double-walled carbon nanotubes: Important effect of interlay interaction

Pore structure and oxidation stability of double-walled carbon nanotube-derived bucky paper

Absorption spectrum of highly pure and soluble single-walled carbon nanotubes

Effect of the van der Waals interaction on analysis of double-walled carbon nanotubes

Effects of silver films with different nano-particle sizes on SERS of single-walled carbon nanotubes

Endohedral condensation and higher exohedral coverage of Kr on open single-walled carbon nanotubes at 77 K

Atomic-resolution imaging of the nucleation points of single-walled carbon nanotubes

Chirality dependence of mechanical properties of single-walled carbon nanotubes under axial tensile strain

Cluster Metrics

Authors

strano, ms 7
thomsen, c 6
kataura, h 6
sauvajol, jl 5
lee, yh 5
iijima, s 5
wang, l 4
terrones, m 4
suzuki, s 4
smalley, re 4
nicholas, rj 4
li, lj 4
li, cy 4
kim, ya 4
johnson, at 4

Sources

physical review b 38
journal of physical chemistry b 24
nano letters 17
carbon 17
chemical physics letters 15
applied physics letters 14
physical review letters 13
journal of the american chemical society 12
nanotechnology 8
journal of nanoscience and nanotechnology 6
chemistry of materials 6
chemical communications 6
langmuir 5
advanced materials 5
small 4

Keywords

chemistry, physical 74
materials science, multidisciplinary 64
physics, condensed matter 49
chemistry, multidisciplinary 47
carbon nanotubes 32
physics, applied 31
physics, multidisciplinary 25
materials science, multidisciplinary 22
physics, atomic, molecular & chemical 20
scattering 18
films 16
bundles 16

growth 14
physics, condensed matter 13
adsorption 13

Publication Year
2005 271
2004 35
2006 2

Country
usa 125
peoples r china 51
japan 39
germany 25
england 22
france 21
south korea 19
italy 10
poland 9
singapore 8
canada 7
spain 6
taiwan 5
mexico 5
sweden 4

Institution
rice univ 14
univ montpellier 2 11
univ illinois 11
chinese acad sci 8
tsing hua univ 7
peking univ 7
univ penn 6
univ oxford 6
univ delaware 6
tech univ berlin 6
shinshu univ 6
osaka univ 6
nanjing univ 6
mit 6
aist 6

DataBase
science citation index 308

CATEGORY 12 - 509A2b ***(2 leaf clusters)***

Single-walled Nanotubes (414 REC)

THRUST

()

- Single-walled (carbon) nanotubes (SWNTs), including nanotube thin films, surface and structural properties, and interaction of nanoparticles with nanotubes (274 Records) Cluster 6
- Single-walled (carbon) nanotubes (SWNTs), emphasizing electrode applications, nanotube films, and surface/ structural properties (140 Records) Cluster 9

- CLUSTER 6
  Single-walled (carbon) nanotubes (SWNTs), including nanotube thin films, surface and structural properties, and interaction of nanoparticles with nanotubes (274 Records)

(Countries: USA dominant, China, Japan. Institutions: CAS, Rice University, UCR, Peking University. Other USA include Penn State University, USN, NASA, University of Pennsylvania.).

Cluster Syntax Features

Descriptive Terms

swnt 51.5%, nanotub 6.5%, single.walled 6.0%, single.walled.carbon 5.7%, walled.carbon 5.0%, wall 3.3%, carbon 3.1%, walled.carbon.nanotubes 3.1%, carbon.nanotubes 2.5%, nanotubes.swnts 1.4%, singl 1.3%, carbon.nanotubes.swnts 1.3%, carbon.nanotube 0.5%, walled.carbon.nanotube 0.5%, raman 0.2%

Discriminating Terms

swnt 33.5%, single.walled 3.7%, single.walled.carbon 3.5%, walled.carbon 3.0%, nanotub 1.9%, walled.carbon.nanotubes 1.8%, film 1.5%, wall 1.4%, carbon.nanotubes 1.0%, nanotubes.swnts 0.9%, carbon.nanotubes.swnts 0.8%, surfac 0.7%, particl 0.6%, structur 0.6%, nanoparticl 0.5%

Single Word Terms

swnt 274, nanotub 270, carbon 269, wall 268, singl 267, electron 86, high 82, function 77, properti 72, chemic 68, raman 67, structur 66, spectroscopi 65, surfac 59, form 56

Double Word Terms

single.walled 267, walled.carbon 257, carbon.nanotubes 225, nanotubes.swnts 172, carbon.nanotube 102, nanotube.swnt 54, raman.spectroscopy 32, electron.microscopy 29, swnts.swnts 23, chemical.vapor 22, vapor.deposition 21, transmission.electron 19, atomic.force 19, room.temperature 17, force.microscopy 17

Triple Word Terms

single.walled.carbon 256, walled.carbon.nanotubes 209, carbon.nanotubes.swnts 162, walled.carbon.nanotube 78, carbon.nanotube.swnt 50, chemical.vapor.deposition 21, transmission.electron.microscopy 18, atomic.force.microscopy 17, functionalization.single.walled 15, single.walled.nanotubes 15, properties.single.walled 14, growth.single.walled 13, functionalized.single.walled 11, carbon.nanotubes.single 11, carbon.nanotubes.swnt 11

Term Cliques
84.23% swnt nanotub single.walled single.walled.carbon walled.carbon wall carbon singl carbon.nanotube walled.carbon.nanotube
83.18% swnt nanotub single.walled single.walled.carbon walled.carbon wall carbon walled.carbon.nanotubes carbon.nanotubes nanotubes.swnts singl carbon.nanotubes.swnts raman

Sample Cluster Record Titles

Separation of single-walled carbon nanotubes on silica gel. Materials morphology and Raman excitation wavelength affect data interpretation

Chemical detection with a single-walled carbon nanotube capacitor

Electric-field-enhanced assembly of single-walled carbon nanotubes on a solid surface

Enhancement of hydrogen physisorption on single-walled carbon nanotubes resulting from defects created by carbon bombardment

Photoluminescence intermittency in an individual single-walled carbon nanotube at room temperature

Diffusion and condensation of lithium atoms in single-walled carbon nanotubes

Low temperature synthesis of extremely dense, and vertically aligned single-walled carbon nanotubes

Vertical growth of individual single-walled carbon nanotubes on silicon and SiO2 substrates

Position-controlled growth of single-walled carbon nanotubes by laser-irradiated chemical vapor deposition

Cluster Metrics

Authors
li, f 11
haddon, rc 9
cheng, hm 9
zhao, b 8

zhao, mw 7
xia, yy 7
smalley, re 7
lu, gq 7
sun, ch 6
song, c 6
liu, xd 6
lefrant, s 6
itkis, me 6
huang, bd 6
wang, q 5

Sources

journal of physical chemistry b 24
journal of the american chemical society 18
applied physics letters 17
physical review b 16
nanotechnology 11
nano letters 10
carbon 10
japanese journal of applied physics part 1-regular papers short notes & review papers 9
chemical physics letters 9
advanced materials 9
langmuir 8
journal of nanoscience and nanotechnology 8
chemistry of materials 8
polymer 6
physical review letters 6

Keywords

chemistry, physical 66
materials science, multidisciplinary 61
physics, applied 45
chemistry, multidisciplinary 42
carbon nanotubes 27
materials science, multidisciplinary 25
physics, condensed matter 21
composites 21
polymer science 17
spectroscopy 15
functionalization 15
spectra 14
scattering 14
purification 14
physics, atomic, molecular & chemical 13

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2005 250
2004 23
2006 1

Country

usa 124
peoples r china 58
japan 43
south korea 16
germany 13
england 11
france 9
italy 8
australia 8
canada 6
brazil 6
romania 5
spain 4
sweden 3
taiwan 2

Institution

chinese acad sci 20
rice univ 16
univ calif riverside 11
peking univ 11
osaka univ 8
univ queensland 7
tohoku univ 7
shandong univ 7
penn state univ 7
usn 6
univ tokyo 6
natl inst adv ind sci & technol 6
nasa 6
zhejiang univ 5
univ penn 5

DataBase

science citation index 274

- CLUSTER 9
  Single-walled (carbon) nanotubes (SWNTs), emphasizing electrode applications, nanotube films, and surface/ structural properties (140 Records)

Countries: USA very dominant, Japan, China. Institutions: Rice University, MIT, Tohoku University, Peking University, NASA, Georgia Institute of Technology. Other USA include Yale, Rochester Institute of Technology, University of Pennsylvania, University of Illinois, NREL, University of Texas.).

Cluster Syntax Features

Descriptive Terms

swnt 41.4%, single.wall 8.3%, single.wall.carbon 7.8%, wall.carbon 7.4%, nanotub 6.3%, wall.carbon.nanotubes 4.3%, wall 3.6%, carbon 3.0%, carbon.nanotubes 2.5%, singl 1.5%, nanotubes.swnts 1.0%, carbon.nanotubes.swnts 0.8%, wall.carbon.nanotube 0.8%, carbon.nanotube 0.5%, electrod 0.2%

Discriminating Terms

swnt 26.1%, single.wall 5.3%, single.wall.carbon 5.0%, wall.carbon 4.7%, wall.carbon.nanotubes 2.8%, nanotub 1.8%, wall 1.6%, film 1.5%, carbon.nanotubes 1.0%, surfac 0.8%, nanotubes.swnts 0.6%, structur 0.6%, particl 0.5%, layer 0.5%, crystal 0.5%

Single Word Terms

nanotub 140, swnt 140, singl 140, wall 140, carbon 137, electron 50, function 36, raman 36, properti 36, spectroscopi 35, metal 35, structur 31, diamet 30, conduct 28, high 28

Double Word Terms

single.wall 139, wall.carbon 134, carbon.nanotubes 119, nanotubes.swnts 72, carbon.nanotube 55, nanotube.swnt 27, nanotubes.swnt 24, raman.spectroscopy 18, electron.microscopy 13, transmission.electron 12, radial.breathing 10, metallic.swnts 9, swnt.bundles 9, arc.discharge 9, semiconducting.swnts 9

Triple Word Terms

single.wall.carbon 133, wall.carbon.nanotubes 113, carbon.nanotubes.swnts 67, wall.carbon.nanotube 46, carbon.nanotube.swnt 24, carbon.nanotubes.swnt 22, transmission.electron.microscopy 9, radial.breathing.mode 8, single.wall.nanotubes 8, properties.single.wall 8, scanning.electron.microscopy 6, chemical.vapor.deposition 6, wall.nanotubes.swnts 5, synthesis.single.wall 5, atomic.force.microscopy 5

Term Cliques

79.74% swnt single.wall single.wall.carbon wall.carbon nanotub wall carbon singl wall.carbon.nanotube carbon.nanotube electrod
82.31% swnt single.wall single.wall.carbon wall.carbon nanotub wall.carbon.nanotubes wall carbon carbon.nanotubes singl nanotubes.swnts carbon.nanotubes.swnts electrod

Sample Cluster Record Titles

Purification of single-wall carbon nanotubes by electrochemical oxidation

Persistent photoconductivity in chemically modified single-wall carbon nanotubes

Effect of Co-MCM-41 conversion to cobalt silicate for catalytic growth of single wall carbon nanotubes

Reconstructing the radial breathing mode resonance Raman spectra for HiPco single-wall carbon nanotubes

Calculations on cyclopyranoses as co-solvents of single-wall carbon nanotubes

Incorporation of single-wall carbon nanotubes into an organic polymer monolithic stationary phase for mu-HPLC and capillary electrochromatography

Highly polarized absorption and photoluminescence of stretch-aligned single-wall carbon nanotubes dispersed in gelatin films

Single-wall carbon nanotube-polymer solar cells

Functionalization and extraction of large fullerenes and carbon-coated metal formed

[during the synthesis of single wall carbon nanotubes by laser oven, direct current arc, and high-pressure carbon monoxide production methods]

Cluster Metrics

Authors
dresselhaus, ms 9
kumar, s 6
samsonidze, gg 5
saito, r 5
landi, bj 5
dresselhaus, g 5
chen, y 5
raffaelle, rp 4
lim, s 4
jorio, a 4
hauge, rh 4
haller, gl 4
ciuparu, d 4
billups, we 4
wang, yb 3

Sources
journal of physical chemistry b 13
physical review b 11
chemical physics letters 10
carbon 9
applied physics letters 8
nanotechnology 7
polymer 4
chemistry of materials 4
journal of the american chemical society 3
journal of nanoscience and nanotechnology 3
diamond and related materials 3
synthetic metals 2
physical review letters 2
physica status solidi b-basic research 2
molecular simulation 2

Keywords
chemistry, physical 29
materials science, multidisciplinary 26
physics, applied 20
carbon nanotubes 16
physics, condensed matter 15

physics, atomic, molecular & chemical 15
films 14
materials science, multidisciplinary 13
chemistry, multidisciplinary 13
composites 13
polymer science 11
growth 10
scattering 9
functionalization 9
spectroscopy 8

Publication Year

2005 122
2004 16
2006 2

Country

usa 74
japan 24
peoples r china 20
brazil 11
germany 6
spain 5
south korea 4
russia 4
netherlands 4
italy 4
singapore 3
france 3
sweden 2
israel 2
canada 2

Institution

rice univ 9
mit 9
tohoku univ 6
peking univ 6
nasa 6
georgia inst technol 6
yale univ 5
rochester inst technol 5
jst 5
univ penn 4
univ illinois 4
univ fed minas gerais 4

natl renewable energy lab 4
chinese acad sci 4
univ texas 3

DataBase
science citation index 140

CATEGORY 13 - 509B1a ***(58 leaf clusters)***

Nanomaterials and Nanoparticles (14263 REC)

THRUST

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- Adsorption, focusing on removal of material from solution, measuring adsorption capacity, and adsorption by bentonites (65 Records) Cluster 94
- Applications of activated carbon, porous carbon, and carbon aerogels, especially for adsorption and as capacitors (182 Records) Cluster 106
- Graphite, carbon black, fullerenes, carbon fibers, and other carbon-containing materials, emphasizing their magnetic/optical/surface properties and electrochemical applications (444 Records) Cluster 221
- Growth, catalytic applications, and properties of carbon nanofibers (CNFs) and carbon supports (110 Records) Cluster 25
- Preparation of materials, especially nanofibers, by electrospinning (91 Records) Cluster 71
- Fibers, emphasizing electrospun fibers, cellulose, and morphology and strength of fibers (164 Records) Cluster 46
- Lithium-ion (especially $LiCoO_2$ and lithium-nickel) batteries, with emphasis on enhancement of capacity and cyclability (345 Records) Cluster 129
- Electrochemical studies and applications, focusing on electrode/ electrolyte properties and applications, capacitors, and hydrogen storage (216 Records) Cluster 204

- Electrode (especially gold) behavior and applications to biosensors (especially glucose and enzyme) and immunosensors (227 Records) Cluster 184
- Nano silica particles, emphasizing coating applications, effects of particle size, dispersion, and aggregation (130 Records) Cluster 103
- Characteristics and synthesis of silica-containing materials, with focus on gels, films, surfaces, monoliths, and porous silica (153 Records) Cluster 121
- Mesoporous silica materials, emphasizing methods of synthesis, as well as adsorption properties (262 Records) Cluster 90
- SBA-15, SBA-1, and other mesoporous silica materials, focusing on adsorption properties and functionalization of SBA-15 with acid (90 Records) Cluster 20
- Nanoporous, mesoporous, and porous materials, with emphasis on determination and control of pore size, evaluation of surface area, alumina and silica materials, and adsorption properties (292 Records) Cluster 185
- Synthesis and characterization of MCM mesoporous silicas and use as molecular sieves and catalysts (147 Records) Cluster 19
- Zeolites (especially ZSM-5, silicalite-1, and MFI), with emphasis on ion exchange, adsorption and acid properties, and synthesis, particularly hydrothermally (145 Records) Cluster 29
- Oxidation and reduction reactions, emphasizing the catalysts involved (particularly CeO2) and their catalytic activity (470 Records) Cluster 237
- Catalysts (especially MCM-incorporated, palladium, and heterogeneous catalysts), especially studies on catalytic activity/selectivity, surface area, and hydrogenation/dehydrogenation reactions (554 Records) Cluster 153
- Catalysts (especially gamma-Al2O3, nickel, and cobalt catalysts), emphasizing activity, structure, and formation of catalysts; steam reforming of methanol; and hydrogenation reactions (222 Records) Cluster 102
- Platinum (Pt) and platinum-ruthenium (PtRu) catalysts, emphasizing their electrochemical applications, including methanol and other fuel cells, methanol electro-oxidation, and reduction reactions (270 Records) Cluster 87
- Platinum (Pt) and iron-platinum (FePt) nanoparticles, focusing on electrocatalytic activity (especially for oxygen reduction), size-

dependent effects/processes, and synthesis (especially by polyol process) of nanoparticles (109 Records) Cluster 80

- Titanium dioxide (TiO2) films, including sol-gel derived and nanocrystalline films, use in dye-sensitized solar cells, photocatalytic activity, and preparation by deposition (141 Records) Cluster 124
- Preparation of titanium dioxide (TiO2) thin films by sol-gel process or deposition, photocatalytic activity of TiO2 films, and doped TiO2 films (105 Records) Cluster 24
- Anatase and rutile titanium dioxide (TiO2), emphasizing photocatalytic use and characterization of TiO2 nanoparticles (379 Records) Cluster 107
- Studies on photocatalytic activity, such as photocatalytic degradation, of titanium dioxide (TiO2), primarily under visible light irradiation (224 Records) Cluster 65
- Preparation of materials (including powders, silica (SiO2), and particles) by sol-gel synthesis and subsequent characterization, especially using x-ray diffraction (XRD) (429 Records) Cluster 199
- Preparation and characterization of powders, emphasizing studies of particle size, synthesis by combustion process or co-precipitation method, and x-ray diffraction (XRD) analyses (491 Records) Cluster 208
- High-energy ball milling, focusing on production of materials (especially nanocrystalline powders), phase formation/transformation, and studies on magnesium hydride (MgH2) (200 Records) Cluster 49
- Sintering (especially spark plasma sintering) to produce and modify materials, including ceramics and magnesium diboride (MgBr2) materials (143 Records) Cluster 198
- Sintering (including spark plasma and liquid phase sintering) of powders, ceramics, nanocomposites, and alumina-based materials, with emphasis on densification and microstructure of products (200 Records) Cluster 101
- Ceramics made of zirconia (ZrO2) and yttrium stabilized zirconia (YSZ), alumina (Al2O3), and silicon carbide (SiC), focusing on mechanical properties and microstructural characterization (255 Records) Cluster 211
- Dielectric (especially ferroelectric and piezoelectric) properties of ceramics, emphasizing glass and barium-titanate (BaTiO3) based materials (192 Records) Cluster 155

- Glass ceramics, including cordierite and various ceramic oxides (Na_2O, SiO_2, and CaO), focusing on crystallization, nucleation, and heat treatment (78 Records) Cluster 59
- Synthesis of nanorods (especially cadmium-sulfide [CdS]), with focus on hydrothermal fabrication, transmission electron microscopy (TEM) studies, and characterization of length and diameter (132 Records) Cluster 68
- Zinc oxide (ZnO), as well as gallium nitride (GaN), nanorods, emphasizing growth, nanorod arrays, and field emission properties (123 Records) Cluster 12
- Nanobelts (especially gallium oxide [Ga_2O_3], zinc oxide [ZnO], and silicon nitride [Si_3N_4]) and nanoribbons, emphasizing growth, fabrication by thermal evaporation, and photoluminescence and emission properties (49 Records) Cluster 13
- Synthesis (especially hydrothermally) of nanostructures and subsequent analysis using transmission electron microscopy (TEM) and x-ray diffraction (XRD) (270 Records) Cluster 218
- Hydrothermal/solvothermal synthesis and morphology of nanocrystals, crystalline materials, and nanowires (302 Records) Cluster 249
- Reaction, surface, phase, and temperature dynamics/behavior of oxides, systems affected by water, and aqueous solutions (648 Records) Cluster 255
- Ferrous substances (especially ferrihydrites and iron oxides, namely goethite and hematite), characterized by Mossbauer spectroscopy and used for dechlorination, arsenic removal, and chemical reduction (162 Records) Cluster 173
- Studies on minerals (especially calcite, smectite, illitite, and fly ash), emphasizing leaching/sorption behavior and weathering (260 Records) Cluster 233
- Biofilms and other biological systems at the nanoscale, focusing on adhesive behavior, applications of/to bacteria, biofilm formation, surface properties, and electron microscopy studies (182 Records) Cluster 226
- Phosphate and calcium compouns (especially calcium phosphates, such as apatite and hydroxyapatite [HAP]), emphasizing studies on cements, bone and bone-like material, and enamel (226 Records) Cluster 194

- Soot, flame-synthesized particles, and humic substances, emphasizing aggregation, particle size, analysis using fractionation (125 Records) Cluster 186
- Aerosols and other fine/ultrafine particles, with emphasis on nucleation and measuring particle size, mass, and concentration, especially in the atmosphere (251 Records) Cluster 126
- Investigations on particle size, focusing on determination of particle size distribution, particles prepared by precipitation method, dispersion of particles, and barium titanate ($BaTiO_3$) particles and powders (380 Records) Cluster 212
- Studies on nano-sized particles, characterized by size, surface characteristics, shape, and morphology (580 Records) Cluster 238
- Nanoparticles (especially silica [SiO_2] and titanium dioxide [TiO_2]), emphasizing preparation, surface modification, and core/shell composites (125 Records) Cluster 164
- Colloidal particles, spheres, suspensions, and crystals, emphasizing particle size, hollow spheres, stabilization, dispersion, and latex materials (258 Records) Cluster 228
- Magnetic particles, focusing on ferrites (such as Fe304 and Fe_2O_3) and ferrofluids, superparamagnetic particles, particle size, and Mossbauer spectroscopy (178 Records) Cluster 179
- Magnetic properties of nanoparticles, emphasizing iron oxide (especially magnetite [Fe_3O_4] and hematite [Fe_2O_3]) nanoparticles and superparamagnetic particles (237 Records) Cluster 175
- Core-shell nanostructures and hollow nanospheres, made of silver (Ag), bimetallic material, and silica (211 Records) Cluster 70
- Titanium dioxide (TiO_2), cadmium sulfide (CdS), cadmium selenide (CdSe), and solid lipid nanoparticles and nanocrystals (138 Records) Cluster 147
- Nanoparticles, including particle size, synthesis, metal and silica nanoparticles, surface properties, dispersion, reactions, and stabilization (930 Records) Cluster 239
- Gold nanoparticles and nanorods, emphasizing plasmon and surface properties, stabilization, synthesis, and application to electrodes (334 Records) Cluster 104
- Gold nanoparticles, focusing on surface properties studied by surface-enhanced Raman scattering (SERS), self-assembly of monolayers and other structures, and electrode applications (221 Records) Cluster 158

- Silver (Ag) nanoparticles, with emphasis on surface-enhanced Raman scattering (SERS) studies (122 Records) Cluster 75
- Silver (Ag), gold, and gold-silver nanoparticles, including surface-enhanced Raman scattering, reduction behavior, effect of ions, and surface properties (294 Records) Cluster 56

- # CLUSTER 94
  Adsorption, focusing on removal of material from solution, measuring adsorption capacity, and adsorption by bentonites (65 Records)

(Countries: China, USA. Institutions: CAS, University of Kerala, National University of Singapore.).

Cluster Syntax Features

Descriptive Terms
adsorpt 49.1%, adsorb 7.1%, isotherm 1.7%, remov 1.3%, adsorption.capacity 1.1%, capac 0.9%, acid 0.7%, bentonit 0.7%, solut 0.7%, freundlich 0.6%, langmuir 0.6%, sorption 0.5%, surfac 0.5%, equilibrium 0.4%, model 0.4%

Discriminating Terms
adsorpt 30.7%, adsorb 4.1%, film 1.9%, isotherm 1.0%, adsorption.capacity 0.8%, remov 0.6%, nanotub 0.6%, nanoparticl 0.5%, magnet 0.5%, structur 0.5%, deposit 0.5%, layer 0.5%, bentonit 0.5%, phase 0.5%, freundlich 0.4%

Single Word Terms
adsorpt 63, adsorb 46, surfac 39, isotherm 30, temperatur 28, solut 24, model 22, capac 21, concentr 21, rai 21, equilibrium 20, langmuir 19, high 19, acid 19, remov 18

Double Word Terms
adsorption.capacity 16, surface.area 13, ray.diffraction 11, scanning.electron 10, adsorption.desorption 9, activated.carbon 8, aqueous.solution 8, adsorption.isotherms 8, langmuir.freundlich 8, ray.photoelectron 8, photoelectron.spectroscopy 8, adsorption.adsorption 8, adsorption.experiments 7, adsorption.data 7, room.temperature 7

Triple Word Terms
ray.photoelectron.spectroscopy 8, photoelectron.spectroscopy.xps 6, scanning.electron.microscopy 6, ray.diffraction.xrd 4, fourier.transform.infrared 4, maximum.adsorption.capacity 3, scanning.electron.microscope 3, isosteric.heat.adsorption 3, bet.surface.area 3, transform.infrared.spectroscopy 3, high.surface.area 3, metal.organic.framework 3, diffraction.nitrogen.adsorption 2, particle.size.surface 2, ray.diffraction.nitrogen 2

Term Cliques
34.62% adsorpt remov adsorption.capacity capac acid bentonit solut freundlich langmuir sorption surfac model
35.62% adsorpt isotherm remov adsorption.capacity capac bentonit solut freundlich langmuir sorption surfac equilibrium model
39.87% adsorpt adsorb remov adsorption.capacity capac acid solut freundlich langmuir sorption surfac model
40.47% adsorpt adsorb isotherm remov adsorption.capacity capac solut freundlich langmuir sorption surfac equilibrium model

Sample Cluster Record Titles

Adsorption of benzene and toluene on coronene nanolayers

Adsorption of malachite green by a magnetic nano-adsorbent

Adsorption of benzoic acid and hydroquinone by organically modified bentonites

Estimation of adsorption capacity for dissociating and non dissociating aromatic compounds on activated carbon with different models

Removal of vanadium(IV) from aqueous solutions by adsorption process with aluminum-pillared bentonite

Adsorption separation of carbon dioxide from flue gas of natural gas-fired boiler by a novel nanoporous "molecular basket" adsorbent

Adsorption from aqueous phenol and aniline solutions on activated carbons with different surface chemistry

Separation of CO2 and N-2 by adsorption in C-168 schwarzite: A combination of quantum mechanics and molecular simulation study

Flexibility in metal-organic framework materials: Impact on sorption properties

Cluster Metrics

Authors
hu, j 3
wu, cd 2
wang, y 2
noeline, bf 2
manohar, dm 2
gao, qm 2
anirudhan, ts 2
zieba, e 1
zhu, cy 1
zhou, an 1
zheng, lb 1
zhao, zg 1
zhao, xs 1
zhao, xr 1
zhao, h 1

Sources
journal of colloid and interface science 9
microporous and mesoporous materials 6
industrial & engineering chemistry research 3
water research 2
separation science and technology 2
journal of solid state chemistry 2
journal of hazardous materials 2
colloids and surfaces a-physicochemical and engineering aspects 2
applied clay science 2
adsorption-journal of the international adsorption society 2
adsorption science & technology 2
zeitschrift fur anorganische und allgemeine chemie 1
synthetic metals 1
surface science 1
separation and purification technology 1

Keywords
adsorption 21
chemistry, physical 18
adsorption 12
chemistry, applied 11
chemistry, physical 11
sorption 10
removal 10
engineering, chemical 9
water 8

chemistry, multidisciplinary 7
activated carbon 7
multidisciplinary 6
engineering, chemical 6
silica 6
materials science, 6

Publication Year

2005 57
2004 7
2006 1

Country

peoples r china 14
usa 11
turkey 5
japan 5
india 4
spain 3
england 3
australia 3
taiwan 2
south korea 2
singapore 2
iran 2
france 2
thailand 1
switzerland 1

Institution

chinese acad sci 3
univ kerala 2
natl univ singapore 2
zhejiang univ technol 1
zhejiang univ 1
yuzuncu yil univ 1
yamaso micron inc 1
xian univ sci & technol 1
westinghouse savannah river co 1
vanderbilt univ 1
urmia univ 1
univ utrecht 1
univ utah 1
univ tecn lisbon 1
univ surrey 1

- # CLUSTER 106
  Applications of activated carbon, porous carbon, and carbon aerogels, especially for adsorption and as capacitors (182 Records)

(Countries: China, Japan, USA, followed by France, South Korea. Institutions: CSIC, National Institute of Materials Science, CNRS. USA includes ORNL.).

Cluster Syntax Features

Descriptive Terms

carbon 34.6%, activated.carbon 6.3%, mesopor 4.8%, adsorpt 4.7%, pore 3.9%, activ 3.1%, mesoporous.carbon 2.2%, aerogel 1.8%, templat 1.4%, micropor 1.4%, activated.carbons 1.2%, surface.area 0.9%, capacit 0.9%, area 0.9%, carbon.aerogels 0.8%

Discriminating Terms

carbon 18.4%, activated.carbon 4.6%, mesopor 2.8%, adsorpt 2.3%, film 2.0%, pore 2.0%, mesoporous.carbon 1.6%, aerogel 1.2%, activ 1.1%, micropor 0.9%, activated.carbons 0.9%, nanoparticl 0.6%, carbon.aerogels 0.6%, templat 0.6%, magnet 0.6%

Single Word Terms

carbon 182, surfac 111, pore 105, activ 96, adsorpt 95, structur 87, area 81, mesopor 72, materi 69, high 67, size 63, templat 55, order 54, synthes 48, temperatur 47

Double Word Terms

surface.area 68, activated.carbon 63, mesoporous.carbon 37, pore.size 35, activated.carbons 26, carbon.materials 26, high.surface 25, nitrogen.adsorption 24, ordered.mesoporous 23, double.layer 23, electron.microscopy 23, pore.volume 21, mesoporous.carbons 19, ray.diffraction 19, surface.areas 19

Triple Word Terms

high.surface.area 20, surface.area.pore 16, ordered.mesoporous.carbon 15, transmission.electron.microscopy 14, pore.size.distribution 14, scanning.electron.microscopy 11, ordered.mesoporous.carbons 11, electrical.double.layer 10, area.pore.volume 10, bet.surface.area 9, double.layer.capacitors 9, double.layer.capacitance 8, carbon.molecular.sieves 8, electric.double.layer 8, chemical.vapor.deposition 8

Term Cliques

35.81% carbon aerogel surface.area capacit area carbon.aerogels
45.88% carbon activ micropor surface.area capacit area
51.92% carbon adsorpt activ micropor surface.area area
46.89% carbon adsorpt activ micropor activated.carbons surface.area
47.71% carbon adsorpt pore micropor activated.carbons surface.area
44.30% carbon mesopor pore mesoporous.carbon templat micropor surface.area area
50.86% carbon mesopor adsorpt pore micropor surface.area area
43.54% carbon mesopor adsorpt pore aerogel surface.area area carbon.aerogels
47.53% carbon activated.carbon activ surface.area capacit area
53.57% carbon activated.carbon adsorpt activ surface.area area
48.53% carbon activated.carbon adsorpt activ activated.carbons surface.area

Sample Cluster Record Titles

Carbon molecular sieve cloths prepared by chemical vapour deposition of methane for separation of gas mixtures

Carbon aerogels for catalysis applications: An overview

Improved activated carbon by thermal treatment in methane and steam: Physicochemical influences on MIB sorption capacity

Improvement of mesoporosity of carbon cryogels by ultrasonic irradiation

Carbon nanofibres and activated carbon nanofibres as electrodes in supercapacitors

A simplified preparation of mesoporous carbon and the examination of the carbon accessibility for electric double layer formation

[Effect of acid pretreatment on the metal loading of activated carbon]

[Adsorption of vitamin B12 on ordered mesoporous carbons coated with PMMA]

[Preparation of titanium dioxide/activated carbon composites using supercritical carbon dioxide]

Cluster Metrics

Authors
vinu, a 7
vix-guterl, c 5
ariga, k 5
xia, yd 4
tascon, jmd 4
setoyama, n 4
parmentier, j 4
mokaya, r 4
miyahara, m 4
martinez-alonso, a 4
fu, rw 4
zhao, xs 3
yang, zx 3
yang, ys 3
yamazaki, t 3

Sources
carbon 22
nanoporous materials iv 11
microporous and mesoporous materials 11
chemistry of materials 10
journal of physical chemistry b 8
journal of non-crystalline solids 7
journal of colloid and interface science 7
journal of power sources 6
new carbon materials 5
langmuir 5
journal of materials chemistry 5
adsorption-journal of the international adsorption society 5
chemistry letters 4
chemical communications 4
korean journal of chemical engineering 3

Keywords

chemistry, physical 71
materials science, multidisciplinary 47
adsorption 35
activated carbon 26
molecular-sieves 22
nanotubes 20
chemistry, multidisciplinary 17
chemistry, applied 15
storage 15
chemistry, physical 15
materials science, multidisciplinary 14
adsorption 14
silica 14
engineering, chemical 13
multidisciplinary 12

Publication Year
2005 160
2004 18
2006 4

Country
peoples r china 36
japan 30
usa 29
france 21
south korea 19
spain 13
poland 10
england 10
germany 9
taiwan 6
india 5
australia 5
thailand 3
singapore 3
hungary 3

Institution
csic 8
natl inst mat sci 7
cnrs 7
tsing hua univ 6
chinese acad sci 6
korea adv inst sci & technol 5
zhongshan univ 4

univ nottingham 4
univ aix marseille 1 4
oak ridge natl lab 4
harbin inst technol 4
univ queensland 3
univ alicante 3
toyota cent res & dev labs inc 3
tohoku univ 3

DataBase
science citation index 182

- # CLUSTER 221
  Graphite, carbon black, fullerenes, carbon fibers, and other carbon-containing materials, emphasizing their magnetic/optical/surface properties and electrochemical applications (444 Records)

(Countries: China, USA, Japan. Institutions: CAS, National University of Singapore, CNRS. USA includes University of Texas.).

Cluster Syntax Features

Descriptive Terms
carbon 59.4%, graphit 3.0%, fiber 1.2%, black 1.0%, catalyst 0.9%, carbon.black 0.8%, composit 0.8%, electrod 0.8%, materi 0.4%, fulleren 0.4%, carbon.fibers 0.4%, hydrogen 0.4%, nanostructur 0.4%, surfac 0.3%, electrochem 0.3%

Discriminating Terms
carbon 43.3%, graphit 2.2%, film 2.1%, black 0.8%, carbon.black 0.7%, fiber 0.6%,

magnet 0.6%, quantum 0.5%, optic 0.4%, crystal 0.4%, si 0.4%, phase 0.4%, layer 0.4%, surfac 0.4%, dot 0.4%

Single Word Terms

carbon 442, structur 142, electron 140, surfac 135, high 125, materi 113, graphit 112, temperatur 112, composit 104, properti 99, microscopi 95, particl 85, form 80, rai 78, mechan 77

Double Word Terms

electron.microscopy 76, transmission.electron 55, scanning.electron 48, carbon.nanotubes 47, ray.diffraction 42, carbon.carbon 37, carbon.black 34, carbon.fibers 27, carbon.fiber 27, carbon.materials 25, raman.spectroscopy 23, ray.photoelectron 22, amorphous.carbon 20, cyclic.voltammetry 20, surface.area 20

Triple Word Terms

transmission.electron.microscopy 43, scanning.electron.microscopy 38, ray.photoelectron.spectroscopy 19, electron.microscopy.tem 17, electron.microscopy.sem 15, chemical.vapor.deposition 15, carbon.carbon.composites 13, transmission.electron.microscope 11, ray.diffraction.xrd 11, photoelectron.spectroscopy.xps 11, atomic.force.microscopy 10, glassy.carbon.electrode 10, high.resolution.transmission 9, resolution.transmission.electron 9, microscopy.transmission.electron 8

Term Cliques

36.98% carbon composit materi carbon.fibers surfac
33.20% carbon composit materi carbon.fibers nanostructur
32.51% carbon black electrod materi surfac electrochem
33.90% carbon black composit materi surfac electrochem
31.38% carbon black carbon.black electrod materi surfac
32.77% carbon black carbon.black composit materi surfac
29.62% carbon black carbon.black composit materi nanostructur
34.19% carbon fiber composit carbon.fibers surfac
32.84% carbon graphit catalyst hydrogen electrochem
32.25% carbon graphit catalyst hydrogen nanostructur
28.51% carbon graphit black electrod materi hydrogen electrochem
24.47% carbon graphit black carbon.black materi fulleren hydrogen nanostructur
27.54% carbon graphit black carbon.black electrod materi hydrogen

Sample Cluster Record Titles

Boron-substituted fullerenes - Can they be one of the options for hydrogen storage?

Preparation of platinum electrocatalysts using carbon supports for oxygen reduction at a gas-diffusion electrode n-Diamond nanocrystal from catalyzed carbon black in a high magnetic field

Diamagnetism of natural fullerene-like carbon

Production of hydrogen and carbon nanotubes from methane

Preparation of carbon-coated magnetic iron nanoparticles from composite rods made from coal and iron powders

Synthesis and characterization of carbon-enriched silicon oxycarbides

Catalyst consumption during growth of carbon nanofilaments on Pd seeds

Carbon microstructures synthesized utilizing the RF microplasma jet at atmospheric pressure

Cluster Metrics

Authors

compton, rg 6
jiang, w 5
huczko, a 5
zhao, xs 4
su, ds 4
schlogl, r 4
okada, s 4
motojima, s 4
li, hj 4
lee, jy 4
kim, j 4
huang, y 4
bystrzejewski, m 4
banks, ce 4
zhou, zc 3

Sources

carbon 27
fullerenes nanotubes and carbon nanostructures 15
journal of power sources 9
physical review b 8
nanotechnology 8
journal of physical chemistry b 8
chemistry of materials 7
rare metal materials and engineering 6

langmuir 6
electrochemical and solid state letters 6
chemical physics letters 6
catalysis today 6
journal of inorganic materials 5
journal of electroanalytical chemistry 5
chemical communications 5

Keywords
chemistry, physical 89
materials science, multidisciplinary 77
materials science, multidisciplinary 69
nanotubes 58
chemistry, multidisciplinary 39
graphite 37
growth 34
nanotubes 28
chemistry, analytical 25
physics, applied 23
physics, 23
nanoparticles 22
films 22
adsorption 22
electrochemistry 21

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2005 393
2004 42
2006 9

Country
peoples r china 105
usa 85
japan 64
germany 37
france 30
south korea 22
poland 19
england 19
australia 18
russia 15
italy 13
canada 12
spain 10
singapore 10
turkey 9

Institution
chinese acad sci 28
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cnrs 9
univ tokyo 7
univ oxford 7
russian acad sci 7
kyoto univ 7
univ sci & technol china 6
tsing hua univ 6
zhejiang univ 5
univ tsukuba 5
univ texas 5
univ cambridge 5
seoul natl univ 5
northwestern polytech univ 5

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science citation index 444

- CLUSTER 25
  Growth, catalytic applications, and properties of carbon nanofibers (CNFs) and carbon supports (110 Records)

(Countries: USA, Japan, Korea, China. Institutions: Shinshu University, University Utrecht, University of Strasbourg, Norwegian University of Science and Technology. USA include ORNL, University of Texas, University of Tennessee, University of Pennsylvania, University of Akron.).

Cluster Syntax Features

Descriptive Terms

nanofib 31.8%, cnf 19.0%, carbon.nanofibers 14.2%, carbon 10.8%, carbon.nanofiber 3.4%, catalyst 1.4%, fiber 1.0%, composit 0.8%, support 0.6%, catalyt 0.4%, graphit 0.3%, ni 0.3%, grown.carbon 0.3%, decomposit 0.2%, vgcf 0.2%

Discriminating Terms

nanofib 20.2%, cnf 12.6%, carbon.nanofibers 9.4%, carbon 3.7%, carbon.nanofiber 2.3%, film 1.8%, surfac 0.6%, magnet 0.5%, nanoparticl 0.5%, temperatur 0.4%, layer 0.4%, particl 0.4%, quantum 0.4%, structur 0.4%, si 0.4%

Single Word Terms

carbon 108, nanofib 102, composit 46, surfac 41, catalyst 40, cnf 38, high 36, materi 35, structur 33, fiber 33, catalyt 29, properti 29, support 28, activ 27, grown 27

Double Word Terms

carbon.nanofibers 82, carbon.nanofiber 43, grown.carbon 16, electron.microscopy 15, nanofibers.cnfs 14, scanning.electron 13, chemical.vapor 13, vapor.deposition 13, transmission.electron 12, surface.area 11, catalytic.decomposition 11, carbon.nanotubes 10, vapor.grown 10, nanofibers.cnf 9, nanofiber.composites 9

Triple Word Terms

carbon.nanofibers.cnfs 14, chemical.vapor.deposition 12, grown.carbon.nanofibers 12, vapor.grown.carbon 10, transmission.electron.microscopy 10, scanning.electron.microscopy 10, carbon.nanofibers.cnf 9, carbon.nanofiber.composites 8, supported.carbon.nanofibers 7, carbon.nanofiber.cnf 5, catalytically.grown.carbon 5, vertically.aligned.carbon 4, high.surface.area 4, growth.carbon.nanofibers 4, carbon.nano.fiber 4

Term Cliques

47.12% nanofib carbon fiber composit decomposit vgcf
46.67% nanofib carbon fiber composit grown.carbon vgcf
50.61% nanofib carbon fiber composit catalyt grown.carbon
48.64% nanofib carbon carbon.nanofiber composit decomposit vgcf
48.18% nanofib carbon carbon.nanofiber composit grown.carbon vgcf
52.58% nanofib carbon.nanofibers carbon fiber decomposit vgcf
52.12% nanofib carbon.nanofibers carbon fiber grown.carbon vgcf
56.06% nanofib carbon.nanofibers carbon fiber catalyt grown.carbon
48.05% nanofib cnf carbon composit support catalyt decomposit
48.70% nanofib cnf carbon fiber composit catalyt decomposit
49.87% nanofib cnf carbon carbon.nanofiber composit support decomposit
49.09% nanofib cnf carbon carbon.nanofiber catalyst support decomposit
45.56% nanofib cnf carbon.nanofibers carbon fiber catalyt graphit ni decomposit

44.18% nanofib cnf carbon.nanofibers carbon catalyst support catalyt graphit ni decomposit

Sample Cluster Record Titles

Low-temperature synthesis of graphitized nanofibers for reversible lithium-ion insertion/extraction

Various carbon nanofiber-copper composite films prepared by electrodeposition

Tensile behavior of carbon nano-fiber-reinforced Cu composite using the liquid infiltration process

Effect of carbon nanofibers on the anisotropy of an aromatic thermotropic liquid crystalline polymer

Electromagnetic interference shielding effectiveness of carbon nanofiber/LCP composites

Carbon nanofiber-based active layers for fuel cell cathodes - preparation and characterization

Polycarbonate carbon nanofiber composites

Macroscopic carbon nanofibers for use as photocatalyst support

Carbon nanostructures with macroscopic shaping for catalytic applications

Cluster Metrics

Authors

ledoux, mj 6
endo, m 6
vieira, r 5
holmen, a 5
de jong, kp 5
chen, d 5
yu, zx 4
van dillen, aj 4
totdal, b 4
sui, zj 4
pham-huu, c 4
lee, s 4
dai, yc 4

zhou, jh 3
zhao, tj 3

Sources
catalysis today 11
carbon 11
journal of physical chemistry b 6
electrochemistry communications 4
journal of applied physics 3
chemical physics letters 3
applied physics letters 3
russian journal of applied chemistry 2
polymer 2
nano letters 2
materials letters 2
journal of the american chemical society 2
journal of catalysis 2
journal of applied polymer science 2
european polymer journal 2

Keywords
nanotubes 36
chemistry, physical 27
fibers 18
materials science, multidisciplinary 17
materials science, multidisciplinary 15
carbon nanofibers 15
engineering, chemical 15
carbon nanofibers 15
chemistry, applied 14
nanotubes 13
growth 13
chemistry, multidisciplinary 12
chemistry, physical 12
polymer science 9
hydrogenation 8

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2005 99
2004 10
2006 1

Country
usa 28
japan 20
south korea 15

peoples r china 14
netherlands 8
france 8
germany 6
norway 5
england 5
spain 4
ukraine 3
brazil 3
switzerland 2
italy 2
israel 2

Institution
shinshu univ 6
univ utrecht 5
univ strasbourg 1 5
norwegian univ sci & technol 5
e china univ sci & technol 4
tokyo inst technol 3
oak ridge natl lab 3
kyushu univ 3
inst nacl pesquisas espaciais 3
univ texas 2
univ tennessee 2
univ penn 2
univ cambridge 2
univ bath 2
univ akron 2

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- # CLUSTER 71
  Preparation of materials, especially nanofibers, by electrospinning (91 Records)

(Countries: USA, followed by South Korea, China. Institutions: National University of Singapore, University of Washington, University of Akron, Seoul National University. Other USA include Penn State University, Ohio State University, University of Florida.).

Cluster Syntax Features

Descriptive Terms
nanofib 38.2%, electrospin 11.1%, electrospun 9.9%, fiber 4.6%, fibr 2.6%, wood 2.3%, nanofibr 2.0%, nonwoven 1.3%, polym 0.9%, diamet 0.8%, mat 0.7%, polyanilin 0.5%, poli 0.5%, cellulos 0.5%, solut 0.4%

Discriminating Terms
nanofib 23.7%, electrospin 7.1%, electrospun 6.3%, fiber 2.2%, film 1.5%, fibr 1.5%, wood 1.4%, nanofibr 1.3%, nonwoven 0.8%, particl 0.6%, carbon 0.5%, magnet 0.5%, nanotub 0.5%, nanoparticl 0.5%, temperatur 0.5%

Single Word Terms
nanofib 60, electrospin 57, fiber 50, solut 44, diamet 43, polym 43, electrospun 43, morpholog 32, poli 31, structur 30, properti 30, surfac 29, composit 26, concentr 25, electron 25

Double Word Terms
electron.microscopy 21, scanning.electron 20, nanofibers.electrospinning 12, average.diameter 11, electrospun.nanofibers 10, polymer.nanofibers 10, microscopy.sem 9, mechanical.properties 9, electric.field 8, poly.vinyl 8, polymer.solution 8, morphology.electrospun 8, electrospinning.nanofibers 8, ray.diffraction 8, surface.area 8

Triple Word Terms
scanning.electron.microscopy 18, electron.microscopy.sem 9, poly.vinyl.alcohol 6, vinyl.alcohol.pva 5, transmission.electron.microscopy 5, atomic.force.microscopy 5, wide.angle.ray 5, fourier.transform.infrared 5, differential.scanning.calorimetry 5, transform.infrared.spectroscopy 4, angle.ray.diffraction 4, electron.microscopy.tem 3, high.surface.area 3, electron.microscopy.esem 3, water.contact.angle 3

Term Cliques
36.54% nanofibr diamet poli solut
23.81% nanofibr diamet polyanilin
27.47% fibr nanofibr solut
12.82% fibr wood cellulos
25.27% fiber mat cellulos
41.13% electrospin electrospun fiber nonwoven polym mat solut
40.29% nanofib diamet polyanilin
46.64% nanofib electrospin electrospun fiber polym diamet mat poli solute

Sample Cluster Record Titles

Nanofibril formation of electrospun TiO2 fibers and its application to dye-sensitized solar cells

Poly[bis(2,2,2-trifluoroethoxy)phosphazene] superhydrophobic nanofibers

Encapsulation of self-assembled FePt magnetic nanoparticles in PCL nanofibers by coaxial electrospinning

Optically transparent bionanofiber composites with low sensitivity to refractive index of the polymer matrix

In vitro and in vivo degradation of non-woven materials made of poly(epsilon-caprolactone) nanofibers prepared by electrospinning under different conditions

Electrospinning of collagen and elastin for tissue engineering applications

Application of electrospun silk fibroin nanofibers as an immobilization support of enzyme

Deformation behavior of electrospun poly(L-lactide-co-epsilon-caprolactone) nonwoven membranes under uniaxial tensile loading

Fabrication of electrically conducting polypyrrole-poly(ethylene oxide) composite nanofibers

Cluster Metrics

Authors
ramakrishna, s 9
xia, yn 5
li, d 5

zhang, yz 4
reneker, dh 4
lee, kh 4
kotaki, m 4
kim, sh 4
kim, hy 4
inai, r 4
chase, gg 4
yano, h 3
shin, c 3
mccann, jt 3
lim, ct 3

Sources

journal of applied polymer science 6
synthetic metals 4
polymer 3
materials letters 3
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advanced materials 3
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journal of polymer science part b-polymer physics 2
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filtration & separation 2
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chemistry, physical 9
nanofibers 8
nanofiber 7
morphology 7
membranes 7
materials science, multidisciplinary 7

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usa 28
south korea 17
peoples r china 15
singapore 11
japan 7
germany 6
sweden 3
australia 3
poland 2
netherlands 2
finland 2
turkey 1
scotland 1
israel 1
czech republic 1

Institution
natl univ singapore 11
univ washington 5
univ akron 5
seoul natl univ 5
tongji univ 4
penn state univ 4
ohio state univ 3
kyoto univ 3
hanyang univ 3
chonbuk natl univ 3
univ twente 2
univ marburg 2
univ florida 2
so yangtze univ 2
riken 2

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science citation index 91

- # CLUSTER 46
  Fibers, emphasizing electrospun fibers, cellulose, and morphology and strength of fibers (164 Records)

(Countries: China, USA, followed by Japan, South Korea. Institutions: CAS, Inha University, Donghua University, Chulalongkorn University. USA include Drexel University, VPI, University of Nebraska, University of Massachusetts.).

Cluster Syntax Features

Descriptive Terms
fiber 77.6%, electrospun 1.9%, electrospin 1.0%, cellulos 1.0%, hollow 0.3%, morpholog 0.3%, polym 0.3%, electrospun.fibers 0.3%, diamet 0.3%, solut 0.3%, composit 0.2%, solvent 0.2%, poli 0.2%, strength 0.2%, spun 0.2%

Discriminating Terms
fiber 47.9%, film 1.7%, electrospun 1.2%, electrospin 0.6%, nanoparticl 0.6%, particl 0.6%, cellulos 0.6%, magnet 0.6%, nanotub 0.5%, deposit 0.4%, layer 0.4%, carbon 0.4%, quantum 0.4%, temperatur 0.4%, surfac 0.4%

Single Word Terms
fiber 161, structur 74, surfac 63, properti 59, electron 55, scan 54, microscopi 51, solut 51, sem 49, diamet 47, morpholog 47, polym 47, composit 45, rai 42, mechan 42

Double Word Terms
scanning.electron 47, electron.microscopy 39, ray.diffraction 28, mechanical.properties 24, microscopy.sem 20, fiber.diameter 17, electrospun.fibers 17, tensile.strength 16, molecular.weight 16, fiber.surface 15, force.microscopy 12, fibers.electrospinning 11,

atomic.force 11, electron.microscope 11, angle.ray 11

Triple Word Terms

scanning.electron.microscopy 33, electron.microscopy.sem 20, atomic.force.microscopy 11, ray.photoelectron.spectroscopy 10, wide.angle.ray 10, scanning.electron.microscope 10, angle.ray.diffraction 9, average.fiber.diameter 7, photoelectron.spectroscopy.xps 7, transmission.electron.microscopy 6, force.microscopy.afm 6, fibers.scanning.electron 6, poly.vinyl.alcohol 5, hollow.fiber.membranes 5, spectroscopy.ray.diffraction 5

Term Cliques

49.59% fiber composit strength
43.09% fiber hollow strength
34.65% fiber hollow morpholog diamet solut spun
33.23% fiber cellulos polym diamet solvent spun
35.57% fiber cellulos polym diamet composit solvent
33.23% fiber cellulos morpholog diamet solvent spun
35.57% fiber cellulos morpholog diamet composit solvent
31.71% fiber cellulos hollow morpholog diamet spun
30.06% fiber electrospun electrospin polym electrospun.fibers diamet solut solvent poli spun
30.06% fiber electrospun electrospin morpholog electrospun.fibers diamet solut solvent poli spun

Sample Cluster Record Titles

Formation of nematic ordered cellulose and chitin

Biodegradation of electrospun poly(epsilon-caprolactone) non-woven fabrics by pure-cultured soil filamentous fungi

Fiber bias in nanoindentation of polymer matrix composites

Influence of amination on the structure of a PAN nascent filament during wet spinning

Nanoscale mechanical characterization of polymeric fibers

A room temperature self-sacrificing template route to Ag2Te fibers

Fabrication of high-strength continuous zirconia fibers and their formation mechanism study

Nano-porous ultra-high specific surface ultrafine fibers

Study on morphology of electrospun poly(vinyl alcohol) mats

Cluster Metrics

Authors

supaphol, p 5
zhang, ln 4
wang, c 4
zeng, j 3
youk, jh 3
yang, mc 3
nithitanakul, m 3
mit-uppatham, c 3
lu, xf 3
long, te 3
fan, lh 3
du, ym 3
chou, wl 3
zhou, jp 2
zhao, yy 2

Sources

polymer 14
journal of applied polymer science 7
journal of polymer science part b-polymer physics 5
journal of membrane science 5
sen-i gakkaishi 4
macromolecules 4
macromolecular materials and engineering 4
fibers and polymers 4
macromolecular symposia 3
macromolecular rapid communications 3
macromolecular bioscience 3
korean journal of chemical engineering 3
journal of colloid and interface science 3
composites science and technology 3
composite interfaces 3

Keywords

polymer science 56
polymer science 28
morphology 28
nanofibers 25
fibers 23
electrospinning 20
materials science, multidisciplinary 16
electrospinning 15
fibers 14

membranes 14
polymer 12
nanofibers 11
materials science, composites 11
chemistry, physical 11
chemistry, multidisciplinary 11

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usa 40
japan 21
south korea 16
germany 6
france 6
thailand 5
switzerland 5
taiwan 4
spain 4
singapore 4
australia 4
russia 3
poland 3
netherlands 3

Institution
chinese acad sci 9
inha univ 5
donghua univ 5
chulalongkorn univ 5
wuhan univ 4
kyoto univ 4
drexel univ 4
virginia polytech inst & state univ 3
univ nebraska 3
univ massachusetts 3
tokyo inst technol 3
shinshu univ 3
riken 3
natl univ singapore 3
jilin univ 3

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science citation index 164

- # CLUSTER 129
  Lithium-ion (especially $LiCoO_2$ and lithium-nickel) batteries, with emphasis on enhancement of capacity and cyclability (345 Records)

(Countries: China dominant, Japan, USA. Institutions: Hanyang University, Wuhan University, CAS, Zhejiang University.).

Cluster Syntax Features

Descriptive Terms

li 11.6%, lithium 9.7%, capac 7.3%, cycl 5.5%, batteri 5.4%, electrochem 3.8%, discharg 3.0%, cathod 2.9%, materi 2.3%, mah 2.1%, spinel 1.7%, lithium.ion 1.5%, ion 1.3%, licoo2 1.3%, ion.batteries 1.2%

Discriminating Terms

li 7.9%, lithium 6.6%, capac 4.8%, batteri 3.8%, cycl 3.5%, discharg 1.9%, electrochem 1.9%, film 1.8%, cathod 1.8%, mah 1.5%, spinel 1.1%, lithium.ion 1.1%, licoo2 0.9%, ion.batteries 0.9%, lini0 0.7%

Single Word Terms
lithium 231, electrochem 226, materi 225, capac 221, li 199, batteri 193, structur 189, cycl 189, ion 188, rai 175, discharg 159, diffract 155, cathod 149, charg 139, xrd 132

Double Word Terms
ray.diffraction 144, lithium.ion 105, ion.batteries 91, charge.discharge 88, electrochemical.properties 75, discharge.capacity 74, scanning.electron 73, electron.microscopy 72, cathode.material 65, diffraction.xrd 62, li.ion 60, solid.state 53, cathode.materials 52, material.lithium 51, particle.size 48

Triple Word Terms
lithium.ion.batteries 63, ray.diffraction.xrd 59, scanning.electron.microscopy 54, solid.state.reaction 35, li.ion.batteries 32, material.lithium.ion 31, cathode.material.lithium 29, ray.photoelectron.spectroscopy 24, powder.ray.diffraction 24, electron.microscopy.sem 22, lithium.ion.battery 21, initial.discharge.capacity 20, transmission.electron.microscopy 20, charge.discharge.cycling 20, materials.lithium.ion 19

Term Cliques
48.03% lithium capac electrochem discharg cathod materi spinel lithium.ion ion ion.batteries
48.74% lithium capac cycl batteri electrochem discharg cathod materi lithium.ion ion licoo2 ion.batteries
50.41% lithium capac cycl batteri electrochem discharg cathod materi mah lithium.ion ion ion.batteries
51.01% li lithium capac cycl batteri electrochem discharg cathod materi ion licoo2 ion.batteries
52.68% li lithium capac cycl batteri electrochem discharg cathod materi mah ion ion.batteries

Sample Cluster Record Titles

Electrochemistry and local structure of nano-sized Li4/3Me5/3O4 (Me=Mn, Ti) spinels

Synthesis and electrochemical properties of 5 V spinel LiNi0.5Mn1.5O4 cathode materials prepared by ultrasonic spray pyrolysis method

Preparation and properties of spherical LiNi0.75Co0.25O2 as a cathode for lithium-ion batteries

New preparation method and electrochemical property of LiMn2O4 electrode

Effects of the Li :(Mn+ Co+Ni) molar ratio on the electrochemical properties of

[LiMn1/3Co1/3Ni1/3O2 cathode material]

[Characterization of nanocrystalline HT-LiCoO2 cathode materials for secondary lithium batteries]

[Electrochemical characteristics of tin-coated MCMB graphite as anode in lithium-ion cells]

[Surface characterization of emulsified lithium powder electrode]

[Fluorine doping of LiNi3/8Co2/8Mn3/8O2 cathode material for lithium-ion batteries]

Cluster Metrics

Authors
sun, yk 14
wang, zx 10
myung, st 10
zhao, xb 8
fey, gtk 8
cao, gs 8
kumar, tp 7
kumagai, n 7
komaba, s 7
chen, lq 7
zhou, yh 6
tarascon, jm 6
tang, zy 6
rao, gvs 6
li, xh 6

Sources
journal of power sources 54
journal of the electrochemical society 30
electrochemical and solid state letters 25
electrochimica acta 22
solid state ionics 21
chinese journal of inorganic chemistry 16
chemistry of materials 12
journal of physical chemistry b 10
materials chemistry and physics 9
journal of solid state chemistry 6
carbon 5
acta chimica sinica 5
transactions of nonferrous metals society of china 4

materials research bulletin 4
journal of inorganic materials 4

Keywords
electrochemistry 90
chemistry, physical 65
electrochemistry 63
materials science, multidisciplinary 61
energy & fuels 54
cathode material 41
performance 40
lithium-ion batteries 39
cells 38
cathode materials 36
cathode 36
materials science, coatings & films 32
batteries 31
physics, condensed matter 29
oxides 29

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peoples r china 114
japan 53
usa 47
south korea 35
taiwan 28
france 25
germany 16
australia 12
india 11
spain 10
singapore 9
russia 7
italy 7
switzerland 5
israel 4

Institution
hanyang univ 15
wuhan univ 14
chinese acad sci 13

zhejiang univ 11
tokyo inst technol 10
iwate univ 9
univ sci & technol china 8
natl cent univ 8
vk corp 7
tsing hua univ 7
tianjin univ 7
natl univ singapore 7
cnrs 7
cent s univ technol 7
univ wollongong 6

DataBase
science citation index 345

- CLUSTER 204
  Electrochemical studies and applications, focusing on electrode/ electrolyte properties and applications, capacitors, and hydrogen storage (216 Records)

(Countries: China dominant, Japan, USA. Institutions: CAS, Zhejiang University, Nankai University, Tsing Hua University, Harbin Institute of Technology.)

Cluster Syntax Features

Descriptive Terms
electrochem 16.1%, electrod 15.7%, ni 4.8%, hydrogen 2.8%, discharg 2.5%, alloi 2.3%, hydrogen.storage 1.7%, capac 1.6%, electrolyt 1.4%, storag 1.3%, oxid 1.2%, cathod 1.0%, cyclic 0.9%, anod 0.9%, composit 0.9%

Discriminating Terms
electrochem 11.5%, electrod 10.6%, ni 2.7%, discharg 1.8%, film 1.7%, hydrogen.storage 1.4%, hydrogen 1.3%, capac 1.1%, alloi 0.9%, electrolyt 0.8%, storag 0.8%, magnet 0.7%, nanotub 0.7%, nanoparticl 0.6%, cathod 0.6%

Single Word Terms
electrochem 164, electrod 138, surfac 88, structur 86, oxid 75, electron 71, high 71, rai 71, properti 71, materi 68, composit 65, cyclic 63, solut 62, discharg 62, scan 61

Double Word Terms
scanning.electron 48, ray.diffraction 44, electron.microscopy 43, cyclic.voltammetry 41, hydrogen.storage 36, electrochemical.properties 32, charge.discharge 31, electrochemical.impedance 29, discharge.capacity 28, diffraction.xrd 26, impedance.spectroscopy 23, ray.photoelectron 21, photoelectron.spectroscopy 20, structure.electrochemical 19, surface.area 18

Triple Word Terms
scanning.electron.microscopy 37, ray.diffraction.xrd 22, electrochemical.impedance.spectroscopy 22, ray.photoelectron.spectroscopy 20, electron.microscopy.sem 15, photoelectron.spectroscopy.xps 12, impedance.spectroscopy.eis 11, hydrogen.storage.alloys 11, cyclic.voltammetry.electrochemical 11, structure.electrochemical.properties 10, solid.oxide.fuel 10, oxide.fuel.cells 10, diffraction.xrd.scanning 9, xrd.scanning.electron 9, transmission.electron.microscopy 8

Term Cliques
24.48% ni hydrogen discharg alloi hydrogen.storage capac storag composit
33.18% electrochem electrolyt oxid cathod anod composit
36.30% electrochem discharg alloi capac cyclic
34.88% electrochem ni discharg alloi capac composit
38.81% electrochem electrod electrolyt oxid cathod anod
40.90% electrochem electrod electrolyt oxid cathod cyclic
45.19% electrochem electrod discharg capac cyclic
44.72% electrochem electrod ni discharg capac

Sample Cluster Record Titles

Electrochemical behavior of carbon electrodes in organic liquid electrolytes containing tetrafluoroborate and hexafluorophosphate anionic species in different non-aqueous solvent systems

Hydrogen storage in magnesium clusters: Quantum chemical study

Preparation of nano-scale Ni(OH)(2) based on controlled crystallization

Electrocatalytic reduction of nitrate at polypyrrole modified electrode

Solution-phase synthesis and electrochemical hydrogen storage of ultra-long single-crystal selenium submicrotubes

Characterization and application-for glucose detection of Co-doped PbO2 films in alkaline media

Effects of rare-earth content on the properties of co-free Mm(x)Ml(1-x)(NiCuAlZn)(5) hydrogen storage alloys

Electrochemical etching of aluminum foil for electrolytic capacitors

Electroseparation of actinides from lanthanides on solid aluminum electrode in LiCl-KCl eutectic melts

Cluster Metrics

Authors

pan, hg 6
zhang, jq 5
wang, w 5
wang, jm 5
lei, yq 5
wang, y 4
jiang, sp 4
hu, wk 4
gao, xp 4
gao, mx 4
cao, cn 4
zhou, hy 3
yuan, ht 3
wang, qd 3
shen, pw 3

Sources

journal of the electrochemical society 18

electrochimica acta 16
journal of alloys and compounds 15
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journal of power sources 9
rare metal materials and engineering 7
journal of physical chemistry b 7
journal of electroanalytical chemistry 6
transactions of nonferrous metals society of china 5
journal of new materials for electrochemical systems 5
solid state ionics 4
materials chemistry and physics 4
electrochemistry communications 4
acta physico-chimica sinica 4
physical chemistry chemical physics 3

Keywords

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materials science, multidisciplinary 42
electrochemistry 36
materials science, multidisciplinary 24
behavior 22
materials science, coatings & films 20
metallurgical engineering 16
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oxidation 14
batteries 14
chemistry, multidisciplinary 13
chemistry, analytical 13
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electrodes 13

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peoples r china 93
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england 9
germany 8
taiwan 7
sweden 7
india 7

france 7
south korea 6
brazil 6
singapore 4
netherlands 4
italy 4
iran 4

Institution
chinese acad sci 18
zhejiang univ 12
nankai univ 9
tsing hua univ 8
harbin inst technol 8
wuhan univ 5
univ sci & technol china 4
nanyang technol univ 4
kyoto univ 4
tianjin univ 3
stockholm univ 3
st jude med ab 3
royal inst technol 3
riso natl lab 3
guilin univ elect technol 3

DataBase
science citation index 216

- # CLUSTER 184
  Electrode (especially gold) behavior and applications to biosensors (especially glucose and enzyme) and immunosensors (227 Records)

(Countries: China dominant, USA, followed by Japan. Institutions: SW China Normal University, Nanjing University, Hunan University, CAS. USA include PNNL, Arizona State University, University of Illinois.).

Cluster Syntax Features

Descriptive Terms
electrod 21.6%, gold 3.9%, biosensor 3.6%, immobil 3.6%, enzym 3.5%, electrochem 3.3%, glucos 3.3%, detect 2.7%, sensor 2.2%, monolay 1.5%, hrp 1.4%, gold.electrode 1.2%, immunosensor 1.1%, assembl 0.9%, redox 0.9%

Discriminating Terms
electrod 13.9%, biosensor 2.5%, glucos 2.4%, enzym 2.4%, immobil 2.3%, gold 1.8%, electrochem 1.7%, detect 1.3%, sensor 1.1%, hrp 1.1%, film 0.9%, gold.electrode 0.9%, immunosensor 0.9%, structur 0.7%, particl 0.7%

Single Word Terms
electrod 175, surfac 137, electrochem 118, gold 115, detect 113, immobil 94, monolay 92, assembl 91, self 86, limit 86, sensit 85, solut 79, concentr 78, potenti 70, linear 70

Double Word Terms
detection.limit 67, self.assembled 63, electrode.surface 50, gold.electrode 46, electron.transfer 43, cyclic.voltammetry 42, assembled.monolayer 32, atomic.force 27, gold.electrodes 26, glucose.oxidase 26, horseradish.peroxidase 25, impedance.spectroscopy 25, electrochemical.impedance 24, force.microscopy 23, quartz.crystal 20

Triple Word Terms
self.assembled.monolayer 32, electrochemical.impedance.spectroscopy 23, atomic.force.microscopy 23, horseradish.peroxidase.hrp 16, force.microscopy.afm 15, impedance.spectroscopy.eis 15, self.assembled.monolayers 15, quartz.crystal.microbalance 14, glucose.oxidase.gox 13, direct.electron.transfer 12, glassy.carbon.electrode 10, assembled.monolayer.sam 10, ray.photoelectron.spectroscopy 10, electron.transfer.rate 9, fourier.transform.infrared 8

Term Cliques
32.82% enzym monolay assembl redox
33.98% immobil enzym detect sensor monolay hrp assembl
29.41% biosensor enzym assembl redox
23.13% biosensor enzym glucos redox

32.03% biosensor immobil enzym detect sensor hrp assembl
28.45% biosensor immobil enzym glucos detect sensor hrp
36.89% electrod immobil detect sensor monolay hrp immunosensor assembl
38.96% electrod biosensor immobil detect sensor hrp assembl
35.37% electrod biosensor immobil glucos detect sensor hrp
43.23% electrod gold electrochem monolay gold.electrode assembl redox
42.29% electrod gold immobil electrochem detect monolay gold.electrode immunosensor assembl
38.33% electrod gold biosensor glucos redox
44.79% electrod gold biosensor electrochem assembl redox
43.47% electrod gold biosensor immobil glucos detect
48.27% electrod gold biosensor immobil electrochem detect assembl

Sample Cluster Record Titles

Recognition and detection of dsDNA at a thionalid self-assembled monolayer modified gold electrode

Amperometric glucose biosensor based on immobilization of glucose oxidase in electropolymerized o-aminophenol film at copper-modified gold electrode

Preparation and application on a kind of immobilization method of anti-diphtheria for potentiometric immunosensor modified colloidal Au and polyvinyl butyral as matrixes

Polyaniline biosensor for choline determination

Determination of trace metals by underpotential deposition-stripping voltammetry at solid electrodes

Hydrogen peroxide sensor based on horseradish peroxidase immobilized on a silver nanoparticles/cysteamine/gold electrode

Intramolecular ion-channel sensors using gold electrodes immobilized with macrocyclic polyamines for voltammetric detection of adenine nucleotides

A novel regenerative capacitive immunosensor based on electrostatic attraction for direct detection of the complement III (C-3)

A reagentless amperometric immunosensor based on gold nanoparticles/thionine/Nafion-membrane-modified gold electrode for determination of alpha-1-fetoprotein

Cluster Metrics

Authors
chai, yq 13
yuan, r 12
tang, dp 10
zhong, x 9
liu, y 9
dai, jy 9
yu, rq 7
shen, gl 7
xu, jj 5
gooding, jj 5
chen, hy 5
zhang, ly 4
wang, n 4
lin, yh 4
li, qf 4

Sources
biosensors & bioelectronics 22
sensors and actuators b-chemical 17
analytica chimica acta 13
electroanalysis 12
langmuir 10
electrochimica acta 10
talanta 9
analytical chemistry 9
electrochemistry communications 8
journal of electroanalytical chemistry 5
analytical and bioanalytical chemistry 5
nano letters 4
journal of the american chemical society 4
frontiers in bioscience 4
chinese chemical letters 4

Keywords
chemistry, analytical 92
self-assembled monolayers 48
films 28
electrochemistry 28
surface 27
chemistry, multidisciplinary 26
electrochemistry 25
chemistry, physical 24
biotechnology & applied microbiology 24
biophysics 23
adsorption 21

biosensors 19
instruments & instrumentation 18
immobilization 17
sensor 16

Publication Year
2005 208
2004 17
2006 2

Country
peoples r china 83
usa 35
japan 19
germany 13
italy 10
france 10
south korea 9
england 8
spain 7
australia 7
sweden 6
singapore 5
czech republic 5
canada 5
russia 4

Institution
sw china normal univ 12
nanjing univ 12
hunan univ 12
chinese acad sci 10
univ new s wales 5
pacific nw natl lab 5
jilin univ 5
arizona state univ 4
zhuzhou inst technol 3
xiamen univ 3
wuhan univ 3
univ tokyo 3
univ lecce 3
univ illinois 3
univ complutense madrid 3

DataBase
science citation index 227

- CLUSTER 103
  Nano silica particles, emphasizing coating applications, effects of particle size, dispersion, and aggregation (130 Records)

(Countries: USA, China, Japan. Institutions: Fudan University, Tokyo University Agriculture and Technology, CAS. USA include University of Kentucky, Clarkson University, University of Illinois.).

Cluster Syntax Features

Descriptive Terms

silica 39.3%, particl 16.1%, silica.particles 13.6%, nano.silica 0.8%, size 0.8%, coat 0.8%, dispers 0.5%, colloid 0.5%, concentr 0.4%, nano 0.4%, surfac 0.4%, sphere 0.3%, spheric 0.3%, aggreg 0.3%, particle.size 0.3%

Discriminating Terms

silica 26.0%, silica.particles 10.3%, particl 7.2%, film 1.9%, carbon 0.6%, nano.silica 0.6%, nanotub 0.6%, temperatur 0.5%, magnet 0.5%, quantum 0.4%, oxid 0.4%, structur 0.4%, crystal 0.4%, properti 0.4%, cell 0.4%

Single Word Terms

silica 129, particl 125, surfac 70, size 68, structur 48, microscopi 42, dispers 40, concentr 40, electron 38, water 35, layer 34, solut 33, coat 33, control 32, nanoparticl 31

Double Word Terms

silica.particles 79, electron.microscopy 32, particle.size 30, transmission.electron 22, scanning.electron 16, silica.nanoparticles 15, nano.silica 11, core.shell 11, size.distribution 11, colloidal.silica 11, fourier.transform 10, spherical.silica 10, sol.gel 10, silica.particle 10, silica.surface 10

Triple Word Terms

transmission.electron.microscopy 21, scanning.electron.microscopy 13, colloidal.silica.particles 8, nano.silica.particles 8, spherical.silica.particles 7, electron.microscopy.tem 7, fourier.transform.infrared 7, dynamic.light.scattering 6, sized.silica.particles 5, van.der.waals 5, energy.dispersive.ray 5, size.silica.particles 5, core.shell.particles 5, mesoporous.silica.particles 5, pore.size.distribution 4

Term Cliques
48.46% silica particl sphere spheric aggreg
50.00% silica particl coat dispers colloid surfac particle.size
46.70% silica particl coat dispers colloid concentr particle.size
47.25% silica particl size concentr sphere aggreg particle.size
54.40% silica particl size coat dispers surfac particle.size
46.54% silica particl size coat dispers concentr sphere particle.size
57.69% silica particl silica.particles spheric aggreg
52.75% silica particl silica.particles colloid surfac aggreg particle.size
49.45% silica particl silica.particles colloid concentr aggreg particle.size
55.05% silica particl silica.particles dispers colloid surfac particle.size
51.76% silica particl silica.particles dispers colloid concentr particle.size
51.92% silica particl silica.particles size nano surfac aggreg particle.size
49.04% silica particl silica.particles size concentr nano aggreg particle.size
51.06% silica particl silica.particles size dispers concentr nano particle.size
48.89% silica particl silica.particles nano.silica size dispers nano surfac particle.size

Sample Cluster Record Titles

Modification and dispersion of nanosilica

Creation of asymmetric bilayer membrane on monodispersed colloidal silica particles

E-coli adhesion to silica in the presence of humic acid

Synthesis of monodisperse high-aspect-ratio colloidal silicon and silica rods

Controlled deposition of nanoparticle clusters by electrohydrodynamic atomization

Silica particles: A novel drug-delivery system

Interfacial alignment mechanism of forming spherical silica with radially oriented nanopores

Particle size and morphology of poly[styrene-co-(butyl acrylate)]/nano-silica composite latex

Preparation of the core/shell dispersion composite particles

Cluster Metrics

Authors

wu, lm 9
zhou, sx 8
you, b 4
gu, gx 4
yuan, jj 3
tan, b 3
takahara, yk 3
rankin, se 3
ohtani, b 3
matsumura, m 3
ikeda, s 3
binks, bp 3
yonemochi, y 2
yamada, t 2
wang, dz 2

Sources

langmuir 17
journal of colloid and interface science 11
colloids and surfaces a-physicochemical and engineering aspects 7
journal of physical chemistry b 5
chemistry of materials 5
journal of the american chemical society 3
journal of dispersion science and technology 3
colloids and surfaces b-biointerfaces 3
chemistry letters 3
chemical communications 3
advanced powder technology 3
nanotechnology 2
nano letters 2
microporous and mesoporous materials 2
journal of non-crystalline solids 2

Keywords

chemistry, physical 52
nanoparticles 20
chemistry, multidisciplinary 16
silica 16
spheres 15
size 14
materials science, multidisciplinary 14
growth 14
materials science, multidisciplinary 12
particles 12
nanoparticles 11
water 10

nanocomposites 9
adsorption 9
silica 8

Publication Year

2005 111
2004 16
2006 3

Country

usa 27
peoples r china 24
japan 22
germany 13
england 10
south korea 6
netherlands 6
australia 6
taiwan 4
switzerland 4
india 4
sweden 3
spain 3
france 3
portugal 2

Institution

fudan univ 9
tokyo univ agr & technol 4
chinese acad sci 4
univ kentucky 3
univ hull 3
osaka univ 3
natl chiao tung univ 3
kobe univ 3
japan sci & technol agcy 3
hokkaido univ 3
hanyang univ 3
clarkson univ 3
yamagata univ 2
univ queensland 2
univ illinois 2

DataBase

science citation index 130

- # CLUSTER 121
  Characteristics and synthesis of silica-containing materials, with focus on gels, films, surfaces, monoliths, and porous silica (153 Records)

(Countries: USA, China, Japan. Institutions: CAS, Fudan University. USA includes USAF.).

Cluster Syntax Features

Descriptive Terms
silica 63.4%, gel 2.3%, sol 1.3%, templat 1.0%, surfac 0.9%, silica.gel 0.8%, sol.gel 0.6%, adsorpt 0.6%, monolith 0.6%, acid 0.6%, macropor 0.4%, mesopor 0.4%, synthesi 0.4%, silica.surface 0.4%, porou 0.4%

Discriminating Terms
silica 43.2%, film 1.8%, gel 1.0%, magnet 0.7%, nanoparticl 0.6%, silica.gel 0.6%, sol 0.6%, nanotub 0.6%, carbon 0.5%, electron 0.5%, quantum 0.4%, layer 0.4%, crystal 0.4%, templat 0.4%, particl 0.4%

Single Word Terms
silica 153, surfac 94, structur 63, gel 56, materi 54, high 49, sol 46, temperatur 45, adsorpt 44, reaction 44, area 40, templat 40, synthesi 39, size 39, format 37

Double Word Terms
sol.gel 35, surface.area 30, silica.surface 24, silica.gel 17, electron.microscopy 15, pore.size 15, porous.silica 15, scanning.electron 14, high.surface 12, ray.diffraction 12, nitrogen.adsorption 11, silica.sol 11, surface.areas 11, amorphous.silica 10, silica.particles 9

Triple Word Terms

scanning.electron.microscopy 10, high.surface.area 10, chemical.vapor.deposition 7, sol.gel.processing 7, tetraethyl.orthosilicate.teos 5, transmission.electron.microscopy 5, pore.size.distribution 5, atomic.force.microscopy 5, sol.gel.silica 5, ray.diffraction.xrd 4, bet.surface.area 4, fourier.transform.infrared 4, adsorption.desorption.isotherms 4, si.mas.nmr 3, particle.size.silica 3

Term Cliques

52.78% silica templat surfac acid
43.27% silica templat surfac monolith porou
37.80% silica sol templat acid mesopor synthesi
30.91% silica sol templat monolith macropor mesopor porou
31.65% silica sol templat monolith macropor mesopor synthesi
36.17% silica gel adsorpt macropor mesopor porou
34.64% silica gel silica.gel adsorpt macropor mesopor
36.93% silica gel silica.gel adsorpt acid mesopor
45.36% silica gel surfac monolith porou
49.41% silica gel surfac adsorpt porou
48.89% silica gel surfac sol.gel acid
45.88% silica gel surfac sol.gel monolith
42.27% silica gel surfac silica.gel adsorpt silica.surface
43.57% silica gel surfac silica.gel adsorpt acid
32.40% silica gel sol monolith macropor mesopor porou
33.15% silica gel sol monolith macropor mesopor synthesi
37.16% silica gel sol sol.gel acid mesopor synthesi
35.01% silica gel sol sol.gel monolith mesopor synthesi

Sample Cluster Record Titles

Application of a high-pressure electro-osmotic pump using nanometer silica in capillary liquid chromatography

Ordered macroporous silica by ice templating

Optically transparent superhydrophobic silica-based films

Synthesis and characterization of nanoporous silica using dendrimer molecules

Preparation approach of monolithic silica column

Study of evaporative drying of treated silica gels

Kinetics of silica oligomerization and nanocolloid formation as a function of pH and ionic strength at 25 degrees C

Controlled silica synthesis inspired by diatom silicon biomineralization

[Evidence of aluminum oxide monolayer formation on a silica gel surface using grafting reactions.]

Cluster Metrics

Authors
yang, h 3
yamakita, s 3
wang, y 3
niwa, m 3
katada, n 3
benvenutti, ev 3
zhao, d 2
zhang, yh 2
woldegiorgis, a 2
wang, j 2
wang, b 2
tu, b 2
tang, y 2
stone, mo 2
song, sx 2

Sources
langmuir 12
journal of non-crystalline solids 8
journal of colloid and interface science 8
microporous and mesoporous materials 7
recent advances in the science and technology of zeolites and related materials, pts a - c 6
chemistry of materials 6
journal of physical chemistry b 5
journal of sol-gel science and technology 4
journal of materials chemistry 4
rare metal materials and engineering 3
nanoporous materials iv 3
journal of the american chemical society 3
bulletin of the chemical society of japan 3
materials science and engineering b-solid state materials for advanced technology 2
journal of nanoscience and nanotechnology 2

Keywords
chemistry, physical 48
materials science, multidisciplinary 22
chemistry, multidisciplinary 20
silica 19

materials science, ceramics 17
adsorption 16
materials science, multidisciplinary 15
chemistry, applied 11
sol-gel 11
chemistry, physical 10
mesoporous molecular-sieves 9
mechanism 9
physics, condensed matter 8
nanoparticles 8
morphology 8

Publication Year

2005 127
2004 24
2006 2

Country

usa 32
peoples r china 26
japan 25
france 12
germany 10
england 10
south korea 9
australia 7
italy 6
india 6
brazil 6
spain 4
ukraine 3
sweden 3
russia 3

Institution

chinese acad sci 12
fudan univ 4
univ montpellier 2 3
tottori univ 3
natl chem lab 3
natl acad sci ukraine 3
csic 3
chiba univ 3
usaf 2
univ vienna 2
univ valencia 2

univ sydney 2
univ s australia 2
univ paris 06 2
univ milan 2

DataBase
science citation index 153

- # CLUSTER 90
  Mesoporous silica materials, emphasizing methods of synthesis, as well as adsorption properties (262 Records)

(Countries: China, followed by Japan, USA. Institutions: CAS, Jilin University, Fudan University. USA include Iowa State University, University of Akron.).

Cluster Syntax Features

Descriptive Terms
mesopor 45.5%, silica 10.9%, mesoporous.silica 10.4%, pore 2.8%, materi 1.4%, surfact 1.3%, templat 1.2%, mesostructur 0.9%, adsorpt 0.6%, ordered.mesoporous 0.6%, mesoporous.materials 0.6%, synthesi 0.5%, order 0.5%, mcm 0.3%, hexagon 0.3%

Discriminating Terms
mesopor 30.9%, mesoporous.silica 7.3%, silica 5.8%, film 1.5%, pore 1.3%, mesostructur 0.6%, surfact 0.6%, nanotub 0.6%, nanoparticl 0.6%, layer 0.5%, magnet 0.5%, deposit 0.5%, templat 0.5%, carbon 0.4%, surfac 0.4%

Single Word Terms
mesopor 262, silica 185, structur 149, pore 149, materi 139, surfac 113, synthesi 112, templat 100, synthes 100, order 99, adsorpt 94, size 92, surfact 91, high 84, rai 79

Double Word Terms

mesoporous.silica 141, ray.diffraction 65, electron.microscopy 58, surface.area 51, transmission.electron 50, ordered.mesoporous 47, pore.size 46, mesoporous.materials 41, adsorption.desorption 34, nitrogen.adsorption 31, scanning.electron 28, synthesis.mesoporous 27, structure.directing 26, sol.gel 24, mesoporous.structure 24

Triple Word Terms

transmission.electron.microscopy 46, ordered.mesoporous.silica 28, ray.diffraction.xrd 23, scanning.electron.microscopy 21, powder.ray.diffraction 21, electron.microscopy.tem 20, high.surface.area 17, mesoporous.silica.materials 16, si.mas.nmr 15, nitrogen.adsorption.desorption 14, structure.directing.agent 14, bet.surface.area 13, periodic.mesoporous.organosilicas 11, synthesis.mesoporous.silica 11, hexagonal.mesoporous.silica 10

Term Cliques

42.24% mesopor pore materi adsorpt mesoporous.materials synthesi order mcm hexagon
44.91% mesopor pore materi templat adsorpt mesoporous.materials synthesi order hexagon
39.69% mesopor pore materi surfact ordered.mesoporous mesoporous.materials synthesi order mcm hexagon
42.10% mesopor pore materi surfact templat ordered.mesoporous mesoporous.materials synthesi order hexagon
48.35% mesopor silica pore materi adsorpt synthesi order mcm hexagon
51.02% mesopor silica pore materi templat adsorpt synthesi order hexagon
43.06% mesopor silica pore materi surfact mesostructur ordered.mesoporous synthesi order mcm hexagon
45.25% mesopor silica pore materi surfact templat mesostructur ordered.mesoporous synthesi order hexagon
44.07% mesopor silica mesoporous.silica pore materi surfact mesostructur ordered.mesoporous order mcm hexagon
46.25% mesopor silica mesoporous.silica pore materi surfact templat mesostructur ordered.mesoporous order hexagon

Sample Cluster Record Titles

Structural control of mesoporous silica nanowire arrays in porous alumina membranes

Synthesis of periodic mesoporous organosilica from bis(triethoxysilyl)methane and their pyrolytic conversion into porous SiCO glasses

High-temperature synthesis of stable ordered mesoporous silica materials by using fluorocarbon-hydrocarbon surfactant mixtures

Synthesis of high-quality MCM-48 mesoporous silica using cationic Gemini surfactant C12-2-12

[Synthesis and sensitivity properties of Pd-doped tin oxide nanoparticles dispersed in mesoporous silica]

[Synthesis, characterization, and catalytic activity of sulfonic acid-functionalized periodic mesoporous organosilicas]

[Mesostructured hollow spheres of graphitic N-doped carbon nanocast from spherical mesoporous silica]

[Periodic mesoporous organosilicas with phenylene bridging groups, 1,4-(CH2)(n)C6H4 (n-0-2)]

[Semi-fluorinated surfactant syntheses of ordered porous materials with tailorable pore sizes]

Cluster Metrics

Authors
zhao, dy 8
yang, qh 8
shi, jl 7
xiao, fs 6
terasaki, o 6
yu, cz 5
yang, j 5
wu, d 5
qiu, sl 5
lin, vsy 5
zhu, gs 4
zhao, l 4
zhang, l 4
yan, y 4
tu, b 4

Sources
microporous and mesoporous materials 24
chemistry of materials 24
journal of materials chemistry 19
nanoporous materials iv 12
journal of physical chemistry b 11
recent advances in the science and technology of zeolites and related materials, pts a - c 10
langmuir 8
journal of the american chemical society 7
chemical communications 7

chemistry letters 6
angewandte chemie-international edition 6
small 4
journal of colloid and interface science 4
comptes rendus chimie 4
thin solid films 3

Keywords

chemistry, physical 93
materials science, multidisciplinary 54
molecular-sieves 47
mcm-41 47
chemistry, multidisciplinary 43
silica 42
chemistry, physical 33
chemistry, applied 31
molecular-sieves 28
copolymer 28
multidisciplinary 27
materials science, 27
adsorption 26
mesoporous silica 23
materials science, multidisciplinary 19

Publication Year

2005 234
2004 25
2006 3

Country

peoples r china 78
japan 46
usa 44
south korea 20
france 20
germany 13
england 11
spain 10
taiwan 9
sweden 8
scotland 7
australia 7
canada 6
russia 5
netherlands 4

Institution
chinese acad sci 26
jilin univ 15
fudan univ 14
univ st andrews 7
yokohama natl univ 6
toyota cent res & dev labs inc 6
univ tokyo 5
univ paris 06 5
stockholm univ 5
iowa state univ 5
yonsei univ 4
univ akron 4
tokyo inst technol 4
shanghai jiao tong univ 4
seoul natl univ 4

DataBase
science citation index 262

- CLUSTER 20
  SBA-15, SBA-1, and other mesoporous silica materials, focusing on adsorption properties and functionalization of SBA-15 with acid (90 Records)

(Countries: China dominant, USA. Institutions: CAS, Fudan University, Ben Gurion University Negev. USA include UCLA, UCB.).

Cluster Syntax Features

Descriptive Terms
sba 54.3%, mesopor 10.8%, silica 4.3%, mesoporous.silica 2.0%, adsorpt 1.3%, pore 1.3%, materi 1.1%, sba.materials 0.7%, acid 0.7%, sba.mesoporous 0.6%, silica.sba 0.5%, mesoporous.silica.sba 0.4%, micropor 0.4%, tpa 0.4%, mesoporous.materials 0.4%

Discriminating Terms
sba 35.3%, mesopor 6.0%, film 1.8%, silica 1.7%, mesoporous.silica 1.2%, layer 0.5%, nanotub 0.5%, particl 0.5%, magnet 0.5%, sba.materials 0.5%, surfac 0.4%, pore 0.4%, temperatur 0.4%, quantum 0.4%, carbon 0.4%

Single Word Terms
sba 90, mesopor 86, materi 65, silica 65, adsorpt 54, surfac 45, pore 45, structur 43, high 39, xrd 39, order 37, size 36, acid 30, rai 30, synthesi 30

Double Word Terms
mesoporous.silica 43, ray.diffraction 23, adsorption.desorption 22, sba.mesoporous 21, silica.sba 20, surface.area 19, mesoporous.materials 18, transmission.electron 18, sba.materials 18, electron.microscopy 17, pore.size 16, ordered.mesoporous 16, nitrogen.adsorption 15, mesoporous.sba 14, sba.silica 11

Triple Word Terms
mesoporous.silica.sba 18, transmission.electron.microscopy 15, sba.mesoporous.silica 10, ray.diffraction.xrd 9, electron.microscopy.tem 8, mesoporous.materials.sba 7, xrd.adsorption.desorption 7, si.mas.nmr 6, sba.mesoporous.materials 6, powder.ray.diffraction 6, nitrogen.adsorption.desorption 5, surface.area.pore 5, mesoporous.molecular.sieves 4, ordered.mesoporous.silica 4, functionalized.mesoporous.silica 4

Term Cliques
51.11% sba mesopor adsorpt materi acid sba.mesoporous tpa mesoporous.materials
53.06% sba mesopor adsorpt materi sba.materials acid sba.mesoporous mesoporous.materials
53.19% sba mesopor adsorpt pore materi sba.mesoporous tpa mesoporous.materials
50.00% sba mesopor mesoporous.silica adsorpt silica.sba mesoporous.silica.sba tpa
52.06% sba mesopor mesoporous.silica adsorpt acid sba.mesoporous tpa
62.70% sba mesopor silica adsorpt materi sba.materials micropor
59.58% sba mesopor silica adsorpt materi sba.materials acid sba.mesoporous
66.98% sba mesopor silica adsorpt pore materi micropor
67.62% sba mesopor silica adsorpt pore materi sba.mesoporous
59.68% sba mesopor silica mesoporous.silica adsorpt silica.sba mesoporous.silica.sba
59.68% sba mesopor silica mesoporous.silica adsorpt sba.materials silica.sba
56.53% sba mesopor silica mesoporous.silica adsorpt sba.materials acid sba.mesoporous

Sample Cluster Record Titles

Behaviour of NiO and Ni-o phases at high loadings in SBA-15 and SBA-16 mesoporous silica matrices

Functionalized mesoporous SBA-15 silica with propylsulfonic groups as catalysts for esterification of salicylic acid with dimethyl carbonate

Effect of nanoporous ZrO2 crystal size on the surface sulphur capacity and performance of sulfated zirconia as an acidic catalytic material

Fabrication and porosity control of mesoporous polycarbosilane from SBA-15 templated polymethylsilane

Adsorption of amino acid on mesoporous molecular sieves

Famotidine drug adsorption on carboxylic acid functionalized ordered SBA-15 mesoporous silica

Photoluminescence property of [Eu(bpy)(2)](3+) dispersed in mesoporous materials SBA-15

Synthesis and characterization of mesoporous silicas functionalized by thiol groups, and application as sorbents for mercury (II)

Quasi-solid-state dye-sensitized solar cells based on mesoporous silica SBA-15 framework materials

Cluster Metrics

Authors

vradman, l 4
shi, jl 4
landau, mv 4
zhu, k 3
zhang, lx 3
yue, b 3
li, wj 3
li, l 3
he, ny 3
coppens, mo 3
chen, hr 3
zhou, yp 2
zhou, l 2
yang, lm 2
yang, c 2

Sources

nanoporous materials iv 15
microporous and mesoporous materials 15
recent advances in the science and technology of zeolites and related materials, pts a - c 7

journal of physical chemistry b 7
langmuir 6
journal of materials chemistry 4
chemistry of materials 4
journal of molecular catalysis a-chemical 3
applied catalysis a-general 3
physical chemistry chemical physics 2
journal of materials research 2
comptes rendus chimie 2
chemistry-a european journal 2
chemical physics letters 2
solid state sciences 1

Keywords
chemistry, physical 30
mcm-41 22
chemistry, applied 19
sba-15 19
chemistry, physical 18
multidisciplinary 15
materials science, 15
molecular-sieves 14
copolymer 13
triblock 10
silica 10
molecular-sieves 9
chemistry, multidisciplinary 9
surface 9
materials science, multidisciplinary 9

Publication Year
2005 80
2004 10

Country
peoples r china 33
usa 13
taiwan 7
france 7
japan 6
germany 6
israel 5
south korea 4
england 4
netherlands 3
india 3

belgium 3
scotland 2
hungary 2
spain 1

Institution
chinese acad sci 12
fudan univ 6
ben gurion univ negev 5
zhuzhou inst technol 4
sami shamoon coll engn 3
natl taiwan univ 3
natl inst mat sci 3
nanjing univ 3
univ st andrews 2
univ paris 06 2
univ calif los angeles 2
univ calif berkeley 2
umist 2
tsing hua univ 2
tianjin univ 2

DataBase
science citation index 90

- CLUSTER 185
  Nanoporous, mesoporous, and porous materials, with emphasis on determination and control of pore size, evaluation of surface area, alumina and silica materials, and adsorption properties (292 Records)

(Countries: China, USA, followed by Japan. Institutions: CAS, University of Queensland, Kent State University, Beijing University of

Chemical Technology. Other USA include University of Kentucky, University of Iowa, UCB.).

Cluster Syntax Features

Descriptive Terms

pore 39.9%, pore.size 4.3%, mesopor 2.7%, surface.area 2.0%, porou 1.9%, area 1.7%, adsorpt 1.5%, size 1.4%, membran 1.3%, nanopor 1.3%, materi 1.1%, silica 1.1%, surfac 1.1%, alumina 1.1%, surfact 0.8%

Discriminating Terms

pore 30.6%, pore.size 3.4%, film 1.7%, mesopor 1.6%, surface.area 1.3%, porou 1.0%, nanopor 0.8%, area 0.8%, nanoparticl 0.7%, nanotub 0.6%, magnet 0.6%, adsorpt 0.6%, alumina 0.6%, pore.size.distribution 0.6%, pore.diameter 0.5%

Single Word Terms

pore 265, surfac 187, size 181, structur 147, area 137, materi 123, distribut 112, adsorpt 111, diamet 105, high 100, mesopor 97, porou 91, order 83, temperatur 82, volum 80

Double Word Terms

pore.size 147, surface.area 113, size.distribution 68, pore.volume 53, pore.diameter 52, pore.structure 46, high.surface 43, nitrogen.adsorption 42, electron.microscopy 38, sol.gel 38, ray.diffraction 36, narrow.pore 33, scanning.electron 31, bet.surface 30, average.pore 29

Triple Word Terms

pore.size.distribution 62, high.surface.area 38, narrow.pore.size 28, bet.surface.area 28, surface.area.pore 25, scanning.electron.microscopy 24, transmission.electron.microscopy 19, pore.size.distributions 16, nitrogen.adsorption.desorption 15, average.pore.diameter 14, adsorption.desorption.isotherms 14, area.pore.volume 14, ray.diffraction.xrd 13, pore.size.pore 12, electron.microscopy.sem 10

Term Cliques

44.52% pore nanopor materi silica
46.23% pore porou nanopor materi
39.38% pore porou membran nanopor
44.01% pore pore.size porou size membran alumina
54.06% pore pore.size porou adsorpt size materi surfac
43.84% pore pore.size mesopor surface.area area size alumina surfact
46.61% pore pore.size mesopor surface.area area size materi silica surfac surfact
49.04% pore pore.size mesopor surface.area area adsorpt size materi silica surface

Sample Cluster Record Titles

Mesoporous activated alumina layers deposited on FeCrAl metallic substrates by an in situ hydrothermal method

Effect of metal oxides on the pyrolysis residues of poly(ethylene terephthalate): Formation of carbonaceous submicron, nano-scale filaments and mesoporous compounds

Design of highly stable, ordered cage mesostructured monoliths with controllable pore geometries and sizes

Characterization of the pore structure of ceramics via propagation of light and infrared radiation

Sol-gel synthesis of mesostructured aluminas from chemically modified aluminum sec-butoxide using non-ionic surfactant templating

Pore structure modification of pitch-based activated carbon by NaOCl and air oxidation/pyrolysis cycles

Characterization and adsorption properties of polymer-based microporous carbons with different surface chemistry

Preparation of three-dimensional ordered macroporous SiCN ceramic using sacrificing template method

Mechanism of guided self-organization producing quasi-monodomain porous alumina

Cluster Metrics

Authors
jaroniec, m 7
do, dd 5
wei, q 4
ustinov, ea 4
schmuki, p 4
rankin, se 4
lu, gq 4
lehmler, hj 4
knutson, bl 4
donatti, da 4
zou, jx 3
zhang, lx 3
xia, yd 3
wang, lj 3
wang, h 3

Sources

microporous and mesoporous materials 21
journal of physical chemistry b 15
chemistry of materials 12
langmuir 9
nanoporous materials iv 6
journal of non-crystalline solids 6
journal of colloid and interface science 6
applied surface science 6
recent advances in the science and technology of zeolites and related materials, pts a - c 5
materials letters 5
journal of the american chemical society 5
journal of sol-gel science and technology 5
journal of materials chemistry 5
acta chimica sinica 5
journal of porous materials 4

Keywords

chemistry, physical 78
materials science, multidisciplinary 35
adsorption 33
materials science, multidisciplinary 30
chemistry, multidisciplinary 30
chemistry, physical 30
chemistry, applied 29
multidisciplinary 26
materials science, 26
silica 24
catalysts 23
materials science, ceramics 18
engineering, chemical 17
adsorption 16
water 14

Publication Year

2005 251
2004 36
2006 5

Country

peoples r china 65
usa 59
japan 33
germany 25
france 22

england 14
south korea 13
australia 13
poland 12
spain 9
taiwan 7
canada 7
russia 6
brazil 6
italy 5

Institution
chinese acad sci 15
univ queensland 9
kent state univ 6
beijing univ chem technol 6
univ kentucky 5
natl inst adv ind sci & technol 5
cnrs 5
univ nottingham 4
univ iowa 4
univ erlangen nurnberg 4
univ calif berkeley 4
seoul natl univ 4
nanjing univ 4
fudan univ 4
beijing univ technol 4

DataBase
science citation index 292

- # CLUSTER 19

  Synthesis and characterization of MCM mesoporous silicas and use as molecular sieves and catalysts (147 Records)

(Countries: China dominant, USA, Germany, India, France. Institutions: CAS, National Taiwan University, Jilin University. USA includes Yale University.).

Cluster Syntax Features

Descriptive Terms

mcm 66.3%, mesopor 4.7%, siev 1.7%, pore 1.3%, materi 1.0%, adsorpt 0.7%, molecular.sieves 0.7%, zeolit 0.6%, silica 0.6%, hydrotherm 0.5%, mesoporous.mcm 0.4%, mesoporous.molecular 0.4%, mcm.mcm 0.4%, mcm.materials 0.4%, mcm.mesoporous 0.4%

Discriminating Terms

mcm 41.5%, mesopor 2.3%, film 1.8%, siev 1.0%, nanoparticl 0.6%, magnet 0.6%, layer 0.5%, nanotub 0.5%, particl 0.5%, carbon 0.5%, surfac 0.5%, deposit 0.5%, temperatur 0.4%, electron 0.4%, molecular.sieves 0.4%

Single Word Terms

mcm 139, mesopor 104, materi 92, xrd 92, adsorpt 83, synthesi 76, synthes 75, structur 68, pore 67, surfac 65, si 55, molecular 54, silica 52, siev 50, order 49

Double Word Terms

molecular.sieves 36, mesoporous.mcm 32, surface.area 31, mas.nmr 31, mcm.materials 29, ray.diffraction 28, adsorption.desorption 27, mesoporous.molecular 27, mcm.mesoporous 27, pore.size 25, nitrogen.adsorption 25, si.mas 24, catalytic.activity 24, mcm.mcm 23, xrd.adsorption 22

Triple Word Terms

si.mas.nmr 23, mesoporous.molecular.sieves 19, ray.diffraction.xrd 16, surface.area.pore 15, xrd.adsorption.desorption 13, mesoporous.molecular.sieve 12, mcm.mesoporous.molecular 12, mcm.molecular.sieves 12, area.pore.volume 10, powder.ray.diffraction 9, transmission.electron.microscopy 9, molecular.sieve.mcm 8, high.surface.area 8, nitrogen.adsorption.desorption 8, pore.size.distribution 7

Term Cliques

48.19% mcm mesopor adsorpt zeolit hydrotherm mcm.mcm
48.72% mcm mesopor materi adsorpt silica hydrotherm mcm.materials mcm.mesoporous
47.36% mcm mesopor materi adsorpt molecular.sieves hydrotherm mcm.materials mcm.mesoporous
50.92% mcm mesopor materi adsorpt molecular.sieves hydrotherm mcm.mcm

47.19% mcm mesopor materi adsorpt molecular.sieves hydrotherm mesoporous.molecular mcm.mesoporous
53.06% mcm mesopor pore materi adsorpt mesoporous.mcm mcm.materials
52.48% mcm mesopor pore materi adsorpt mesoporous.mcm mcm.mcm
50.43% mcm mesopor pore materi adsorpt silica mcm.materials mcm.mesoporous
49.06% mcm mesopor pore materi adsorpt molecular.sieves mcm.materials mcm.mesoporous
52.87% mcm mesopor pore materi adsorpt molecular.sieves mcm.mcm
43.03% mcm mesopor siev adsorpt zeolit hydrotherm mesoporous.molecular mcm.mesoporous
43.62% mcm mesopor siev adsorpt molecular.sieves hydrotherm mesoporous.molecular mcm.mesoporous

Sample Cluster Record Titles

Novel synthesis of ordered MCM-41 titanosilicates with very high titanium content via ultrasound radiation

Characterization of hydrothermally treated MCM-41 and Ti-MCM-41 molecular sieves

CuCl2 immobilized on amino-functionalized MCM-41 and MCM-48 and their catalytic performance toward the vapor-phase oxy-carbonylation of methanol to dimethylcarbonate

Synthesis of Ti-containing MCM-41 mesoporous molecular sieve in the presence of ammonia

Are mesoporous silicas and aluminosilicas assembled from zeolite seeds inherently hydrothermally stable? Comparative evaluation of MCM-48 materials assembled from zeolite seeds

A novel method for the preparation of MOR/MCM-41 composite molecular sieve

Esterification of acetic acid over mesoporous Al-MCM-41 molecular sieves

Preparation, characterization of MCM-56 and catalytic activity in one-step synthesis of MIBK from acetone

Catalytic reduction of methyl viologen by sulfide ion within MCM-41

Cluster Metrics

Authors

zhang, y 4
wu, th 4
sakthivel, a 4
mou, cy 4
liu, s 4
hartmann, m 4
haller, gl 4
dou, t 4
ziolek, m 3
zhao, j 3
zhang, jl 3
yan, zc 3
yan, xw 3
wu, d 3
wang, s 3

Sources

microporous and mesoporous materials 15
nanoporous materials iv 14
recent advances in the science and technology of zeolites and related materials, pts a - c 12
journal of physical chemistry b 8
catalysis communications 5
applied catalysis a-general 5
solid state sciences 4
materials letters 4
journal of molecular catalysis a-chemical 4
journal of catalysis 4
journal of thermal analysis and calorimetry 3
journal of colloid and interface science 3
industrial & engineering chemistry research 3
chinese journal of catalysis 3
rare metal materials and engineering 2

Keywords

chemistry, physical 44
mcm-41 37
mesoporous molecular-sieves 32
chemistry, physical 31
chemistry, applied 25
silica 19
adsorption 18
multidisciplinary 16
materials science, 16
molecular-sieves 15
chemistry, multidisciplinary 14

catalysts 14
mcm-41 13
surface 13
engineering, chemical 13

Publication Year
2005 126
2004 21

Country
peoples r china 46
usa 16
germany 14
india 13
france 13
japan 9
taiwan 8
spain 8
south korea 8
england 6
brazil 6
poland 5
italy 4
hungary 4
australia 4

Institution
chinese acad sci 12
natl taiwan univ 5
jilin univ 5
yonsei univ 4
yale univ 4
tech univ munich 4
taiyuan univ technol 4
natl chem lab 4
fudan univ 4
univ szeged 3
univ petr 3
univ osaka prefecture 3
univ kaiserslautern 3
univ fed rio grande norte 3
ruhr univ bochum 3

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science citation index 147

- # CLUSTER 29
  Zeolites (especially ZSM-5, silicalite-1, and MFI), with emphasis on ion exchange, adsorption and acid properties, and synthesis, particularly hydrothermally (145 Records)

(Countries: China dominant, USA, Germany, Japan. Institutions: Fudan University, University of Stuttgart, University of Iowa, Jilin University. Other USA includes UCR.).

Cluster Syntax Features

Descriptive Terms
zeolit 73.2%, zsm 3.1%, adsorpt 0.8%, exchang 0.7%, mesopor 0.7%, silicalit 0.5%, framework 0.5%, si 0.4%, acid 0.4%, mfi 0.4%, pore 0.4%, zsm.zeolite 0.3%, ma 0.3%, crystal 0.3%, hydrotherm 0.3%

Discriminating Terms
zeolit 46.4%, zsm 1.9%, film 1.8%, nanoparticl 0.6%, carbon 0.5%, nanotub 0.5%, surfac 0.5%, layer 0.5%, electron 0.4%, deposit 0.4%, magnet 0.4%, particl 0.4%, quantum 0.4%, oxid 0.4%, structur 0.4%

Single Word Terms
zeolit 145, structur 60, xrd 58, adsorpt 58, crystal 52, sampl 48, surfac 47, synthesi 47, high 46, synthes 45, si 43, materi 42, temperatur 42, acid 40, form 38

Double Word Terms
mas.nmr 22, ray.diffraction 20, zsm.zeolite 18, surface.area 18, solid.state 15, ion.exchange 15, electron.microscopy 13, temperature.programmed 11, type.zeolite 11, nitrogen.adsorption 11, acid.sites 10, xrd.sem 9, si.ratios 9, scanning.electron 9, hydrothermal.treatment 9

Triple Word Terms

si.mas.nmr 9, scanning.electron.microscopy 8, ray.diffraction.xrd 8, fourier.transform.infrared 6, magic.angle.spinning 6, solid.state.nmr 6, nuclear.magnetic.resonance 6, dynamic.light.scattering 5, extra.framework.aluminum 5, transmission.electron.microscopy 5, temperature.programmed.desorption 5, external.surface.area 5, bronsted.acid.sites 5, powder.ray.diffraction 4, structure.directing.agent 4

Term Cliques
39.72% zeolit framework acid mfi crystal
35.29% zeolit mesopor si acid zsm.zeolite hydrotherm
35.75% zeolit mesopor si acid pore zsm.zeolite
38.39% zeolit mesopor framework acid crystal hydrotherm
34.38% zeolit mesopor framework si acid ma hydrotherm
37.82% zeolit mesopor framework si acid pore
36.00% zeolit mesopor silicalit zsm.zeolite crystal
38.51% zeolit adsorpt si acid zsm.zeolite hydrotherm
37.14% zeolit adsorpt framework si acid ma hydrotherm
35.57% zeolit adsorpt framework si acid mfi ma
36.65% zeolit adsorpt framework si acid mfi pore
36.35% zeolit adsorpt exchang si acid pore zsm.zeolite
38.13% zeolit adsorpt exchang framework si acid pore
39.45% zeolit zsm acid mfi crystal
34.48% zeolit zsm mesopor acid zsm.zeolite crystal hydrotherm
34.71% zeolit zsm mesopor acid pore zsm.zeolite
37.47% zeolit zsm adsorpt acid zsm.zeolite hydrotherm
37.93% zeolit zsm adsorpt acid pore zsm.zeolite
37.59% zeolit zsm adsorpt acid mfi pore

Sample Cluster Record Titles

Gas sensors based on nanosized-zeolite films to identify dimethylmethylphosphonate

Local structures of Ag (I) clusters prepared within zeolites by ion-exchange method and their photochemical properties

Studies on structure and acid-base properties of high silica MFI-type zeolite modified with methylamine

Studies on crystallography, stability, acidity and skeletal isomerization of C-5 olefins of THF-FER zeolite

Standardization of catalyst preparation using reference catalyst: ion exchange of mordenite type zeolite - 1. Remarkable dealumination accompanying ion exchange

[Hydrothermal transformation of porous glass beads into porous glass beads containing zeolite beta (BEA)]

[Chemical and mechanical supported crystallization (CMSC) of MFI-type zeolite on different reactive substrate materials]

[Effect of alkali treatment on the structure and catalytic properties of ZSM-5 zeolite]

[Synthesis and characterization of the nanocrystalline zeolite ZSM-35]

Cluster Metrics

Authors

long, yc 7
larsen, sc 5
guo, j 5
grassian, vh 5
zhu, gs 4
weitkamp, j 4
qiu, sl 4
mintova, s 4
cheng, xw 4
bein, t 4
zhong, y 3
wang, rw 3
wang, lj 3
wang, j 3
sun, xy 3

Sources

recent advances in the science and technology of zeolites and related materials, pts a - c 19
microporous and mesoporous materials 14
journal of inorganic materials 6
applied catalysis a-general 6
nanoporous materials iv 5
langmuir 4
journal of the american chemical society 4
chemistry of materials 4
catalysis today 4
journal of physical chemistry b 3
journal of materials chemistry 3
journal of catalysis 3
chinese journal of inorganic chemistry 3
chemistry-a european journal 3

progress in chemistry 2

Keywords
chemistry, multidisciplinary 31
chemistry, physical 30
chemistry, physical 24
chemistry, applied 22
zsm-5 20
zeolite 17
multidisciplinary 16
zeolites 16
materials science, 16
adsorption 16
engineering, chemical 11
mechanism 10
materials science, multidisciplinary 9
environmental sciences 9
mcm-41 8

Publication Year
2005 116
2004 29

Country
peoples r china 41
usa 20
germany 18
japan 14
france 10
india 9
spain 5
england 5
belgium 5
taiwan 4
south korea 4
netherlands 4
norway 3
hungary 3
canada 3

Institution
fudan univ 10
univ stuttgart 5
univ iowa 5
jilin univ 5
taiyuan univ technol 4

delft univ technol 4
zhaotong teachers coll 3
univ tokyo 3
univ petr 3
univ munich 3
univ haute alsace 3
univ erlangen nurnberg 3
univ calif riverside 3
sinopec 3
nanjing univ sci & technol 3

DataBase
science citation index 145

- # CLUSTER 237
  Oxidation and reduction reactions, emphasizing the catalysts involved, oxide catalysts (particularly CeO2), and their catalytic activity (470 Records)

(Countries: USA, China, followed by Italy, Japan, Germany. Institutions: CAS, University of Trieste, Nankai University. USA includes UCB.).

Cluster Syntax Features

Descriptive Terms
oxid 11.6%, catalyt 9.4%, catalyst 6.0%, activ 5.3%, reaction 4.2%, ceo2 2.8%, support 2.2%, oxygen 1.9%, select 1.8%, surfac 1.3%, catalytic.activity 1.3%, speci 1.2%, reduct 1.0%, acid 0.9%, site 0.8%

Discriminating Terms
catalyt 7.9%, oxid 6.5%, catalyst 3.7%, activ 2.9%, film 2.5%, ceo2 2.5%, reaction 2.1%, support 1.3%, catalytic.activity 1.1%, oxygen 1.0%, select 1.0%, magnet 0.8%, nanotub 0.8%, speci 0.7%, layer 0.6%

Single Word Terms
oxid 308, activ 280, surfac 268, catalyst 260, catalyt 257, reaction 243, temperatur 220, structur 165, high 145, xrd 133, spectroscopi 131, select 131, support 130, oxygen 126, format 126

Double Word Terms
catalytic.activity 108, temperature.programmed 82, surface.area 79, ray.diffraction 74, ray.photoelectron 54, photoelectron.spectroscopy 50, electron.microscopy 44, programmed.reduction 44, programmed.desorption 38, diffraction.xrd 34, spectroscopy.xps 33, catalytic.properties 32, reduction.tpr 30, gas.phase 30, oxidation.reaction 27

Triple Word Terms
ray.photoelectron.spectroscopy 49, temperature.programmed.reduction 44, temperature.programmed.desorption 38, photoelectron.spectroscopy.xps 32, ray.diffraction.xrd 31, programmed.reduction.tpr 29, transmission.electron.microscopy 23, high.surface.area 21, scanning.electron.microscopy 18, programmed.desorption.tpd 18, bet.surface.area 16, catalytic.activity.oxidation 12, selective.catalytic.reduction 12, diffraction.xrd.temperature 10, chemical.vapor.deposition 10

Term Cliques
41.09% oxid catalyt catalyst activ surfac catalytic.activity speci reduct acid site
38.17% oxid catalyt catalyst activ select catalytic.activity speci reduct acid site
43.90% oxid catalyt catalyst activ support surfac catalytic.activity speci reduct
40.66% oxid catalyt catalyst activ support select catalytic.activity speci reduct
44.33% oxid catalyt catalyst activ support oxygen surfac speci reduct
41.09% oxid catalyt catalyst activ support oxygen select speci reduct
41.47% oxid catalyt catalyst activ ceo2 surfac catalytic.activity reduct site
41.89% oxid catalyt catalyst activ ceo2 oxygen surfac reduct site
42.13% oxid catalyt catalyst activ ceo2 support surfac catalytic.activity reduct
42.55% oxid catalyt catalyst activ ceo2 support oxygen surfac reduct
44.09% oxid catalyt catalyst activ reaction surfac catalytic.activity speci reduct site
41.17% oxid catalyt catalyst activ reaction select catalytic.activity speci reduct site
44.47% oxid catalyt catalyst activ reaction oxygen surfac speci reduct site
41.55% oxid catalyt catalyst activ reaction oxygen select speci reduct site

Sample Cluster Record Titles

Gas phase catalysis by metal nanoparticles in nanoporous alumina membranes

Catalytic and FT-IR study on the reaction pathway for oxidation of propane and propylene on V- or Mo-V-based catalysts

Dendrimer-mediated formation of Cu-CuOx nanoparticles on silica and their physical and catalytic characterization

Dehydrocondensation of alcohols to form ethers over mesoporous SBA-15 catalyst

Effect of La2O3 in CeO2-ZrO2 on catalytic performance of Pd-only three-way catalyst

Characterization and catalytic activity of zirconium dioxide prepared by sol-gel

Structural characterization of nanosized CeO2-SiO2, CeO2-TiO2, and CeO2-ZrO2 catalysts by XRD, raman, and HREM techniques

Decomposition of hydrogen peroxide at water-ceramic oxide interfaces

Activity and stability of low-content gold-cerium oxide catalysts for the water-gas shift reaction

Cluster Metrics

Authors
wu, sh 7
wang, xy 7
zheng, xc 6
wang, sr 6
wang, y 5
wang, x 5
kaliaguine, s 5
corma, a 5
bell, at 5
wang, sp 4
vinod, cp 4
van santen, ra 4
schlogl, r 4
nieuwenhuys, be 4
li, yd 4

Sources
journal of physical chemistry b 46
journal of catalysis 40
applied catalysis a-general 28
catalysis today 27
journal of molecular catalysis a-chemical 17
applied catalysis b-environmental 15
catalysis letters 13
journal of the american chemical society 12
chemistry of materials 10
microporous and mesoporous materials 9
chinese journal of inorganic chemistry 8
surface science 7
applied surface science 7
angewandte chemie-international edition 7

industrial & engineering chemistry research 6

Keywords
chemistry, physical 230
engineering, chemical 81
chemistry, multidisciplinary 55
oxidation 54
chemistry, applied 50
chemistry, physical 49
adsorption 43
surface 37
environmental sciences 31
co oxidation 31
catalysts 31
carbon-monoxide 31
oxidation 30
oxygen 30
materials science, multidisciplinary 30

Publication Year
2005 439
2004 29
2006 2

Country
usa 88
peoples r china 67
italy 38
japan 36
germany 35
france 29
india 24
spain 23
netherlands 22
south korea 20
russia 17
england 15
brazil 14
taiwan 11
mexico 11

Institution
chinese acad sci 14
univ trieste 9
nankai univ 9
tsing hua univ 8

russian acad sci 8
natl inst adv ind sci & technol 8
nanjing univ 8
eindhoven univ technol 8
csic 8
cnr 8
cnrs 7
univ padua 6
univ fed sao carlos 6
univ calif berkeley 6
leiden univ 6

DataBase
science citation index 470

- # CLUSTER 153
  Catalysts (especially MCM-incorporated, palladium, and heterogeneous catalysts), especially studies on catalytic activity/selectivity, surface area, and hydrogenation/dehydrogenation reactions (554 Records)

(Countries: China dominant, USA, India, Germany. Institutions: CAS, SIC, National Chemistry Lab.).

Cluster Syntax Features

Descriptive Terms
catalyst 58.5%, catalyt 3.0%, activ 2.8%, support 2.7%, reaction 1.6%, select 1.5%, oxid 1.0%, hydrogen 0.9%, acid 0.7%, mcm 0.6%, catalytic.activity 0.5%, metal 0.5%, convers 0.3%, palladium 0.3%, heterogen 0.3%

Discriminating Terms
catalyst 40.4%, film 2.1%, catalyt 1.8%, support 1.4%, activ 1.0%, select 0.7%, magnet 0.6%, layer 0.6%, nanotub 0.6%, structur 0.5%, crystal 0.5%, quantum 0.5%, electron 0.4%, reaction 0.4%, optic 0.4%

Single Word Terms
catalyst 554, activ 351, catalyt 308, reaction 303, surfac 245, support 226, temperatur 224, xrd 214, oxid 207, select 207, high 194, structur 164, metal 158, acid 148, adsorpt 144

Double Word Terms
catalytic.activity 138, surface.area 105, ray.diffraction 89, electron.microscopy 62, diffraction.xrd 52, temperature.programmed 45, particle.size 42, activity.selectivity 39, ray.photoelectron 38, bet.surface 38, low.temperature 37, photoelectron.spectroscopy 36, reaction.temperature 36, transmission.electron 35, reaction.conditions 34

Triple Word Terms
ray.diffraction.xrd 41, ray.photoelectron.spectroscopy 36, bet.surface.area 35, transmission.electron.microscopy 31, scanning.electron.microscopy 26, photoelectron.spectroscopy.xps 22, temperature.programmed.reduction 21, high.surface.area 19, surface.area.pore 15, temperature.programmed.desorption 15, programmed.reduction.tpr 13, fourier.transform.infrared 13, water.gas.shift 12, electron.microscopy.tem 12, ray.powder.diffraction 12

Term Cliques
42.99% catalyst catalyt reaction acid mcm heterogen
40.61% catalyst catalyt reaction hydrogen metal palladium heterogen
42.44% catalyst catalyt reaction oxid mcm metal heterogen
44.42% catalyst catalyt activ support reaction hydrogen catalytic.activity metal palladium
43.27% catalyst catalyt activ support reaction select acid mcm catalytic.activity convers
47.77% catalyst catalyt activ support reaction select hydrogen catalytic.activity metal
42.89% catalyst catalyt activ support reaction select oxid mcm catalytic.activity metal convers

Sample Cluster Record Titles

The surface properties of iron catalyst for ammonia synthesis

Catalytic performance of metal-substituted ZSM-5 zeolites for vapor phase Bechmann rearrangement of cyclohexanone oxime

Supported foam-copper catalysts for methanol selective oxidation

Pd colloid-catalyzed methoxycarbonylation of iodobenzene in ionic liquids

Copolymerization of ethene with styrene using CGC catalysts: the effect of the cyclopentadienyl ligand substitution on the catalyst activity and copolymer structure

Catalytic activity of the M/(3ZnO center dot ZrO2) system (M = Cu, Ag, Au) in the hydrogenation of CO2 to methanol

FeF3/MgF2: novel Lewis acidic catalyst systems

Synthesis, characterization, and catalytic activity of vanadium-incorporated, -grafted, and -immobilized mesoporous MCM-41 in the oxidation,of aromatics

Selective oxidation of propane to acrylic acid on K-doped MoVSbO catalysts: catalyst characterization and catalytic performance

Cluster Metrics

Authors

fierro, jlg 11
xu, bq 7
thomas, jm 7
pandurangan, a 7
halligudi, sb 7
wang, y 6
reyes, p 6
raja, r 6
fan, kn 6
zhang, x 5
wang, h 5
finke, rg 5
devassy, bm 5
bao, xh 5
zhang, qh 4

Sources

applied catalysis a-general 51
journal of catalysis 39
catalysis today 38
journal of molecular catalysis a-chemical 36
chinese journal of catalysis 29
catalysis letters 21
nanoporous materials iv 14
industrial & engineering chemistry research 14
chemical communications 13
applied catalysis b-environmental 13
topics in catalysis 11

journal of physical chemistry b 11
advanced synthesis & catalysis 11
recent advances in the science and technology of zeolites and related materials, pts a - c 10
catalysis communications 10

Keywords
chemistry, physical 223
engineering, chemical 114
chemistry, applied 97
chemistry, physical 90
environmental sciences 60
oxidation 56
chemistry, multidisciplinary 55
catalysts 47
nanoparticles 36
silica 32
hydrogenation 32
engineering, chemical 30
surface 27
nanoparticles 25
selective oxidation 25

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2005 501
2004 51
2006 2

Country
peoples r china 122
usa 62
india 52
germany 44
spain 39
france 37
japan 34
south korea 27
italy 25
england 21
netherlands 20
brazil 13
poland 12
taiwan 11
romania 11

Institution

chinese acad sci 33
csic 21
natl chem lab 17
indian inst chem technol 10
anna univ 10
inst rech catalyse 9
tsing hua univ 8
max planck gesell 8
fudan univ 8
dalian univ technol 8
univ utrecht 7
univ cambridge 7
royal inst great britain 7
natl inst adv ind sci & technol 7
cnrs 7

DataBase
science citation index 554

- CLUSTER 102
  Catalysts (especially gamma-Al2O3, nickel, and cobalt catalysts), emphasizing activity, structure, and formation of catalysts; steam reforming of methanol; and hydrogenation reactions (222 Records)

(Countries: China dominant, USA, Japan, Spain, France. Institutions: CAS, Tsing Hua University, CSIC. USA includes VPI.).

Cluster Syntax Features

Descriptive Terms
catalyst 30.7%, al2o3 7.9%, ni 5.5%, support 3.6%, reform 3.5%, co 2.6%, activ 2.2%, gamma.al2o3 1.8%, catalyt 1.6%, methan 1.4%, nickel 1.2%, steam 1.1%, hydrogen 1.0%, steam.reforming 1.0%, gamma 0.9%

Discriminating Terms
catalyst 18.7%, al2o3 4.9%, ni 2.8%, reform 2.5%, film 2.0%, support 1.8%, gamma.al2o3 1.3%, co 1.2%, methan 0.9%, steam 0.8%, catalyt 0.8%, steam.reforming 0.7%, nickel 0.6%, activ 0.6%, nanotub 0.6%

Single Word Terms
catalyst 219, activ 152, support 121, surfac 119, catalyt 118, al2o3 114, reaction 112, temperatur 103, xrd 102, oxid 96, high 88, structur 85, rai 80, hydrogen 79, reduct 79

Double Word Terms
ray.diffraction 65, gamma.al2o3 45, catalytic.activity 43, surface.area 43, temperature.programmed 42, al2o3.catalysts 41, al2o3.catalyst 36, electron.microscopy 35, diffraction.xrd 34, steam.reforming 33, programmed.reduction 32, transmission.electron 25, ni.catalysts 22, fischer.tropsch 21, reduction.tpr 19

Triple Word Terms
ray.diffraction.xrd 33, temperature.programmed.reduction 31, transmission.electron.microscopy 25, programmed.reduction.tpr 19, fischer.tropsch.synthesis 18, gamma.al2o3.catalyst 14, ray.photoelectron.spectroscopy 13, bet.surface.area 12, electron.microscopy.tem 12, gamma.al2o3.catalysts 11, photoelectron.spectroscopy.xps 11, scanning.electron.microscopy 10, catalysts.ray.diffraction 9, incipient.wetness.impregnation 9, co2.reforming.methane 8

Term Cliques
50.00% catalyst support gamma.al2o3 catalyt gamma
60.09% catalyst support co activ catalyt
41.44% catalyst ni reform activ catalyt nickel steam hydrogen steam.reforming
43.02% catalyst ni reform activ catalyt methan nickel steam
52.77% catalyst ni support activ catalyt nickel hydrogen
49.64% catalyst al2o3 support gamma.al2o3 gamma
68.24% catalyst al2o3 support active

Sample Cluster Record Titles

Influence of catalyst treatments on the adsorption properties of gamma-Al2O3 supported Pt, Rh and Ru catalysts

In-situ XRD and Raman spectroscopic study on the solid state reaction of CuO/Al2O3 catalysts at high temperature

Development of cobalt catalysts for the steam reforming of naphthalene as a model compound of tar derived from biomass gasification

Comparison of Co/MgO and Ni/MgO catalysts for the steam reforming of naphthalene as a model compound of tar derived from biomass gasification

Preparation, solid-state characteristics, and catalytic properties of promoted vanadium phosphate materials

The effect of cerium, lanthanum and zirconium on nickel/alumina catalysts for the hydrogenation of carbon oxides

Structure and activity of RuO2/Y-Al2O3 catalyst doped with CeO2 in wet air oxidation degradation of phenol

Preparation of copper catalyst washcoats for methanol steam reforming in microchannels based on nanoparticles

Hydrogenation catalysts formation in the system AlEt3-Co(acac)(2,3)

Cluster Metrics

Authors
fierro, jlg 6
okamoto, y 4
kubota, t 4
zhu, wp 3
zheng, xm 3
yang, ws 3
yang, sx 3
yan, sr 3
xu, bq 3
xiong, w 3
wang, yh 3
wan, jf 3
szanyi, j 3
shu, yy 3
ressler, t 3

Sources
journal of catalysis 30

applied catalysis a-general 25
catalysis today 22
chinese journal of catalysis 18
journal of molecular catalysis a-chemical 16
journal of physical chemistry b 10
catalysis letters 8
chemistry of materials 5
industrial & engineering chemistry research 4
catalysis communications 4
applied surface science 4
applied catalysis b-environmental 4
nanoporous materials iv 3
microporous and mesoporous materials 3
acta chimica sinica 3

Keywords

chemistry, physical 118
engineering, chemical 73
chemistry, physical 47
chemistry, applied 45
alumina 27
environmental sciences 25
hydrogenation 21
catalysts 20
co 20
hydrogen 19
reduction 18
nickel 17
ch4 17
chemistry, multidisciplinary 16
support 16

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2005 204
2004 18

Country

peoples r china 63
usa 25
japan 22
spain 18
france 18
mexico 12
england 9
brazil 8
germany 7

venezuela 6
south korea 6
russia 5
poland 5
india 5
scotland 4

Institution
chinese acad sci 16
tsing hua univ 10
csic 10
univ autonoma metropolitana iztapalapa 6
inst mexicano petr 6
univ paris 06 4
shimane univ 4
fudan univ 4
zhejiang univ 3
zhejiang normal univ 3
xichang coll 3
virginia polytech inst & state univ 3
univ tokyo 3
univ st andrews 3
univ sci & tech lille flandres artois 3

DataBase
science citation index 222

- # CLUSTER 87
  Platinum (Pt) and platinum-ruthenium (PtRu) catalysts, emphasizing their electrochemical applications, including methanol and other fuel

cells, methanol electro-oxidation, and reduction reactions (270 Records)

(Countries: USA, China, followed by Japan. Institutions: CAS dominant, University of Illinois, Tsing Hua University. Other USA include University of Texas, University of Wisconsin, BNL.).

Cluster Syntax Features

Descriptive Terms

pt 45.7%, catalyst 8.3%, methanol 3.5%, ru 3.5%, platinum 1.9%, pt.ru 1.7%, support 1.4%, fuel 1.4%, electrod 1.3%, oxid 1.3%, activ 1.1%, electrocatalyst 1.0%, reduct 0.7%, catalyt 0.5%, cell 0.5%

Discriminating Terms

pt 30.6%, catalyst 4.2%, methanol 2.3%, ru 2.1%, film 1.7%, pt.ru 1.3%, platinum 1.2%, fuel 0.9%, electrocatalyst 0.7%, magnet 0.6%, nanotub 0.6%, support 0.6%, crystal 0.5%, structur 0.5%, quantum 0.4%

Single Word Terms

pt 230, catalyst 162, surfac 142, activ 142, oxid 136, support 117, temperatur 100, electron 99, reduct 98, metal 97, reaction 97, structur 97, cell 95, rai 93, platinum 93

Double Word Terms

electron.microscopy 58, fuel.cell 55, fuel.cells 54, cyclic.voltammetry 49, pt.ru 47, ray.diffraction 43, transmission.electron 43, methanol.fuel 42, photoelectron.spectroscopy 40, direct.methanol 40, supported.pt 40, ray.photoelectron 40, methanol.oxidation 38, catalytic.activity 38, carbon.supported 34

Triple Word Terms

transmission.electron.microscopy 40, direct.methanol.fuel 40, ray.photoelectron.spectroscopy 39, methanol.fuel.cell 27, carbon.supported.pt 25, methanol.fuel.cells 21, photoelectron.spectroscopy.xps 20, scanning.electron.microscopy 18, oxygen.reduction.reaction 17, ray.diffraction.xrd 16, electron.microscopy.ray 13, temperature.programmed.desorption 12, cyclic.voltammetry.chronoamperometry 11, electron.microscopy.tem 11, proton.exchange.membrane 11

Term Cliques

44.03% pt catalyst fuel electrod activ electrocatalyst reduct cell
43.91% pt catalyst support fuel activ electrocatalyst reduct catalyt cell
45.45% pt catalyst platinum electrod activ electrocatalyst reduct
46.93% pt catalyst platinum support activ electrocatalyst reduct
43.70% pt catalyst platinum pt.ru electrod oxid activ electrocatalyst
45.00% pt catalyst platinum pt.ru support oxid activ electrocatalyst

40.81% pt catalyst ru pt.ru support fuel oxid activ electrocatalyst catalyt cell
39.80% pt catalyst methanol ru pt.ru fuel electrod oxid activ electrocatalyst cell
40.74% pt catalyst methanol ru pt.ru support fuel oxid activ electrocatalyst cell

Sample Cluster Record Titles

Electro-oxidation of methanol diffused through proton exchange membrane on Pt surface: crossover rate of methanol

Methanol electro-oxidation and direct methanol fuel cell using Pt/Rh and Pt/Ru/Rh alloy catalysts

Preparation and characterization of carbon supported Pt and PtRu alloy catalysts reduced by alcohol for polymer electrolyte fuel cell

AB(5)-type hydrogen storage alloys as catalysts in hydrogen-diffusion electrodes for novel H-2/hydride//perovskite/O-2 alkaline fuel cells

Growth of RuO2 by electrochemical and gas-phase oxidation of an Ru(0001) surface

Monodispersed hard carbon spherules as a catalyst support for the electrooxidation of methanol

Methanol electrochemical oxidation at nanometer-scale PtRu materials

Electrooxidation of methanol on platinum-ruthenium catalysts applied to a cation-exchange membrane

Ethanol electrooxidation on a carbon-supported Pt catalyst: Reaction kinetics and product yields

Cluster Metrics

Authors

sun, gq 12
xin, q 11
zhou, zh 6
zhou, wj 5
zhou, b 5
song, sq 5
jiang, lh 5
yin, gp 4
xiong, l 4

wieckowski, a 4
wang, zb 4
wang, gx 4
viswanathan, b 4
tsiakaras, p 4
tang, sh 4

Sources
journal of physical chemistry b 34
electrochimica acta 22
journal of power sources 16
journal of the electrochemical society 13
surface science 10
journal of catalysis 10
langmuir 9
electrochemistry communications 9
journal of electroanalytical chemistry 8
electrochemical and solid state letters 8
catalysis today 7
applied catalysis b-environmental 7
applied catalysis a-general 7
journal of molecular catalysis a-chemical 6
journal of the american chemical society 5

Keywords
chemistry, physical 111
platinum 79
electrochemistry 54
oxidation 54
electrooxidation 38
electrochemistry 38
catalysts 32
co 30
adsorption 30
methanol 29
electrodes 27
chemistry, multidisciplinary 25
nanoparticles 24
engineering, chemical 22
catalysts 21

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2005 238
2004 29
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Country

usa 73
peoples r china 56
japan 32
germany 16
south korea 14
spain 11
france 11
taiwan 10
netherlands 8
india 8
russia 7
singapore 6
greece 6
brazil 6
switzerland 5

Institution

chinese acad sci 19
univ illinois 9
tsing hua univ 7
seoul natl univ 6
natl inst adv ind sci & technol 6
univ texas 5
univ poitiers 5
csic 5
xiamen univ 4
univ wisconsin 4
univ belgrade 4
natl synchrotron radiat res ctr 4
indian inst technol 4
harbin inst technol 4
brookhaven natl lab 4

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science citation index 270

- # CLUSTER 80
  Platinum (Pt) and iron-platinum (FePt) nanoparticles, focusing on electrocatalytic activity (especially for oxygen reduction), size-dependent effects/processes, and synthesis (especially by polyol process) of nanoparticles (109 Records)

(Countries: USA, Japan, China. Institutions: CAS, Tokyo Institute of Technology, Osaka University. USA include UCB, LANL, USC, UCD.).

Cluster Syntax Features

Descriptive Terms
pt 34.0%, nanoparticl 16.1%, pt.nanoparticles 8.5%, fept 4.8%, platinum 4.6%, fept.nanoparticles 2.3%, platinum.nanoparticles 1.8%, particl 0.8%, fe.pt 0.7%, reduct 0.6%, size 0.5%, electrocatalyt 0.4%, polyol 0.4%, metal 0.4%, fe.pt.nanoparticles 0.3%

Discriminating Terms
pt 22.3%, nanoparticl 6.8%, pt.nanoparticles 6.2%, fept 3.3%, platinum 3.1%, fept.nanoparticles 1.7%, film 1.5%, platinum.nanoparticles 1.3%, nanotub 0.6%, crystal 0.5%, fe.pt 0.5%, quantum 0.4%, temperatur 0.4%, si 0.4%, optic 0.4%

Single Word Terms
nanoparticl 107, pt 89, particl 54, platinum 51, size 49, surfac 46, structur 41, metal 35, reduct 34, electron 30, high 30, reaction 29, synthesi 29, activ 28, microscopi 27

Double Word Terms
pt.nanoparticles 56, platinum.nanoparticles 29, electron.microscopy 23, particle.size 21, transmission.electron 20, fept.nanoparticles 19, catalytic.activity 12, room.temperature 12, fe.pt 11, absorption.spectroscopy 10, ray.diffraction 10, size.distribution 9, glassy.carbon 9, magnetic.properties 8, microscopy.tem 8

Triple Word Terms
transmission.electron.microscopy 20, electron.microscopy.tem 8, ray.photoelectron.spectroscopy 7, fe.pt.nanoparticles 6, resolution.transmission.electron 5, pt.nanoparticles.supported 5, high.resolution.transmission 5, narrow.size.distribution 5, glassy.carbon.electrode 4, anisotropy.field.koe 4, nanoparticles.catalytic.activity 4, stabilized.pt.nanoparticles 4, monte.carlo.simulations 3, poly.vinylpyrrolidone.pvp 3, synthesized.chemical.reduction 3

Term Cliques
28.26% nanoparticl fept.nanoparticles fe.pt polyol fe.pt.nanoparticles
36.15% nanoparticl fept.nanoparticles particl fe.pt fe.pt.nanoparticles
37.98% nanoparticl fept fept.nanoparticles size polyol
31.01% nanoparticl fept fept.nanoparticles fe.pt polyol
45.87% nanoparticl fept fept.nanoparticles particl size
38.90% nanoparticl fept fept.nanoparticles particl fe.pt
49.91% pt nanoparticl size electrocatalyt polyol
47.16% pt nanoparticl reduct electrocatalyt polyol
39.45% pt nanoparticl fe.pt reduct polyol fe.pt.nanoparticles
52.56% pt nanoparticl platinum particl size electrocatalyt metal
51.77% pt nanoparticl platinum platinum.nanoparticles particl size electrocatalyt
46.79% pt nanoparticl pt.nanoparticles particl fe.pt reduct fe.pt.nanoparticles
50.69% pt nanoparticl pt.nanoparticles platinum particl reduct electrocatalyt metal
50.00% pt nanoparticl pt.nanoparticles platinum platinum.nanoparticles particl reduct electrocatalyt

Sample Cluster Record Titles

Preparation of Pt-Ru-Co trimetallic nanoparticles and their electrocatalytic properties

Polyol synthesis of platinum nanoparticles: Control of morphology with sodium nitrate

Influence of particle agglomeration on the catalytic activity of carbon-supported Pt nanoparticles in CO monolayer oxidation

Preparation of FePt nanoparticle monolayer by Langmuir-Blogett method

Platinum-nanoparticles on different types of carbon supports: Correlation of electrocatalytic activity with carrier morphology

Small-angle X-ray scattering of carbon-supported Pt nanoparticles for fuel cell

Preparation of tetrahedral Pt nanoparticles having {111} facet on their surface

Platinum nanoparticles from the hydrosilylation reaction: Capping agents, physical characterizations, and electrochemical properties

Crystal structure and compressibility of FePt nanoparticles under high pressures and high temperatures

Cluster Metrics

Authors
ross, pn 4
yang, p 3
sato, k 3
kitamoto, y 3
jeyadevan, b 3
hua, np 3
du, yk 3
chan, ky 3
zhong, cj 2
xu, jz 2
xie, h 2
wang, ly 2
wang, gf 2
van hove, ma 2
tohji, k 2

Sources
electrochimica acta 9
journal of applied physics 7
journal of physical chemistry b 6
recent advances in the science and technology of zeolites and related materials, pts a - c 4
langmuir 4
journal of colloid and interface science 4
chemistry of materials 4
journal of the american chemical society 3
chemistry letters 3
scripta materialia 2
physical chemistry chemical physics 2
nanotechnology 2
journal of nanoscience and nanotechnology 2
journal of materials chemistry 2
journal of magnetism and magnetic materials 2

Keywords
chemistry, physical 30
chemistry, multidisciplinary 17
platinum 17
electrochemistry 12
nanoparticles 11
materials science, multidisciplinary 11
films 11
physics, applied 10
materials science, multidisciplinary 10

surface 10
particles 9
nanoparticles 9
clusters 9
reduction 8
oxidation 8

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2005 97
2004 11
2006 1

Country
usa 25
japan 25
peoples r china 22
germany 7
singapore 4
england 4
sweden 3
spain 3
south korea 3
russia 3
canada 3
taiwan 2
switzerland 2
romania 2
italy 2

Institution
chinese acad sci 7
tokyo inst technol 6
osaka univ 5
univ calif berkeley 4
tohoku univ 4
univ hong kong 3
suzhou univ 3
los alamos natl lab 3
vienna tech univ 2
univ szeged 2
univ s carolina 2
univ erlangen nurnberg 2
univ durham 2
univ calif davis 2
univ alicante 2

DataBase
science citation index 109

- # CLUSTER 124
  Titanium dioxide (TiO2) films, including sol-gel derived and nanocrystalline films, use in dye-sensitized solar cells, photocatalytic activity, and preparation by deposition (141 Records)

Countries: China, followed by Japan. Institutions: CAS, Zhejiang University, Institute of Fundamental Studies.).

Cluster Syntax Features

Descriptive Terms
tio2 34.8%, film 15.2%, tio2.films 9.9%, anatas 1.3%, sol 1.0%, photocatalyt 0.9%, dye 0.8%, solar 0.8%, deposit 0.7%, tio2.film 0.7%, dye.sensitized 0.7%, sol.gel 0.7%, gel 0.6%, nanocrystallin 0.6%, sensit 0.6%

Discriminating Terms
tio2 24.6%, tio2.films 8.1%, film 4.1%, anatas 0.8%, magnet 0.7%, nanotub 0.7%, carbon 0.7%, particl 0.6%, surfac 0.6%, photocatalyt 0.6%, tio2.film 0.6%, nanoparticl 0.5%, structur 0.5%, dye.sensitized 0.5%, sol 0.5%

Single Word Terms
film 139, tio2 130, deposit 63, substrat 60, electron 56, structur 50, properti 49, glass 43, temperatur 41, gel 41, surfac 40, sol 39, anatas 38, thin 38, nanocrystallin 37

Double Word Terms
tio2.films 74, sol.gel 39, tio2.film 25, electron.microscopy 23, ray.diffraction 22, thin.films 22, films.deposited 20, titanium.dioxide 18, scanning.electron 18, nanocrystalline.tio2 18, glass.substrates 18, dye.sensitized 18, solar.cells 15, photocatalytic.activity 14, sensitized.solar 14

Triple Word Terms
dye.sensitized.solar 14, scanning.electron.microscopy 13, atomic.force.microscopy 12,

sensitized.solar.cells 11, force.microscopy.afm 10, nanocrystalline.tio2.films 10, transmission.electron.microscopy 10, ray.diffraction.xrd 9, sol.gel.derived 8, films.sol.gel 8, ray.photoelectron.spectroscopy 8, tio2.thin.films 7, anatase.tio2.films 6, tio2.films.deposited 6, titanium.dioxide.films 6

Term Cliques
32.15% film dye solar dye.sensitized nanocrystallin sensit
30.73% film dye solar tio2.film dye.sensitized sensit
37.47% film dye solar deposit nanocrystallin sensit
44.44% tio2 film dye dye.sensitized nanocrystallin sensit
43.03% tio2 film dye tio2.film dye.sensitized sensit
49.76% tio2 film dye deposit nanocrystallin sensit
42.46% tio2 film anatas sol photocatalyt tio2.film sol.gel gel
56.86% tio2 film tio2.films anatas deposit nanocrystallin
53.19% tio2 film tio2.films anatas photocatalyt gel
55.79% tio2 film tio2.films anatas photocatalyt deposit

Sample Cluster Record Titles

Atomic layer deposition of TiO2-xNx thin films for photocatalytic applications

Flexible metallic substrates for TiO2 film of dye-sensitized solar cells

Epitaxial growth and characteristics of N-doped anatase TiO2 films grown using a free-radical nitrogen oxide source

Epitaxial growth of tin oxide films on (001)TiO2 substrates by KrF and XeCl excimer laser annealing

Improvement of piezoelectric crystal sensor for the detection of organic vapors using nanocrystalline TiO2 films

Challenges of producing TiO2 films by microwave heating

HAP/TiO2 composite films: Preparation, characterisation and their behaviors in simulated body fluid

Growth of anatase films on vicinal and flat LaAlO3 (110) substrates by oxygen plasma assisted molecular beam epitaxy

Effect of Ar plasma treatment on the photo-electrical properties of nanocrystal TiO2 films

Cluster Metrics

Authors
zhao, xj 4
zhao, qn 4
zhang, jy 4
verma, a 4
liu, bs 4
he, x 4
bakhshi, ak 4
agnihotry, sa 4
yang, h 3
vigil, e 3
tennakone, k 3
perera, vps 3
domenech, x 3
ding, xg 3
ayllon, ja 3

Sources
thin solid films 11
solar energy materials and solar cells 8
rare metal materials and engineering 8
journal of physical chemistry b 7
journal of sol-gel science and technology 5
sensors and actuators b-chemical 4
journal of applied physics 4
applied surface science 4
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 3
langmuir 3
journal of the electrochemical society 3
journal of photochemistry and photobiology a-chemistry 3
journal of non-crystalline solids 3
journal of electroanalytical chemistry 3
chemistry letters 3

Keywords
materials science, multidisciplinary 46
chemistry, physical 23
tio2 22
physics, applied 21
thin-films 20
physics, 17
thin-films 14
condensed matter 13
photocatalysis 13
materials science, ceramics 11

engineering 11
titanium-dioxide 11
surface 11
physics, condensed matter 11
metallurgy & metallurgical 11

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2005 121
2004 14
2006 6

Country
peoples r china 39
japan 24
usa 12
south korea 10
england 9
italy 7
india 6
germany 6
sri lanka 5
spain 5
taiwan 4
switzerland 3
ireland 3
cuba 3
australia 3

Institution
chinese acad sci 7
zhejiang univ 5
inst fundamental studies 5
wuhan univ technol 4
wuhan univ 4
univ london imperial coll sci technol & med 4
univ delhi 4
natl phys lab 4
univ autonoma barcelona 3
kobe univ 3
hong kong polytech univ 3
univ tokyo 2
univ sci & technol china 2
univ nottingham 2
univ milan 2

- # CLUSTER 24
  Preparation of titanium dioxide (TiO2) thin films by sol-gel process or deposition, photocatalytic activity of TiO2 films, and doped TiO2 films (105 Records)

(Countries: China, followed by South Korea. Institutions: CAS dominant, Zhejiang University, Seoul National University, UNAM.).

Cluster Syntax Features

Descriptive Terms
tio2 28.8%, tio2.thin 13.9%, tio2.thin.films 10.3%, film 8.6%, thin.films 6.2%, thin 5.7%, anatas 1.4%, photocatalyt 1.2%, sol 0.8%, dope 0.7%, tio2.films 0.7%, sol.gel 0.6%, gel 0.4%, doped.tio2 0.4%, deposit 0.4%

Discriminating Terms
tio2 17.7%, tio2.thin 10.2%, tio2.thin.films 7.6%, thin.films 3.1%, thin 2.2%, film 1.2%, anatas 0.9%, surfac 0.7%, photocatalyt 0.7%, carbon 0.7%, nanoparticl 0.7%, nanotub 0.6%, magnet 0.6%, particl 0.6%, structur 0.5%

Single Word Terms
film 104, thin 104, tio2 102, deposit 54, temperatur 50, substrat 50, rai 46, anatas 42, sol 41, structur 40, glass 40, electron 39, diffract 39, gel 38, properti 37

Double Word Terms

thin.films 102, tio2.thin 75, sol.gel 38, ray.diffraction 35, tio2.films 28, thin.film 25, films.deposited 20, atomic.force 18, force.microscopy 17, doped.tio2 17, glass.substrates 17, films.sol 17, scanning.electron 16, electron.microscopy 16, anatase.phase 15

Triple Word Terms
tio2.thin.films 69, tio2.thin.film 18, atomic.force.microscopy 16, films.sol.gel 16, thin.films.deposited 15, ray.diffraction.xrd 14, thin.films.sol 14, doped.tio2.thin 13, scanning.electron.microscopy 11, ray.photoelectron.spectroscopy 10, thin.films.tio2 10, transmission.electron.microscopy 9, activity.tio2.thin 8, films.ray.diffraction 8, atomic.layer.deposition 7

Term Cliques
63.39% tio2 film thin.films thin anatas sol tio2.films sol.gel gel
58.86% tio2 film thin.films thin anatas sol dope sol.gel gel doped.tio2
64.29% tio2 film thin.films thin anatas photocatalyt sol doped.tio2
65.60% tio2 film thin.films thin anatas photocatalyt sol tio2.films
71.96% tio2 tio2.thin tio2.thin.films film thin.films thin anatas tio2.films deposit
66.57% tio2 tio2.thin tio2.thin.films film thin.films thin anatas dope doped.tio2 deposit
68.04% tio2 tio2.thin tio2.thin.films film thin.films thin anatas photocatalyt doped.tio2
69.21% tio2 tio2.thin tio2.thin.films film thin.films thin anatas photocatalyt tio2.films

Sample Cluster Record Titles

Synthesis and hydrophilicity of TiO2 thin films from aqueous TiOSO4 solution

Preparation of anatase TiO2 thin films with ((OPr)-Pr-i)(2)Ti(CH3COCHCONEt2)(2) precursor by MOCVD

Direct photodeposition of nanostructured TiO2 thin films from B-diketonate complexes, and their photocatalytic behaviour.

Very thin TiO2 films prepared by plasma enhanced atomic layer deposition (PEALD)

Preparation of multi-nanocrystalline transition metal oxide (TiO2-NiTiO3) mesoporous thin films

Quantum confinement effects of CdTe nanocrystals sequestered in TiO2matrix: effect of oxygen incorporation

Synthesis and characterization of anatase-TiO2 thin films

Preparation of TiO2 thin films at low temperature and characterization of their properties

Low-temperature preparation of photocatalytic TiO2 thin films from anatase sols

Cluster Metrics

Authors
hwang, cs 4
yu, jg 3
wang, j 3
lokhande, cd 3
kim, sk 3
kim, bh 3
joo, os 3
jeong, ds 3
jeon, ys 3
jeon, ko 3
hwang, ks 3
zhou, xw 2
zhou, f 2
yu, y 2
yu, hg 2

Sources
thin solid films 10
applied surface science 5
rare metal materials and engineering 4
surface & coatings technology 3
journal of the korean physical society 3
journal of inorganic materials 3
journal of crystal growth 3
topics in catalysis 2
materials letters 2
materials chemistry and physics 2
journal of sol-gel science and technology 2
journal of physical chemistry b 2
journal of optoelectronics and advanced materials 2
journal of materials research 2
high-performance ceramics iii, pts 1 and 2 2

Keywords
materials science, multidisciplinary 30
physics, applied 18
tio2 16
physics, 16
chemistry, physical 14
thin films 13
deposition 13

tio2 12
condensed matter 11
titanium-dioxide 10
photocatalytic activity 9
physics, condensed matter 8
physics, multidisciplinary 7
physics, applied 7
materials science, ceramics 7

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2003 1

Country
peoples r china 34
south korea 20
japan 10
india 8
france 7
germany 5
england 5
taiwan 4
mexico 4
turkey 3
spain 3
usa 2
singapore 2
italy 2
australia 2

Institution
chinese acad sci 9
zhejiang univ 4
seoul natl univ 4
wuhan univ technol 3
tsing hua univ 3
nambu univ 3
kyushu univ 3
korea inst sci & technol 3
chonnam natl univ 3
univ paris 06 2
univ nacl autonoma mexico 2
unam 2
sungkyunkwan univ 2

shivaji univ 2
royal inst great britain 2

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science citation index 105

- # CLUSTER 107
  Anatase and rutile titanium dioxide (TiO2), emphasizing photocatalytic use and characterization of TiO2 nanoparticles (379 Records)

China dominant, Japan, USA, South Korea. Institutions: CAS, Tianjin University, Kyoto University, Tsing Hua University. USA includes ORNL.).

Cluster Syntax Features

Descriptive Terms
tio2 69.7%, anatas 3.2%, rutil 0.9%, titanium 0.7%, photocatalyt 0.6%, sol 0.5%, anatase.tio2 0.5%, surfac 0.4%, oxid 0.4%, tio2.nanoparticles 0.3%, photocatalyst 0.3%, titania 0.3%, gel 0.3%, tio2.particles 0.3%, ti 0.3%

Discriminating Terms
tio2 47.3%, anatas 2.1%, film 1.3%, magnet 0.6%, nanotub 0.6%, rutil 0.6%, carbon 0.5%, structur 0.5%, quantum 0.4%, temperatur 0.4%, layer 0.4%, field 0.4%, photocatalyt 0.3%, deposit 0.3%, si 0.3%

Single Word Terms
tio2 376, surfac 200, anatas 158, structur 132, size 126, particl 119, oxid 116, electron 116, xrd 116, titanium 115, activ 109, phase 103, gel 102, properti 100, temperatur 98

Double Word Terms
sol.gel 89, titanium.dioxide 58, anatase.tio2 58, electron.microscopy 51, surface.area 51, tio2.nanoparticles 49, tio2.particles 48, ray.diffraction 48, transmission.electron 37, anatase.rutile 32, tio2.tio2 31, photocatalytic.activity 31, scanning.electron 29, pure.tio2 28, diffraction.xrd 27

Triple Word Terms
transmission.electron.microscopy 30, scanning.electron.microscopy 26, dye.sensitized.solar 25, ray.photoelectron.spectroscopy 23, ray.diffraction.xrd 21, titanium.dioxide.tio2 20, electron.microscopy.tem 17, photoelectron.spectroscopy.xps 17, sensitized.solar.cells 17, fourier.transform.infrared 15, tio2.sol.gel 15, electron.microscopy.sem 14, bet.surface.area 11, sensitized.solar.cell 11, photocatalytic.activity.tio2 10

Term Cliques
36.52% tio2 sol anatase.tio2 surfac oxid titania ti
39.45% tio2 photocatalyt surfac oxid tio2.particles ti
37.84% tio2 photocatalyt sol anatase.tio2 surfac oxid ti
37.20% tio2 titanium anatase.tio2 surfac oxid titania ti
37.04% tio2 anatas photocatalyt sol anatase.tio2 surfac photocatalyst gel
34.89% tio2 anatas rutil sol anatase.tio2 surfac titania gel ti
38.30% tio2 anatas rutil photocatalyt surfac tio2.particles ti
33.61% tio2 anatas rutil photocatalyt sol anatase.tio2 surfac tio2.nanoparticles gel ti
35.41% tio2 anatas rutil titanium anatase.tio2 surfac titania gel ti

Sample Cluster Record Titles

Characterization of nanometer-sized Al/TiO2 photocatalysts and the decomposition of benzene in plasma- and photo-types systems

Straightforward fabrication of highly ordered TiO2 nanowire arrays in AAM on aluminum substrate

Preparation and characterization of mesoporous SBA-15 supported dye-sensitized TiO2 photocatalyst

Predicting the energetics, phase stability, and morphology evolution of faceted and spherical anatase nanocrystals

Reactions of ammonia on stoichiometric and reduced $TiO_2(001)$ single crystal surfaces

Catalytic activity of porous TiO_2 obtained by sol-gel process in the degradation of phenol

Photoinduced reactivity of titanium dioxide

Adsorption of poly(acrylic acid) onto the surface of titanium dioxide and the colloidal stability of aqueous suspension

The preparation of rutile TiO_2 nanopowders, phase transformation and their photocatalysed properties

Cluster Metrics

Authors
zhong, sh 9
liu, y 7
yoshikawa, s 6
mei, cs 5
kiwi, j 5
adachi, m 5
zhang, xd 4
wu, y 4
wang, fm 4
overbury, sh 4
li, j 4
kang, m 4
kado, t 4
hayase, s 4
gao, l 4

Sources
journal of physical chemistry b 24
materials letters 13
journal of sol-gel science and technology 11
chemistry letters 11
rare metal materials and engineering 10
langmuir 10
journal of photochemistry and photobiology a-chemistry 9
chinese journal of inorganic chemistry 8
acta chimica sinica 8
sensors and actuators b-chemical 7
materials chemistry and physics 7
journal of solid state chemistry 7
journal of colloid and interface science 7

journal of the american chemical society 6
journal of inorganic materials 6

Keywords
chemistry, physical 95
tio2 69
materials science, multidisciplinary 64
chemistry, multidisciplinary 59
titania 46
water 40
oxidation 37
particles 31
tio2 30
photocatalysis 29
films 29
materials science, ceramics 28
oxide 28
nanoparticles 28
titanium-dioxide 25

Publication Year
2005 336
2004 37
2006 6

Country
peoples r china 157
japan 53
usa 45
south korea 38
germany 16
taiwan 11
italy 9
switzerland 8
france 8
england 8
spain 7
india 7
singapore 6
australia 6
mexico 5

Institution
chinese acad sci 30
tianjin univ 19
kyoto univ 15

tsing hua univ 11
zhejiang univ 9
seoul natl univ 8
jilin univ 8
kyushu inst technol 6
kyung hee univ 6
peking univ 5
osaka univ 5
oak ridge natl lab 5
fudan univ 5
e china univ sci & technol 5
xiamen univ 4

DataBase
science citation index 379

- # CLUSTER 65
  Studies on photocatalytic activity, such as photocatalytic degradation, of titanium dioxide (TiO2), primarily under visible light irradiation (224 Records)

(Countries: China very dominant, Japan, South Korea. Institutions: CAS, University of Osaka Prefecture, Zhejiang University, Kyoto University.).

Cluster Syntax Features

Descriptive Terms
photocatalyt 29.9%, tio2 15.2%, photocatalytic.activity 6.8%, titania 3.8%, photocatalyst

2.9%, visible.light 2.4%, anatas 2.4%, activ 2.3%, degrad 2.2%, visibl 1.6%, light 1.2%, photocatalytic.degradation 0.9%, dope 0.7%, irradi 0.6%, dye 0.6%

Discriminating Terms

photocatalyt 20.2%, tio2 8.2%, photocatalytic.activity 4.6%, titania 2.3%, photocatalyst 1.9%, visible.light 1.6%, film 1.6%, anatas 1.5%, degrad 1.2%, visibl 0.9%, activ 0.6%, photocatalytic.degradation 0.6%, magnet 0.6%, nanotub 0.6%, carbon 0.5%

Single Word Terms

photocatalyt 202, tio2 166, activ 161, degrad 107, surfac 102, anatas 94, light 88, photocatalyst 88, xrd 86, structur 78, temperatur 77, oxid 74, irradi 73, high 71, visibl 71

Double Word Terms

photocatalytic.activity 140, visible.light 61, photocatalytic.degradation 57, sol.gel 53, surface.area 50, ray.diffraction 45, titanium.dioxide 37, light.irradiation 32, diffraction.xrd 31, anatase.rutile 30, activity.tio2 26, methyl.orange 26, doped.tio2 26, electron.microscopy 26, methylene.blue 25

Triple Word Terms

ray.diffraction.xrd 31, visible.light.irradiation 28, photocatalytic.activity.tio2 23, high.photocatalytic.activity 16, transmission.electron.microscopy 14, scanning.electron.microscopy 14, ray.photoelectron.spectroscopy 12, high.surface.area 12, photoelectron.spectroscopy.xps 11, electron.microscopy.tem 10, degradation.methyl.orange 10, photocatalytic.activity.degradation 9, size.surface.area 9, fourier.transform.infrared 9, bet.surface.area 9

Term Cliques

40.97% photocatalyt photocatalyst visible.light activ visibl light dope irradi dye
45.71% photocatalyt tio2 photocatalyst activ degrad light photocatalytic.degradation dope irradi dye
46.34% photocatalyt tio2 photocatalyst activ degrad visibl light dope irradi dye
54.61% photocatalyt tio2 titania activ light dope
50.45% photocatalyt tio2 photocatalytic.activity photocatalyst activ degrad visibl dope dye
55.41% photocatalyt tio2 photocatalytic.activity photocatalyst anatas activ degrad dye
58.48% photocatalyt tio2 photocatalytic.activity titania activ dope
61.98% photocatalyt tio2 photocatalytic.activity titania anatas active

Sample Cluster Record Titles

Preparation of porous TiO2 cryogel fibers through unidirectional freezing of hydrogel followed by freeze-drying

Synthesis and characterization of nano titania powder with high photoactivity for gas-phase photo-oxidation of benzene from TiOCl2 aqueous solution at low temperatures

Photooxidation of xylenol orange in the presence of palladium-modified TiO2 catalysts

Preparation and photocatalytic activity of titanium oxide anchored on the channel surface of nanoporous material VSB-1

Discoloration and mineralization of Orange II by using Fe3+-doped TiO2 and bentonite clay-based Fe nanocatalysts

Photocatalytic degradation of two selected dye derivatives, chromotrope 2B and amido black 10B, in aqueous suspensions of titanium dioxide

The preparation of TiO2 nanoparticle photocatalysts by a flame method and their photocatalytic reactivity for the degradation of 2-propanol

Mesoporous spherical aggregates of anatase nanocrystals with wormhole-like framework structures: Their chemical fabrication, characterization, and photocatalytic performance

A kinetic model for distinguishing between direct and indirect interfacial hole transfer in the heterogeneous photooxidation of dissolved organics on TiO2 nanoparticle suspensions

Cluster Metrics

Authors
lee, gd 7
hong, ss 7
anpo, m 7
yu, jg 6
park, ss 5
jing, lq 5
fu, hg 5
amal, r 5
zhang, jl 4
yuan, cw 4
yu, y 4
yoshikawa, s 4
ju, cs 4
gao, l 4
fu, xz 4

Sources
journal of physical chemistry b 15
applied catalysis b-environmental 14

journal of molecular catalysis a-chemical 9
journal of photochemistry and photobiology a-chemistry 7
research on chemical intermediates 6
rare metal materials and engineering 6
journal of solid state chemistry 6
chemistry of materials 6
catalysis communications 6
langmuir 5
chinese journal of catalysis 5
catalysis today 5
solar energy materials and solar cells 4
materials letters 4
journal of the american ceramic society 4

Keywords
chemistry, physical 92
tio2 51
degradation 50
water 40
photocatalysis 34
photocatalysis 29
oxidation 29
tio2 28
materials science, multidisciplinary 27
anatase 26
chemistry, multidisciplinary 25
particles 25
titanium-dioxide 20
engineering, chemical 20
chemistry, physical 20

Publication Year
2005 195
2004 23
2006 6

Country
peoples r china 100
japan 35
south korea 23
usa 16
germany 10
india 9
australia 9
france 7
taiwan 5

italy 5
spain 4
thailand 3
singapore 2
russia 2
iran 2

Institution
chinese acad sci 21
univ osaka prefecture 9
zhejiang univ 8
kyoto univ 8
pukyong natl univ 7
wuhan univ technol 6
univ new s wales 6
wuhan univ 5
tsing hua univ 5
pohang univ sci & technol 5
ne normal univ 5
jilin univ 5
heilongjiang univ 5
nims 4
nanjing univ 4

DataBase
science citation index 224

- CLUSTER 199
  Preparation of materials (including powders, silica (SiO_2), and particles) by sol-gel synthesis and subsequent characterization, especially using x-ray diffraction (XRD) (429 Records)

(Countries: China dominant, USA, India. Institutions: National Chemistry lab, CAS, Shandong University.).

Cluster Syntax Features

Descriptive Terms

gel 29.1%, sol 16.2%, sol.gel 13.0%, powder 2.3%, phase 1.0%, precursor 0.8%, calcin 0.6%, sio2 0.6%, materi 0.6%, xrd 0.6%, particl 0.5%, synthesi 0.5%, size 0.5%, temperatur 0.5%, silica 0.4%

Discriminating Terms

gel 21.9%, sol 12.2%, sol.gel 10.0%, film 1.8%, powder 0.9%, surfac 0.7%, nanotub 0.7%, carbon 0.5%, layer 0.5%, quantum 0.5%, deposit 0.5%, nanoparticl 0.5%, polym 0.4%, structur 0.4%, calcin 0.4%

Single Word Terms

gel 411, sol 340, temperatur 200, size 197, powder 182, rai 182, phase 176, xrd 172, structur 161, diffract 160, particl 158, synthesi 156, electron 142, materi 142, properti 127

Double Word Terms

sol.gel 328, ray.diffraction 143, electron.microscopy 97, transmission.electron 73, particle.size 69, diffraction.xrd 68, scanning.electron 57, synthesized.sol 45, citric.acid 42, gel.derived 34, surface.area 34, gel.synthesis 33, heat.treatment 32, gel.route 31, room.temperature 29

Triple Word Terms

ray.diffraction.xrd 61, transmission.electron.microscopy 51, scanning.electron.microscopy 50, synthesized.sol.gel 44, sol.gel.synthesis 32, sol.gel.derived 30, sol.gel.route 27, electron.microscopy.sem 26, electron.microscopy.tem 23, powders.sol.gel 20, fourier.transform.infrared 17, average.particle.size 17, sol.gel.auto 16, diffraction.xrd.transmission 16, powder.sol.gel 15

Term Cliques

51.25% gel sol sol.gel sio2 xrd particl silica
50.25% gel sol sol.gel sio2 materi particl silica
53.55% gel sol sol.gel precursor xrd particl silica
52.55% gel sol sol.gel precursor materi particl silica
53.67% gel sol sol.gel phase sio2 xrd particl temperatur
53.68% gel sol sol.gel phase sio2 materi particl
49.73% gel sol sol.gel phase precursor calcin materi particl synthesi
49.13% gel sol sol.gel powder phase precursor calcin xrd particl synthesi size temperature

Sample Cluster Record Titles

Phase separation in sol-gel derived ZrO2-SiO2 nanostructured materials

Effect of drying temperature on the characteristics of the lead zirconium titanate powders prepared by sol-gel process

Effect of pH on the formation and combustion process of sol-gel auto-combustion derived NiZn ferrite/SiO2 composites

Sol-gel synthesis of Zn-thiourea-SiO2 thin films from (EtO)(3)Si(CH2)(3)NHC(=S)NHPh as molecular precursor

Sol-gel synthesis and characterization of YBa2(Cu1-xCrx)(4)O-8 superconductor

Micro-Raman study of indium doped zirconia obtained by sol-gel

Effect of presence of an acid catalyst on structure and properties of iron-doped siloxane-polyoxyethylene nanocomposites prepared by sol-gel

Sol-gel preparation and characterization of CoFe2O4-SiO2 nanocomposites

Synthesis of Ba(Mg1/3Ta2/3)O-3 microwave ceramics through a sol-gel route using acetate salts

Cluster Metrics

Authors

ravi, v 12
pasricha, r 7
tondello, e 6
armelao, l 6
yang, h 5
wu, kh 5
ge, cc 5
yuan, dr 4
yan, qz 4
su, xt 4
liu, w 4
kareiva, a 4
dhage, sr 4
chen, ch 4
bottaro, g 4

Sources

journal of sol-gel science and technology 26
rare metal materials and engineering 22
journal of non-crystalline solids 19
materials letters 18
journal of the american ceramic society 15
chemistry of materials 15
high-performance ceramics iii, pts 1 and 2 14
journal of physical chemistry b 10
journal of inorganic materials 10
materials research bulletin 9
journal of materials chemistry 9
materials science and engineering b-solid state materials for advanced technology 8
materials chemistry and physics 8
journal of the european ceramic society 8
journal of rare earths 6

Keywords

materials science, multidisciplinary 109
materials science, ceramics 94
chemistry, physical 60
materials science, multidisciplinary 58
sol-gel 53
nanoparticles 31
engineering 29
metallurgy & metallurgical 29
sol-gel 26
powders 26
physics, applied 26
physics, condensed matter 24
oxides 24
chemistry, multidisciplinary 23
silica 22

Publication Year

2005 360
2004 61
2006 7
2003 1

Country

peoples r china 135
usa 33
india 30
italy 23

japan 22
taiwan 20
france 20
south korea 18
germany 17
poland 14
spain 13
mexico 13
england 13
brazil 10
portugal 9

Institution
natl chem lab 14
chinese acad sci 13
shandong univ 12
zhejiang univ 10
natl cheng kung univ 10
univ sci & technol beijing 9
tsing hua univ 9
univ autonoma metropolitana iztapalapa 8
xian jiaotong univ 7
univ padua 7
univ aveiro 6
polish acad sci 6
univ sci & technol china 5
tianjin univ 5
jilin univ 5

DataBase
science citation index 429

- # CLUSTER 208
  Preparation and characterization of powders, emphasizing studies of particle size, synthesis by combustion process or co-precipitation method, and x-ray diffraction (XRD) analyses (491 Records)

(Countries: China, South Korea, India, followed by USA, Japan. Institutions: CAS, National Chemistry Lab, Tsing Hua University.).

Cluster Syntax Features

Descriptive Terms
powder 50.7%, particl 1.4%, combust 1.4%, synthesi 1.4%, size 1.3%, precipit 1.1%, calcin 1.0%, synthes 0.9%, precursor 0.8%, phase 0.8%, xrd 0.7%, temperatur 0.7%, nanocrystallin 0.6%, particle.size 0.6%, nano 0.6%

Discriminating Terms
powder 38.5%, film 2.3%, combust 1.1%, nanotub 0.7%, layer 0.7%, nanoparticl 0.7%, calcin 0.6%, precipit 0.6%, surfac 0.6%, quantum 0.5%, carbon 0.5%, deposit 0.5%, magnet 0.5%, structur 0.4%, si 0.4%

Single Word Terms
powder 486, size 282, particl 260, temperatur 241, synthesi 229, phase 204, rai 204, xrd 203, synthes 192, diffract 167, electron 160, structur 146, tem 130, microscopi 129, high 128

Double Word Terms
ray.diffraction 142, particle.size 132, electron.microscopy 119, diffraction.xrd 84, transmission.electron 81, scanning.electron 79, powders.synthesized 62, surface.area 56, solid.state 55, microscopy.sem 44, single.phase 40, microscopy.tem 38, low.temperature 34, xrd.tem 32, room.temperature 32

Triple Word Terms
ray.diffraction.xrd 74, transmission.electron.microscopy 65, scanning.electron.microscopy 64, electron.microscopy.sem 42, electron.microscopy.tem 38, solid.state.reaction 28, average.particle.size 27, powder.ray.diffraction 24, powders.ray.diffraction 23, xrd.transmission.electron 22, ray.powder.diffraction 18, xrd.scanning.electron 14, diffraction.xrd.transmission 14, scanning.electron.microscope 14, differential.thermal.dta 13

Term Cliques
42.33% powder particl size precipit calcin synthes phase xrd temperatur particle.size

nano
42.75% powder particl synthesi size precipit calcin synthes phase xrd temperatur nanocrystallin particle.size
44.57% powder particl synthesi size precipit calcin synthes precursor phase xrd temperatur
44.03% powder particl combust synthesi size calcin synthes precursor phase xrd temperature

Sample Cluster Record Titles

X-ray diffraction analysis of quasi-crystalline AlCuFe powder oxidation at 500 degrees C

Preparation and electrochemical characterization of size controlled SnO2-RuO2 composite powder for monolithic hybrid battery

Direct synthesis of iron oxide nanopowders by the combustion approach: Reaction mechanism and properties

Preparation of nano metal carbide powders by electric explosion of conductors in liquid hydrocarbons

Fabrication and characterization of nano Fe-Al mixture powders by the simultaneous pulsed wire evaporation method

Preparation and electromagnetic performance of Cu/T-ZnO whiskers composite powders by electroless copper plating

Preparation and gas-sensing properties of zinc oxide nano-powders by microwave hydrolysis

Synthesis and characterization of microwave-hydrothermally derived Ba1-xSrxTiO3 powders

Synthesis of nano-sized ceria powders by two-emulsion method using sodium hydroxide

Cluster Metrics

Authors

ravi, v 15
zhao, xb 8
lee, jh 8

fu, yp 8
samuel, v 7
shi, jl 6
zhu, tj 5
tu, jp 5
pasricha, r 5
liu, h 5
lee, js 5
huang, by 5
dhage, sr 5
zhang, y 4
won, cw 4

Sources
rare metal materials and engineering 30
materials letters 30
journal of alloys and compounds 21
journal of the american ceramic society 19
high-performance ceramics iii, pts 1 and 2 17
ceramics international 17
chinese journal of inorganic chemistry 13
materials research bulletin 11
materials chemistry and physics 11
journal of the european ceramic society 10
journal of materials research 10
journal of the ceramic society of japan 8
transactions of nonferrous metals society of china 7
materials science and engineering b-solid state materials for advanced technology 7
materials science and engineering a-structural materials properties microstructure and processing 7

Keywords
materials science, multidisciplinary 164
materials science, ceramics 80
engineering 49
metallurgy & metallurgical 49
chemistry, physical 46
physics, applied 40
materials science, multidisciplinary 40
powders 38
particles 33
physics, condensed matter 25
nanoparticles 25
chemistry, inorganic & nuclear 24
oxides 23
metallurgical engineering 22

microstructure 22

Publication Year
2005 434
2004 49
2006 8

Country
peoples r china 177
south korea 52
india 51
usa 38
japan 38
france 29
taiwan 26
russia 17
italy 13
germany 13
brazil 10
australia 9
switzerland 8
england 8
poland 7

Institution
chinese acad sci 27
natl chem lab 20
tsing hua univ 17
zhejiang univ 13
hanyang univ 12
univ sci & technol china 8
russian acad sci 8
natl inst mat sci 8
wu feng inst technol 7
shandong univ 7
cent s univ 7
univ sci & technol beijing 6
jinan univ 6
natl taiwan univ 5
korea inst sci & technol 5

DataBase
science citation index 491

- # CLUSTER 49
  High-energy ball milling, focusing on production of materials (especially nanocrystalline powders), phase formation/transformation, and studies on magnesium hydride (MgH2) (200 Records)

(Countries: China, followed by Japan, USA. Institutions: CAS, RAS. USA includes UCD.).

Cluster Syntax Features

Descriptive Terms
mill 51.3%, ball 7.9%, powder 6.5%, ball.milling 3.6%, alloi 1.2%, phase 1.0%, nanocrystallin 0.8%, mechan 0.8%, high.energy 0.8%, energy.ball 0.6%, high.energy.ball 0.6%, milling.time 0.6%, mgh2 0.6%, hydrogen 0.6%, mechanical.alloying 0.6%

Discriminating Terms
mill 34.0%, ball 5.1%, powder 2.9%, ball.milling 2.4%, film 1.9%, surfac 0.7%, layer 0.6%, nanoparticl 0.6%, nanotub 0.5%, deposit 0.5%, high.energy 0.5%, magnet 0.5%, quantum 0.4%, high.energy.ball 0.4%, energy.ball 0.4%

Single Word Terms
mill 195, powder 151, ball 135, mechan 108, high 103, rai 102, phase 100, size 98, diffract 96, temperatur 89, energi 86, structur 81, composit 72, particl 72, format 71

Double Word Terms
ball.milling 104, ray.diffraction 74, high.energy 69, energy.ball 48, milling.time 43, electron.microscopy 42, mechanical.alloying 36, ball.milled 32, particle.size 31, scanning.electron 30, ball.mill 30, diffraction.xrd 28, milled.powders 27, mechanical.milling 25, transmission.electron 25

Triple Word Terms
high.energy.ball 48, energy.ball.milling 44, transmission.electron.microscopy 24, scanning.electron.microscopy 23, ray.diffraction.xrd 22, differential.scanning.calorimetry 18, electron.microscopy.sem 16, ray.powder.diffraction 14, planetary.ball.mill 13, synthesized.high.energy 12, electron.microscopy.tem 11, high.energy.milling 11, solid.state.reaction 9, spark.plasma.sintering 7, diffraction.transmission.electron 7

Term Cliques
37.67% mill alloi mechan mgh2 hydrogen mechanical.alloying
47.50% mill powder alloi phase nanocrystallin mechan milling.time mechanical.alloying
48.70% mill ball ball.milling mgh2 hydrogen
54.00% mill ball powder ball.milling phase nanocrystallin high.energy milling.time
50.94% mill ball powder ball.milling phase nanocrystallin high.energy energy.ball high.energy.ball

Sample Cluster Record Titles

Controlled mechano-chemical synthesis of nanostructured ternary complex hydride Mg2FeH6 under low-energy impact mode with and without pre-milling

Characterisation of Mg-x wt.% FeTi (x=5-30) and Mg-40 wt.% FeTiMn hydrogen absorbing materials prepared by mechanical alloying

Mechanochemical synthesis of nanocomposite powder for ultrafine (Ti, Mo)C-Ni cermet without core-rim structure

Phase transformations in nanocrystalline TiO2 milled in different milling atmospheres

Formation of an intermediate phase in the ball milling synthesis of the sillenite phase of BSO and BTO

Characteristics of nano-reactor and phenomena during mechanical milling of hematite-graphite mixture

Nanoparticles of ZnO obtained by mechanical milling

Nanocrystalline NiCrAlY powder synthesis by mechanical cryomilling

Controlled reduction of NiO using reactive ball milling under hydrogen atmosphere leading to Ni-NiO nanocomposites

Cluster Metrics

Authors

pradhan, sk 8
zhou, t 4
varin, ra 4
petkov, v 4
jiang, w 4
ichikawa, t 4
calka, a 4
zhang, yf 3
wang, lj 3
spassov, t 3
schultz, l 3
oleszak, d 3
morozova, o 3
huot, j 3
grabias, a 3

Sources

journal of alloys and compounds 33
materials science and engineering a-structural materials properties microstructure and processing 9
rare metal materials and engineering 8
journal of the american ceramic society 7
reviews on advanced materials science 6
materials chemistry and physics 6
journal of materials processing technology 6
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 5
powder technology 5
materials science and engineering b-solid state materials for advanced technology 5
materials transactions 4
journal of materials science 4
transactions of nonferrous metals society of china 3
scripta materialia 3
journal of physical chemistry b 3

Keywords

materials science, multidisciplinary 67
materials science, multidisciplinary 45
chemistry, physical 43
metallurgical engineering 36
metallurgy & 36
engineering 20
metallurgy & metallurgical 20

materials science, ceramics 17
powders 17
kinetics 17
x-ray diffraction 15
mechanical alloying 15
system 13
ball milling 13
mechanical alloying 12

Publication Year

2005 169
2004 24
2006 7

Country

peoples r china 37
japan 22
usa 18
india 15
germany 15
poland 13
spain 12
france 12
canada 11
south korea 10
russia 10
italy 9
serbia monteneg 7
mexico 7
brazil 7

Institution

chinese acad sci 14
russian acad sci 6
univ wollongong 5
univ belgrade 5
xian jiaotong univ 4
warsaw univ technol 4
univ waterloo 4
univ calif davis 4
univ cagliari 4
univ burdwan golapbag 4
univ burdwan 4
tohoku univ 4
silesian tech univ 4
indian inst technol 4

ifw dresden 4

DataBase
science citation index 200

- CLUSTER 198
  Sintering (especially spark plasma sintering) to produce and modify materials, including ceramics and magnesium diboride (MgBr2) materials (143 Records)

China, followed by USA, Japan. Institutions: CAS dominant, Polish Academy of Sciences, UCD, National Institute of Materials Science.).

Cluster Syntax Features

Descriptive Terms

sinter 17.2%, pressur 7.4%, grain 2.8%, gpa 2.6%, high.pressure 2.5%, phase 2.4%, mgb2 1.8%, sampl 1.7%, temperatur 1.7%, plasma.sintering 1.4%, spark.plasma 1.4%, ceram 1.4%, spark.plasma.sintering 1.4%, spark 1.2%, powder 1.1%

Discriminating Terms

sinter 13.1%, pressur 4.5%, film 2.2%, gpa 2.0%, high.pressure 1.9%, mgb2 1.5%, grain 1.2%, plasma.sintering 1.2%, spark.plasma 1.2%, spark.plasma.sintering 1.1%, spark 1.0%, surfac 0.9%, sp 0.8%, carbon 0.7%, nanoparticl 0.7%

Single Word Terms

temperatur 93, high 82, phase 77, grain 67, sinter 61, rai 61, size 61, pressur 59, diffract 58, powder 57, sampl 57, properti 55, structur 54, microstructur 49, electron 44

Double Word Terms

ray.diffraction 53, high.pressure 33, grain.size 33, room.temperature 24, plasma.sintering 22, electron.microscopy 21, spark.plasma 21, high.temperature 19, phase.transition 18, grain.growth 17, pressure.gpa 16, scanning.electron 15, sintering.sps 15, transmission.electron 14, mechanical.properties 13

Triple Word Terms

spark.plasma.sintering 21, plasma.sintering.sps 15, diamond.anvil.cell 11, transmission.electron.microscopy 11, scanning.electron.microscopy 10, average.grain.size 8, synchrotron.ray.diffraction 7, critical.current.density 7, gpa.room.temperature 6, high.pressure.gpa 6, ray.diffraction.xrd 6, dispersive.ray.diffraction 6, scanning.electron.microscope 5, pressure.high.temperature 5, energy.dispersive.ray 5

Term Cliques

45.45% high.pressure phase sampl temperatur
41.40% grain sampl temperatur plasma.sintering powder
46.68% grain phase temperatur ceram
42.66% grain phase mgb2 sampl temperatur
41.12% pressur gpa high.pressure phase temperatur
26.22% sinter grain plasma.sintering spark.plasma ceram spark.plasma.sintering spark powder
38.46% sinter grain temperatur plasma.sintering ceram powder

Sample Cluster Record Titles

The effect of nano-powder additions on the superconducting properties of MgB2

The effect of phosphorus additions on densification, grain growth and properties of nanocrystalline WC-Co composites

Sintering of nanophase WC-15vol.%Co hard metals by rapid sintering process

Mechanical properties and microstructure of silicon nitride ceramics by pressureless sintering

Rapid fabrication of nano-structured Ti5Si3-TiC composites by spark plasma sintering

Preparation and sintering of Ce1-xGdxO2-x/2 nanopowders and their electrochemical and EPR characterization

Spark-plasma sintering of silicon carbide whiskers (SiCw) reinforced nanocrystalline alumina

[Nanocrystalline WC-10%Co-0.8%VC cemented carbides prepared by spark plasma sintering]

[Machinable Ti(3)AIC(2) ceramics produced by spark plasma sintering]

Cluster Metrics

Authors
jin, cq 5
muller, e 4
mukherjee, ak 4
yuan, rz 3
yu, y 3
wu, mk 3
sundqvist, b 3
stiewe, c 3
shi, xl 3
shao, gq 3
liu, j 3
kuntz, jd 3
gierlotka, s 3
duan, xl 3
duan, rg 3

Sources
rare metal materials and engineering 8
journal of the american ceramic society 8
physical review b 7
superconductor science & technology 5
physica c-superconductivity and its applications 5
journal of applied physics 5
solid state ionics 4
journal of materials science 4
ieee transactions on applied superconductivity 4
materials science and engineering a-structural materials properties microstructure and processing 3
journal of the european ceramic society 3
journal of solid state chemistry 3
journal of physical chemistry b 3
journal of alloys and compounds 3
scripta materialia 2

Keywords
materials science, multidisciplinary 38
physics, applied 24

materials science, ceramics 19
microstructure 18
physics, condensed matter 15
physics, condensed matter 14
engineering 12
chemistry, physical 12
metallurgy & metallurgical 12
physics, applied 10
critical-current density 8
phase 8
microstructure 7
composites 7
ceramics 7

Publication Year
2005 121
2004 21
2006 1

Country
peoples r china 35
usa 21
japan 20
india 13
germany 11
france 10
russia 9
poland 8
south korea 6
italy 6
taiwan 5
sweden 5
spain 5
australia 5
ukraine 4

Institution
chinese acad sci 17
polish acad sci 6
univ calif davis 5
natl inst mat sci 5
shanghai univ 4
osaka univ 4
cnrs 4
wuhan univ technol 3
umea univ 3

russian acad sci 3
natl cheng kung univ 3
natl acad sci ukraine 3
australian nucl sci & technol org 3
acad sinica 3
warsaw univ technol 2

DataBase
science citation index 143

- # CLUSTER 101
  Sintering (including spark plasma and liquid phase sintering) of powders, ceramics, nanocomposites, and alumina-based materials, with emphasis on densification and microstructure of products (200 Records)

(Countries: China dominant, Japan, USA, South Korea. Institutions: CAS, Lehigh University, Hanyang University. Other USA includes Penn State University.).

Cluster Syntax Features

Descriptive Terms
sinter 57.0%, powder 6.3%, ceram 2.2%, densif 1.0%, sintering.temperature 0.9%,

composit 0.9%, grain 0.7%, alumina 0.7%, temperatur 0.7%, microstructur 0.6%, phase 0.6%, size 0.5%, particl 0.5%, densiti 0.5%, sampl 0.4%

Discriminating Terms

sinter 38.8%, powder 2.9%, film 1.9%, ceram 1.1%, surfac 0.8%, densif 0.7%, sintering.temperature 0.6%, magnet 0.6%, carbon 0.6%, nanoparticl 0.6%, layer 0.6%, nanotub 0.6%, structur 0.5%, deposit 0.5%, quantum 0.4%

Single Word Terms

sinter 199, powder 143, temperatur 121, size 102, phase 95, microstructur 82, particl 81, densiti 78, composit 76, grain 73, high 72, ceram 72, sampl 72, properti 68, materi 65

Double Word Terms

sintering.temperature 50, ray.diffraction 43, grain.size 37, electron.microscopy 32, particle.size 30, scanning.electron 30, mechanical.properties 25, spark.plasma 24, low.temperature 23, plasma.sintering 23, relative.density 22, diffraction.xrd 22, liquid.phase 17, pressureless.sintering 16, nano.sized 16

Triple Word Terms

spark.plasma.sintering 23, scanning.electron.microscopy 22, ray.diffraction.xrd 21, plasma.sintering.sps 13, transmission.electron.microscopy 12, average.grain.size 12, liquid.phase.sintering 11, electron.microscopy.sem 11, solid.oxide.fuel 8, sintering.low.temperature 6, scanning.electron.microscope 6, particle.size.distribution 6, oxide.fuel.cells 6, diffraction.xrd.scanning 5, low.sintering.temperature 5

Term Cliques

51.50% sinter composit grain temperatur size densiti sampl
52.71% sinter composit grain temperatur phase size sampl
44.57% sinter composit grain alumina size densiti sampl
45.21% sinter composit grain alumina size particl densiti
45.79% sinter composit grain alumina phase size sampl
46.43% sinter composit grain alumina phase size particl
49.64% sinter sintering.temperature grain temperatur size densiti sampl
49.63% sinter sintering.temperature grain temperatur microstructur phase size sampl
42.71% sinter sintering.temperature grain alumina size densiti sampl
43.36% sinter sintering.temperature grain alumina size particl densiti
43.56% sinter sintering.temperature grain alumina microstructur phase size sampl
44.12% sinter sintering.temperature grain alumina microstructur phase size particl
50.86% sinter densif temperatur microstructur phase size sampl
43.93% sinter densif alumina microstructur phase size sampl
44.57% sinter densif alumina microstructur phase size particl
49.21% sinter densif composit temperatur size densiti sampl
50.43% sinter densif composit temperatur phase size sampl
42.29% sinter densif composit alumina size densiti sampl
42.93% sinter densif composit alumina size particl densiti
43.50% sinter densif composit alumina phase size sampl

44.14% sinter densif composit alumina phase size particl
44.57% sinter ceram composit grain alumina size densiti
45.79% sinter ceram composit grain alumina phase size
42.71% sinter ceram sintering.temperature grain alumina size densiti
43.56% sinter ceram sintering.temperature grain alumina microstructur phase size
43.93% sinter ceram densif alumina microstructur phase size
42.29% sinter ceram densif composit alumina size densiti
43.50% sinter ceram densif composit alumina phase size
54.56% sinter powder composit grain temperatur size particl densiti
55.62% sinter powder composit grain temperatur phase size particl
52.94% sinter powder sintering.temperature grain temperatur size particl densiti
52.56% sinter powder sintering.temperature grain temperatur microstructur phase size particl
54.00% sinter powder densif temperatur microstructur phase size particl
52.56% sinter powder densif composit temperatur size particl densiti
53.62% sinter powder densif composit temperatur phase size particl
54.00% sinter powder ceram composit grain temperatur size densiti
55.06% sinter powder ceram composit grain temperatur phase size
52.38% sinter powder ceram sintering.temperature grain temperatur size densiti
52.06% sinter powder ceram sintering.temperature grain temperatur microstructur phase size
53.44% sinter powder ceram densif temperatur microstructur phase size
52.00% sinter powder ceram densif composit temperatur size densiti
53.06% sinter powder ceram densif composit temperatur phase size

Sample Cluster Record Titles

Microstructure of sol-gel synthesized Al2O3-ZrO2(Y2O3) nano-composites studied by transmission electron microscopy

Sintered glass-ceramic from municipal solid waste incinerator ashes

Solid solution formation at the sintering of hydroxyapatite-fluorapatite ceramics

Abrasive wear of steam-treated sintered iron

Effect of the dimensional factor on sintering composites of the system W-Sc2O3

Preparation, sintering, and water incorporation of proton conducting Ba0.99Zr0.8Y0.2O3-delta: comparison between three different synthesis techniques

Influence of particle morphology on nanostructural feature and conducting property in Sm-doped CeO2 sintered body

[Spark plasma sintering of functionally graded material in the Ti-TiB2-B system]

[Low-temperature, single step, reactive sintering of lead magnesium niobate using Mg(OH)(2)-coated Nb2O5 powders]

Cluster Metrics

Authors
harmer, mp 6
li, jg 5
mori, t 4
lee, js 4
chen, ld 4
zyryanov, vv 3
khor, ka 3
ikegami, t 3
dong, wm 3
chan, hm 3
zhu, qs 2
zhang, kf 2
yang, h 2
xu, q 2
wang, yw 2

Sources
journal of the american ceramic society 21
rare metal materials and engineering 12
journal of the european ceramic society 12
high-performance ceramics iii, pts 1 and 2 11
solid state ionics 9
materials science and engineering a-structural materials properties microstructure and processing 7
science of sintering 5
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 5
materials letters 5
journal of the ceramic society of japan 5
materials research bulletin 4
journal of inorganic materials 4
journal of alloys and compounds 4
powder metallurgy 3
international journal of refractory metals & hard materials 3

Keywords
materials science, ceramics 60

materials science, multidisciplinary 56
ceramics 26
microstructure 23
engineering 20
sintering 20
powders 20
metallurgy & metallurgical 20
chemistry, physical 16
behavior 16
sintering 15
physics, condensed matter 14
ceramics 13
composites 11
metallurgy & metallurgical engineering 10

Publication Year
2005 176
2004 18
2006 6

Country
peoples r china 61
japan 28
usa 23
south korea 19
india 10
spain 9
germany 9
france 8
taiwan 6
russia 6
italy 6
england 6
brazil 6
ukraine 4
poland 4

Institution
chinese acad sci 12
lehigh univ 7
hanyang univ 7
tsing hua univ 5
tianjin univ 5
natl inst mat sci 5
indian inst technol 5
wuhan univ technol 4

univ sci & technol beijing 4
harbin inst technol 4
cnrs 4
univ sci & technol china 3
seoul natl univ 3
ras 3
penn state univ 3

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science citation index 200

- # CLUSTER 211
  Ceramics made of zirconia (ZrO_2) and yttrium stabilized zirconia (YSZ), alumina (Al_2O_3), and silicon carbide (SiC), focusing on mechanical properties and microstructural characterization (255 Records)

(Countries: China dominant, USA, followed by Japan, France. Institutions: CAS, RAS, Tsing Hua University.).

Cluster Syntax Features

Descriptive Terms

ceram 21.2%, zro2 5.8%, zirconia 5.5%, composit 5.4%, al2o3 5.1%, alumina 3.2%, nano 1.9%, powder 1.5%, phase 1.4%, ysz 1.2%, sinter 1.0%, coat 0.9%, microstructur 0.8%, materi 0.8%, sic 0.8%

Discriminating Terms

ceram 16.6%, zro2 4.5%, zirconia 4.4%, al2o3 3.6%, film 2.3%, composit 2.2%, alumina 2.2%, ysz 0.9%, nano 0.8%, nanotub 0.7%, magnet 0.7%, nanoparticl 0.6%, carbon 0.6%, surfac 0.5%, quantum 0.5%

Single Word Terms

composit 140, ceram 133, phase 118, properti 109, temperatur 106, materi 100, powder 99, size 89, particl 89, structur 84, surfac 79, mechan 78, high 77, electron 75, al2o3 71

Double Word Terms

electron.microscopy 53, scanning.electron 50, ray.diffraction 42, mechanical.properties 38, high.temperature 27, stabilized.zirconia 23, transmission.electron 22, fracture.toughness 21, heat.treatment 21, alpha.al2o3 20, diffraction.xrd 20, yttria.stabilized 19, grain.size 17, microscopy.sem 17, nano.sized 17

Triple Word Terms

scanning.electron.microscopy 42, ray.diffraction.xrd 18, transmission.electron.microscopy 17, electron.microscopy.sem 17, yttria.stabilized.zirconia 16, solid.oxide.fuel 15, strength.fracture.toughness 12, electron.microscopy.tem 11, oxide.fuel.cells 9, solid.state.reaction 9, al2o3.alpha.al2o3 7, xrd.scanning.electron 7, stabilized.zirconia.ysz 7, microstructure.mechanical.properties 7, diffraction.xrd.scanning 6

Term Cliques

32.10% composit al2o3 alumina phase microstructur materi sic
33.45% composit al2o3 alumina phase coat microstructur materi
30.31% composit al2o3 alumina phase sinter microstructur sic
30.25% composit al2o3 alumina nano coat microstructur materi
30.15% composit al2o3 alumina nano powder microstructur materi sic
28.58% composit al2o3 alumina nano powder sinter microstructur sic
33.14% zirconia alumina phase materi
30.00% zirconia alumina phase sinter
23.92% zro2 nano powder ysz sinter
30.00% zro2 al2o3 phase coat microstructur materi
30.04% zro2 al2o3 phase sinter microstructur

26.27% zro2 al2o3 nano coat microstructur materi
29.87% zro2 al2o3 nano powder microstructur materi
27.78% zro2 al2o3 nano powder sinter microstructur
33.33% zro2 zirconia phase materi
25.73% zro2 zirconia phase ysz sinter
40.08% ceram composit phase materi sic
37.57% ceram composit phase sinter sic
36.14% ceram composit nano powder materi sic
34.05% ceram composit nano powder sinter sic

Sample Cluster Record Titles

Microstructure and mechanical properties of two kinds of Al2O3/SiC nanocomposites

A study on the microstructure of nano-scale ceramic tool materials

Hard, tough and strong ZrO2-WC composites from nanosized powders

Formation and properties of the BSTN composite ceramics with perovskite and tungsten bronze phases

Hydrothermal synthesis of zirconia-based nanocrystals in the ZrO2-In2O3 system

Gel casting and properties of porous silicon carbide/silicon nitride composite ceramics

Probing the effects of interfacial chemistry on the kinetics of phase transitions in amorphous and tetragonal zirconia nanocrystals

Effect of starting powders size on the Al2O3-TiC composites

Effect of polyethylene glycol on the microstructure and PTCR characteristics of n-BaTiO3 ceramics

Cluster Metrics

Authors
zhao, zm 4
zhang, xd 4
zhang, l 4
zhang, h 4
fantozzi, g 4
sekino, t 3
qi, lh 3

pezzotti, g 3
pan, w 3
niihara, k 3
li, xd 3
kim, yh 3
jin, zh 3
ivanov, vv 3
hirata, y 3

Sources

journal of the european ceramic society 18
journal of the american ceramic society 15
high-performance ceramics iii, pts 1 and 2 13
rare metal materials and engineering 10
surface & coatings technology 8
materials letters 8
glass physics and chemistry 7
advanced engineering materials 6
transactions of nonferrous metals society of china 5
solid state ionics 5
reviews on advanced materials science 5
journal of inorganic materials 5
ceramics international 5
journal of the ceramic society of japan 4
journal of materials science 4

Keywords

materials science, multidisciplinary 64
materials science, ceramics 61
microstructure 34
ceramics 21
behavior 21
engineering 20
metallurgy & metallurgical 20
zirconia 19
composites 19
alumina 18
chemistry, physical 16
materials science, multidisciplinary 16
system 15
ceramics 13
strength 12

Publication Year

2005 226
2004 23

2006 5
2003 1

Country
peoples r china 90
usa 36
japan 24
france 20
russia 14
italy 12
germany 12
south korea 11
poland 11
taiwan 6
spain 6
singapore 6
india 6
england 5
ukraine 4

Institution
chinese acad sci 12
russian acad sci 11
tsing hua univ 10
shanghai jiao tong univ 6
shandong univ 6
zhejiang univ 5
tianjin univ 5
natl univ singapore 5
huazhong univ sci & technol 5
xian jiaotong univ 4
wuhan univ technol 4
sichuan univ 4
osaka univ 4
inst natl sci appl 4
hefei univ technol 4

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science citation index 255

- # CLUSTER 155
  Dielectric (especially ferroelectric and piezoelectric) properties of ceramics, emphasizing glass and barium-titanate (BaTiO3) based materials (192 Records)

(Countries: China, India, USA. Institutions: Indian Institute of Technology, CAS, Tsing Hua University.).

Cluster Syntax Features

Descriptive Terms

ceram 22.0%, dielectr 14.4%, ferroelectr 4.1%, dielectric.properties 2.2%, glass 2.2%, temperatur 2.0%, sinter 1.9%, phase 1.5%, dielectric.constant 1.5%, batio3 1.4%, properti 1.1%, grain 1.0%, constant 1.0%, piezoelectr 1.0%, dope 0.9%

Discriminating Terms

ceram 15.7%, dielectr 9.6%, ferroelectr 2.8%, film 2.2%, dielectric.properties 1.7%, sinter 1.1%, dielectric.constant 1.0%, batio3 1.0%, surfac 1.0%, glass 0.9%, nanoparticl 0.7%, carbon 0.7%, piezoelectr 0.7%, particl 0.6%, nanotub 0.6%

Single Word Terms

temperatur 143, ceram 139, dielectr 123, properti 118, phase 117, structur 117, rai 94, diffract 86, high 83, sampl 76, grain 73, constant 70, electron 67, materi 65, ferroelectr 64

Double Word Terms

ray.diffraction 74, dielectric.constant 59, dielectric.properties 57, electron.microscopy 45, solid.state 39, room.temperature 36, scanning.electron 35, high.temperature 27, state.reaction 26, electrical.properties 26, grain.size 25, transmission.electron 25, phase.transition 22, diffraction.xrd 21, temperature.coefficient 19

Triple Word Terms

solid.state.reaction 26, scanning.electron.microscopy 25, transmission.electron.microscopy 22, ray.diffraction.xrd 17, conventional.solid.state 16, microwave.dielectric.properties 15, dielectric.constant.epsilon 13, electron.microscopy.sem 10, morphotropic.phase.boundary 9, temperature.coefficient.resonant 9, high.dielectric.constant 8, diffraction.scanning.electron 8, electron.microscopy.tem 8, ceramics.polycrystalline.samples 8, ray.diffraction.scanning 8

Term Cliques

38.80% glass phase
44.43% ceram dielectr temperatur sinter dielectric.constant properti grain constant

piezoelectr dope
43.33% ceram dielectr temperatur sinter dielectric.constant batio3 properti grain constant piezoelectr
46.70% ceram dielectr dielectric.properties temperatur sinter dielectric.constant properti constant dope
45.49% ceram dielectr dielectric.properties temperatur sinter dielectric.constant batio3 properti constant
43.85% ceram dielectr ferroelectr temperatur dielectric.constant batio3 properti grain constant piezoelectr
46.40% ceram dielectr ferroelectr temperatur phase dielectric.constant properti grain constant piezoelectr dope
46.06% ceram dielectr ferroelectr dielectric.properties temperatur dielectric.constant batio3 properti constant
48.65% ceram dielectr ferroelectr dielectric.properties temperatur phase dielectric.constant properti constant dope

Sample Cluster Record Titles

The structure, electrical and ethanol-sensing properties of La1-xPbxFeO3 perovskite ceramics with x <= 0.3

Tunability and relaxor properties of ferroelectric barium stannate titanate ceramics

Conductivity and superconductivity of (Bi,Pb)(4)Sr3Ca3Cu4Ox glass-ceramics

Microstructure and dielectric properties of Ba(Cd1/3Ta2/3)O-3 microwave ceramics synthesized with a boron oxide sintering aid

Structure of nanocrystalline titania ceramics studied by x-ray diffraction, atomic force microscopy, and thermal phonon kinetics

Dielectric properties of LiNbO3 glass mixed with strong glass former SiO2

Crystallization and dielectric properties of 2SrTiO(3)-SiO2 glass

Dielectric properties of LTNO ceramics and LTNO/PVDF composites

Ferroelectric and optic properties of the translucent BaTiO3 ceramics derived from nanocrystalline monolith

Cluster Metrics

Authors

yin, qr 9
li, gr 9
choudhary, rnp 9
zheng, ly 6
sebastian, mt 6
li, lt 5
gui, zl 5
chen, w 5
bijumon, pv 5
zhou, j 4
zhao, sc 4
zhang, l 4
xu, q 4
thakur, ak 4
sharma, s 4

Sources
high-performance ceramics iii, pts 1 and 2 16
materials letters 9
journal of applied physics 8
journal of the american ceramic society 7
applied physics letters 7
materials science and engineering b-solid state materials for advanced technology 6
journal of the european ceramic society 6
journal of materials science 6
journal of electroceramics 6
physical review b 5
journal of non-crystalline solids 5
physica b-condensed matter 4
materials chemistry and physics 4
journal of materials research 4
japanese journal of applied physics part 1-regular papers brief communications & review papers 4

Keywords
materials science, multidisciplinary 46
materials science, ceramics 31
physics, applied 26
ceramics 24
physics, applied 22
physics, condensed matter 19
ceramics 17
microstructure 17
system 14
physics, condensed matter 14
temperature 12

physics, multidisciplinary 11
engineering, electrical & electronic 11
materials science, multidisciplinary 11
dielectric properties 11

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2005 153
2004 37
2006 2

Country
peoples r china 51
india 35
usa 29
japan 15
germany 11
france 11
taiwan 9
russia 9
england 9
south korea 8
italy 7
brazil 5
romania 4
mexico 4
canada 4

Institution
indian inst technol 14
chinese acad sci 14
tsing hua univ 8
russian acad sci 6
penn state univ 6
wuhan univ technol 5
univ sheffield 5
natl cheng kung univ 5
jingdezhen ceram inst 4
csir 4
univ aveiro 3
solid state phys lab 3
pusan natl univ 3
kfa julich gmbh 3
european synchrotron radiat facil 3

DataBase
science citation index 192

- CLUSTER 59
  Glass ceramics, including cordierite and various ceramic oxides (Na_2O, SiO_2, and CaO), focusing on crystallization, nucleation, and heat treatment (78 Records)

(Countries: China, followed by France, Russia. Institutions: CAS, Tsing Hua University. USA includes UCD.).

Cluster Syntax Features

Descriptive Terms

glass 39.9%, glass.ceramics 10.3%, ceram 6.4%, crystal 3.4%, cordierit 1.9%, heat 1.1%, phase 0.8%, nucleat 0.8%, na2o 0.8%, sio2 0.7%, glass.ceramic 0.7%, heat.treatment 0.6%, composit 0.6%, cao 0.6%, treatment 0.6%

Discriminating Terms

glass 24.5%, glass.ceramics 7.1%, ceram 3.6%, film 2.0%, cordierit 1.3%, surfac 0.7%, carbon 0.6%, nanoparticl 0.6%, crystal 0.6%, layer 0.6%, nanotub 0.6%, magnet 0.6%, na2o 0.5%, deposit 0.5%, particl 0.5%

Single Word Terms

glass 72, crystal 54, phase 43, rai 42, ceram 41, temperatur 40, heat 38, diffract 38, composit 36, xrd 35, structur 34, treatment 29, size 29, thermal 29, sampl 28

Double Word Terms

ray.diffraction 33, glass.ceramics 32, heat.treatment 23, electron.microscopy 17, diffraction.xrd 16, glass.ceramic 15, scanning.electron 14, crystalline.phases 12, al2o3.sio2 11, differential.thermal 11, energy.dispersive 9, thermal.dta 9, xrd.sem 9, glass.composition 9, phase.separation 8

Triple Word Terms

ray.diffraction.xrd 14, scanning.electron.microscopy 11, differential.thermal.dta 8, energy.dispersive.ray 7, transmission.electron.microscopy 7, electron.microscopy.sem 6, angle.ray.scattering 6, oxyfluoride.glass.ceramics 5, powder.ray.diffraction 5, activation.energy.crystallization 5, small.angle.ray 5, al2o3.sio2.system 4, diffraction.xrd.transmission 4, ray.powder.diffraction 4, electron.microscopy.tem 4

Term Cliques
40.00% ceram crystal cordierit phase cao
47.25% glass crystal phase na2o glass.ceramic heat.treatment composit
43.75% glass crystal phase na2o sio2 glass.ceramic composit cao
44.87% glass crystal phase nucleat na2o glass.ceramic heat.treatment
41.67% glass crystal phase nucleat na2o sio2 glass.ceramic cao
50.64% glass ceram crystal phase sio2 glass.ceramic composit treatment
47.92% glass ceram crystal phase sio2 glass.ceramic composit cao
48.56% glass ceram crystal phase nucleat sio2 glass.ceramic treatment
45.83% glass ceram crystal phase nucleat sio2 glass.ceramic cao
50.00% glass ceram crystal heat phase glass.ceramic heat.treatment composit treatment
46.79% glass glass.ceramics ceram crystal phase nucleat glass.ceramic cao
47.29% glass glass.ceramics ceram crystal phase nucleat glass.ceramic heat.treatment treatment
49.43% glass glass.ceramics ceram crystal heat phase glass.ceramic heat.treatment treatment

Sample Cluster Record Titles

Crystallization behavior of PbF2-SiO2 based bulk xerogels

Silicate glasses obtained from fine silica powder modified with galvanic waste addition

In situ high-temperature X-ray study of ZnO-TeO2 glass crystallization under ultrasonic treatment

The influence of NiO on phase separation and crystallization of glasses of the MgO-Al2O3-SiO2-TiO2 system

Silicon oxynitride glasses produced by ammonolysis from colloidal silica

Effect of alumina concentration on thermal and structural properties of MAS glass and glass-ceramics

CaO-Al2O3-SiO2 glass-ceramics of the composition based on inorganic waste

Pyroxene-based glass-ceramics as glazes for floor tiles

Nucleation and crystallization of glass-ceramics from coal fly ash

Cluster Metrics

Authors
wang, ys 5
peng, f 4
bao, f 4
zhilin, aa 3
sigaev, vn 3
reaney, im 3
luo, wq 3
liang, km 3
hu, zj 3
golubkov, vv 3
dymshits, os 3
champagnon, b 3
capoen, b 3
califano, v 3
bouazaoui, m 3

Sources
journal of non-crystalline solids 16
physics and chemistry of glasses 5
journal of the american ceramic society 4
journal of the ceramic society of japan 3
journal of applied physics 3
glass technology 3
chinese journal of structural chemistry 3
ceramics international 3
materials science and engineering b-solid state materials for advanced technology 2
journal of thermal analysis and calorimetry 2
journal of the european ceramic society 2
journal of materials research 2
high-performance ceramics iii, pts 1 and 2 2
bioceramics 17 2
thin solid films 1

Keywords
materials science, ceramics 34
materials science, multidisciplinary 17
ceramics 10
crystallization 9
materials science, multidisciplinary 8
chemistry, physical 8
system 7
nucleation 6
glass-ceramics 5

materials science, ceramics 5
glass-ceramic 5
films 5
er3+ 5
spectroscopy 4
physics, applied 4

Publication Year
2005 63
2004 14
2006 1

Country
peoples r china 18
france 12
russia 9
japan 8
england 8
usa 7
italy 5
germany 5
spain 3
south korea 3
new zealand 3
egypt 3
brazil 3
serbia monteneg 2
poland 2

Institution
chinese acad sci 6
tsing hua univ 5
univ sheffield 4
si vavilov state opt inst 4
cnrs 4
victoria univ wellington 3
univ lyon 1 3
univ london imperial coll sci technol & med 3
univ valencia 2
univ sci & technol lille 2
univ rennes 1 2
univ naples federico ii 2
univ clermont ferrand 2
univ calif davis 2
russian acad sci 2

- # CLUSTER 68
  Synthesis of nanorods (especially cadmium-sulfide [CdS]), with focus on hydrothermal fabrication, transmission electron microscopy (TEM) studies, and characterization of length and diameter (132 Records)

(Countries: China very dominant, USA. Institutions: University S&T China, CAS, Zhejiang University, Nanjing University.).

Cluster Syntax Features

Descriptive Terms
nanorod 65.9%, hydrotherm 1.6%, synthesi 1.1%, synthes 0.8%, nanorods.synthesized 0.5%, rout 0.5%, length 0.5%, product 0.5%, diamet 0.4%, surfact 0.4%, single.crystalline 0.4%, cds.nanorods 0.4%, tem 0.4%, reaction 0.4%, electron.microscopy 0.4%

Discriminating Terms
nanorod 42.2%, film 1.9%, hydrotherm 0.8%, surfac 0.8%, carbon 0.6%, layer 0.6%, particl 0.5%, nanotub 0.5%, nanoparticl 0.5%, magnet 0.5%, deposit 0.4%, quantum 0.4%, structur 0.4%, si 0.4%, nanorods.synthesized 0.3%

Single Word Terms
nanorod 132, synthesi 85, synthes 79, electron 67, xrd 59, rai 58, microscopi 56, transmiss 56, diffract 56, tem 55, diamet 53, mechan 52, structur 51, length 50, format 50

Double Word Terms

transmission.electron 55, electron.microscopy 55, ray.diffraction 42, diffraction.xrd 33, microscopy.tem 28, nanorods.synthesized 27, single.crystalline 20, electron.diffraction 20, scanning.electron 20, area.electron 17, solid.state 15, xrd.transmission 14, high.resolution 14, large.scale 13, growth.mechanism 13

Triple Word Terms

transmission.electron.microscopy 49, electron.microscopy.tem 27, ray.diffraction.xrd 26, scanning.electron.microscopy 18, area.electron.diffraction 17, xrd.transmission.electron 13, diffraction.xrd.transmission 13, high.resolution.transmission 12, resolution.transmission.electron 12, ray.photoelectron.spectroscopy 10, solid.state.reaction 10, ray.powder.diffraction 10, electron.diffraction.saed 8, powder.ray.diffraction 8, electron.microscopy.sem 8

Term Cliques

41.06% nanorod synthesi nanorods.synthesized single.crystalline cds.nanorods
50.95% nanorod synthesi synthes rout length tem reaction electron.microscopy
51.33% nanorod synthesi synthes rout length diamet tem electron.microscopy
48.01% nanorod synthesi synthes rout length diamet single.crystalline electron.microscopy
47.44% nanorod synthesi synthes nanorods.synthesized length diamet single.crystalline electron.microscopy
46.06% nanorod synthesi synthes nanorods.synthesized length product surfact tem reaction electron.microscopy
46.36% nanorod synthesi synthes nanorods.synthesized length product diamet surfact tem electron.microscopy
42.73% nanorod hydrotherm synthesi single.crystalline cds.nanorods
52.71% nanorod hydrotherm synthesi synthes length product tem
51.08% nanorod hydrotherm synthesi synthes rout length tem
47.29% nanorod hydrotherm synthesi synthes rout length single.crystalline

Sample Cluster Record Titles

Monodentate ligand-assisted hydrothermal synthesis of CdS nanorods

Photochemical synthesis of Bi2Se3 nanosphere and nanorods

Characteristics and optical properties of Cd1-xMnxS nanorods prepared through hydrothermal route

A co-reduction synthesis of superconducting NbC nanorods

Templateless hydrothermal synthesis of aligned ZnO nanorods

Preparation and characterization of MnOOH nanorods in reverse micelles

A simple method to synthesize single-crystalline lanthanide orthovanadate nanorods

One-step synthesis of single-crystalline CdSe nanorods via gamma-ray irradiation

Cadmium sulfide nanorods formed in microemulsions

Cluster Metrics

Authors
qian, yt 12
liu, l 8
jia, dz 8
cao, yl 6
zhang, h 5
xiao, dq 5
wang, x 5
yang, zh 4
xu, zd 4
li, yd 4
zhu, jj 3
zhang, zd 3
yang, dr 3
xin, xq 3
shi, l 3

Sources
materials letters 15
chemistry letters 8
materials chemistry and physics 7
nanotechnology 6
journal of solid state chemistry 6
chinese journal of inorganic chemistry 6
journal of crystal growth 5
materials research bulletin 4
journal of the american chemical society 4
chemical journal of chinese universities-chinese 4
chemical communications 4
journal of physical chemistry b 3
journal of materials chemistry 3
inorganic chemistry 3
applied physics letters 3

Keywords
nanowires 52
materials science, multidisciplinary 41
growth 41

chemistry, multidisciplinary 32
nanorods 28
nanoparticles 27
nanotubes 21
nanowires 19
physics, applied 18
nanostructures 17
chemistry, inorganic & nuclear 16
nanocrystals 16
materials science, multidisciplinary 16
route 13
chemistry, physical 12

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2005 116
2004 11
2006 5

Country

peoples r china 97
usa 13
south korea 6
japan 5
india 3
taiwan 2
mexico 2
germany 2
belgium 2
thailand 1
singapore 1
russia 1
portugal 1
norway 1
israel 1

Institution

univ sci & technol china 18
chinese acad sci 17
zhejiang univ 15
nanjing univ 12
xinjiang univ 8
sichuan univ 5
tsing hua univ 4
shandong univ 3
korea adv inst sci & technol 3
henan univ 3

beijing inst technol 3
univ texas 2
univ tennessee 2
univ sci & technol beijing 2
univ nacl autonoma mexico 2

DataBase
science citation index 132

- # CLUSTER 12
  Zinc oxide (ZnO), as well as gallium nitride (GaN), nanorods, emphasizing growth, nanorod arrays, and field emission properties (123 Records)

(Countries: China dominant, South korea, USA, followed by Taiwan, Japan. Institutions: CAS, Zhejiang University, National Tsing Hua University. USA includes University of Florida.).

Cluster Syntax Features

Descriptive Terms
nanorod 53.4%, zno 15.3%, zno.nanorods 11.4%, nanorod.arrays 1.1%, arrai 1.1%, growth 1.0%, zno.nanorod 0.9%, align 0.8%, substrat 0.4%, gan.nanorods 0.3%, emiss 0.3%, aligned.zno 0.3%, zn 0.2%, grown 0.2%, nanorods.grown 0.2%

Discriminating Terms
nanorod 32.9%, zno 8.0%, zno.nanorods 7.4%, film 1.4%, nanorod.arrays 0.7%, surfac 0.6%, zno.nanorod 0.6%, particl 0.5%, nanoparticl 0.5%, carbon 0.5%, magnet 0.5%, structur 0.5%, nanotub 0.5%, layer 0.4%, quantum 0.4%

Single Word Terms
nanorod 123, zno 78, growth 65, substrat 60, temperatur 55, high 54, electron 49, diamet 48, align 45, synthes 42, arrai 41, structur 40, deposit 40, grown 39, emiss 36

Double Word Terms
zno.nanorods 67, transmission.electron 33, electron.microscopy 33, zno.nanorod 26, ray.diffraction 26, nanorod.arrays 23, room.temperature 20, scanning.electron 20, growth.zno 20, aligned.zno 20, nanorods.grown 18, nanorods.synthesized 18, high.resolution 15, single.crystal 14, single.crystalline 13

Triple Word Terms
transmission.electron.microscopy 27, scanning.electron.microscopy 15, growth.zno.nanorods 14, electron.microscopy.tem 13, high.resolution.transmission 12, ray.diffraction.xrd 12, zno.nanorod.arrays 12, resolution.transmission.electron 12, aligned.zno.nanorods 12, zno.nanorods.grown 11, chemical.vapor.deposition 11, aligned.zno.nanorod 8, zno.nanorods.zno 8, area.electron.diffraction 8, zno.nanorods.synthesized 8

Term Cliques
44.23% nanorod growth substrat gan.nanorods nanorods.grown
38.31% nanorod nanorod.arrays arrai zno.nanorod align substrat aligned.zno grown
39.43% nanorod zno.nanorods growth zno.nanorod align substrat aligned.zno zn grown nanorods.grown
40.98% nanorod zno.nanorods arrai growth zno.nanorod align substrat aligned.zno grown nanorods.grown
41.39% nanorod zno zno.nanorods growth zno.nanorod align substrat emiss aligned.zno zn nanorods.grown
44.15% nanorod zno zno.nanorods arrai growth zno.nanorod align substrat aligned.zno nanorods.grown

Sample Cluster Record Titles

In situ study of the ZnO-NaCl system during the growth of ZnO nanorods

High-density, uniform gallium nitride nanorods grown on Au-coated silicon substrate

Directed spatial organization of zinc oxide nanorods

Well-aligned zinc oxide nanorods and nanowires prepared without catalyst

Self-assembly ZnO nanorods by pulsed laser deposition under argon atmosphere

Field emission behavior of cuboid zinc oxide nanorods on zinc-filled porous silicon

Large hexagonal arrays of aligned ZnO nanorods

Preparation and photocatalytic property of ZnO nanorods with uniform morphology

Synthesis and optical properties of well-aligned ZnO nanorod array on an undoped ZnO film

Cluster Metrics

Authors
tien, lc 4
ren, f 4
pearton, sj 4
park, jg 4
norton, dp 4
kang, bs 4
chen, sy 4
zhu, lp 3
ye, zz 3
xue, cs 3
wang, th 3
wang, gz 3
wang, fz 3
tak, y 3
park, jy 3

Sources
applied physics letters 17
journal of crystal growth 11
nanotechnology 10
applied physics a-materials science & processing 7
journal of physical chemistry b 6
solid state communications 5
chemical physics letters 5
thin solid films 4
journal of vacuum science & technology b 3
journal of nanoscience and nanotechnology 3
japanese journal of applied physics part 1-regular papers brief communications & review papers 3
physica e-low-dimensional systems & nanostructures 2
nano letters 2
materials letters 2
materials chemistry and physics 2

Keywords

nanowires 40
growth 36
physics, applied 32
materials science, multidisciplinary 27
physics, applied 18
materials science, multidisciplinary 18
films 18
arrays 18
photoluminescence 17
thin-films 16
nanostructures 13
room-temperature 12
nanobelts 12
crystallography 11
chemical-vapor-deposition 11

Publication Year
2005 116
2004 5
2006 2

Country
peoples r china 48
south korea 21
usa 18
taiwan 13
japan 13
singapore 3
india 3
germany 3
france 3
russia 2
italy 2
belgium 2
thailand 1
sweden 1
poland 1

Institution
chinese acad sci 14
zhejiang univ 6
natl tsing hua univ 6
pohang univ sci & technol 5
peking univ 5
korea inst sci & technol 5
univ florida 4

natl chiao tung univ 4
univ sci & technol china 3
univ sci & technol beijing 3
shandong univ 3
shandong normal univ 3
natl univ singapore 3
natl inst mat sci 3
nanjing univ 3

DataBase
science citation index 123

- CLUSTER 13
  Nanobelts (especially gallium oxide [Ga2O3], zinc oxide [ZnO], and silicon nitride [Si3N4]) and nanoribbons, emphasizing growth, fabrication by thermal evaporation, and photoluminescence and emission properties (49 Records)

Countries: China dominant, USA, South Korea. Institutions: CAS, Inha University, Georgia Institute of Technology. Other USA include UCF, University of Texas, University of Pittsburgh.).

Cluster Syntax Features

Descriptive Terms

nanobelt 62.3%, nanoribbon 1.5%, growth 1.3%, ga2o3 1.0%, zno.nanobelts 1.0%, zno 1.0%, nanostructur 0.9%, ga2o3.nanobelts 0.8%, zn 0.7%, single.crystalline 0.6%, thermal.evaporation 0.6%, photoluminesc 0.5%, emiss 0.5%, width 0.5%, si3n4.nanobelts 0.4%

Discriminating Terms

nanobelt 39.0%, film 1.8%, nanoribbon 0.9%, zno.nanobelts 0.6%, ga2o3 0.6%, nanoparticl 0.6%, surfac 0.6%, particl 0.6%, carbon 0.6%, layer 0.5%, ga2o3.nanobelts 0.5%, magnet 0.5%, nanotub 0.5%, quantum 0.4%, deposit 0.3%

Single Word Terms

nanobelt 40, growth 37, structur 31, synthes 31, singl 30, electron 27, emiss 23, photoluminesc 23, microscopi 22, mechan 21, width 21, transmiss 21, direct 21, oxid 21, thick 20

Double Word Terms

electron.microscopy 22, transmission.electron 21, single.crystalline 19, scanning.electron 14, ray.diffraction 14, high.resolution 12, thermal.evaporation 11, nanobelts.synthesized 11, growth.mechanism 11, resolution.transmission 10, photoluminescence.spectrum 10, room.temperature 10, single.crystal 9, nanobelts.single 9, vapor.solid 8

Triple Word Terms

transmission.electron.microscopy 19, scanning.electron.microscopy 13, high.resolution.transmission 10, resolution.transmission.electron 10, electron.microscopy.sem 7, electron.microscopy.tem 7, nanobelts.single.crystalline 7, ray.diffraction.xrd 6, chemical.vapor.deposition 6, sem.transmission.electron 4, microscopy.sem.transmission 4, area.electron.diffraction 4, nanobelts.synthesized.thermal 4, vapor.solid.growth 4, room.temperature.photoluminescence 4

Term Cliques

35.92% nanostructur ga2o3.nanobelts single.crystalline photoluminesc emiss
34.69% ga2o3 thermal.evaporation photoluminesc emiss width
33.47% ga2o3 nanostructur thermal.evaporation photoluminesc emiss
31.02% ga2o3 nanostructur ga2o3.nanobelts photoluminesc emiss
45.58% growth single.crystalline thermal.evaporation photoluminesc emiss width
44.56% growth nanostructur single.crystalline thermal.evaporation photoluminesc emiss
40.48% growth nanostructur zn thermal.evaporation photoluminesc emiss
42.86% growth zno.nanobelts nanostructur single.crystalline photoluminesc emiss
38.78% growth zno.nanobelts nanostructur zn photoluminesc emiss
36.73% growth zno.nanobelts zno nanostructur single.crystalline
31.84% growth zno.nanobelts zno nanostructur zn
41.50% nanoribbon growth single.crystalline

33.33% nanoribbon growth zn
44.56% nanobelt ga2o3.nanobelts single.crystalline photoluminesc emiss width
40.48% nanobelt ga2o3 ga2o3.nanobelts photoluminesc emiss width
49.39% nanobelt growth single.crystalline width si3n4.nanobelts
55.44% nanobelt growth single.crystalline photoluminesc emiss width
50.34% nanobelt growth zno.nanobelts single.crystalline photoluminesc emiss
45.71% nanobelt growth zno.nanobelts zno single.crystalline

Sample Cluster Record Titles

Structure and luminescence properties of CdS nanobelts

Growth of beta-Ga2O3 nanobelts on Ir-coated substrates

Catalyst-assisted vapor-liquid-solid growth of single-crystal CdS nanobelts and their luminescence properties

Lithium-assisted synthesis and characterization of crystalline 3C-SiC nanobelts

Rapid synthesis and visible photoluminescence of ZnS nanobelts

Study of Ga2O3 nanobelts synthesized by the thermal annealing of GaN powders

Integration of metal oxide nanobelts with microsystems for nerve agent detection

Structure control of CdS nanobelts and their luminescence properties

High sensitivity of CuO modified SnO2 nanoribbons to H2S at room temperature

Cluster Metrics

Authors
wang, zl 6
kim, nh 6
kim, hw 6
zhou, wy 3
zhao, xw 3
zhang, zx 3
zhang, r 3
zhang, ld 3
ye, ch 3
xie, ss 3
xiang, yj 3
song, l 3

luo, sd 3
liu, lf 3
liu, df 3

Sources
journal of physical chemistry b 7
journal of crystal growth 4
applied physics letters 4
applied physics a-materials science & processing 4
sensors and actuators b-chemical 2
journal of the american chemical society 2
journal of applied physics 2
chemical physics letters 2
science 1
scanning 1
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 1
physical review b 1
physica status solidi a-applications and materials science 1
physica e-low-dimensional systems & nanostructures 1
nanotechnology 1

Keywords
nanowires 18
growth 16
photoluminescence 14
nanobelts 14
chemistry, physical 10
nanorods 9
physics, applied 8
nanoribbons 8
films 8
fabrication 8
nanotubes 7
thermal evaporation 6
nanowires 6
nanotubes 6
materials science, multidisciplinary 6

Publication Year
2005 45
2004 4

Country
peoples r china 33
usa 12

south korea 8
thailand 1
taiwan 1
singapore 1
italy 1
india 1

Institution
chinese acad sci 13
inha univ 6
georgia inst technol 6
nanjing univ 5
tsing hua univ 4
univ cent florida 3
wuhan univ technol 2
univ sci & technol china 2
peking univ 2
e china normal univ 2
chinese univ hong kong 2
zhongshan univ 1
univ texas 1
univ sci & technol beijing 1
univ pittsburgh 1

DataBase
science citation index 49

- # CLUSTER 218
  Synthesis (especially hydrothermally) of nanostructures and

subsequent analysis using transmission electron microscopy (TEM) and x-ray diffraction (XRD) (270 Records)

(Countries: China very dominant, USA, Japan. Institutions: CAS, University S&T China, followed by Shandong University, Nanjing University.).

Cluster Syntax Features

Descriptive Terms

electron.microscopy 3.9%, transmission.electron 3.3%, transmission.electron.microscopy 3.0%, transmiss 3.0%, electron 2.7%, microscopi 2.6%, tem 2.4%, diffract 2.4%, product 2.1%, microscopy.tem 1.9%, diffraction.xrd 1.9%, electron.microscopy.tem 1.8%, rai 1.8%, hydrotherm 1.7%, xrd 1.7%

Discriminating Terms

film 2.5%, electron.microscopy 2.3%, transmission.electron 2.1%, transmission.electron.microscopy 2.0%, transmiss 1.7%, microscopy.tem 1.5%, tem 1.5%, electron.microscopy.tem 1.4%, diffraction.xrd 1.4%, hydrotherm 1.3%, product 1.2%, diffract 1.0%, microscopi 0.9%, surfac 0.9%, xrd 0.9%

Single Word Terms

electron 252, microscopi 231, rai 227, diffract 224, transmiss 222, xrd 164, tem 159, structur 144, synthes 138, synthesi 132, product 128, scan 125, temperatur 100, powder 100, sem 96

Double Word Terms

electron.microscopy 224, transmission.electron 216, ray.diffraction 161, diffraction.xrd 143, microscopy.tem 130, scanning.electron 107, microscopy.sem 67, xrd.transmission 61, high.resolution 60, electron.diffraction 54, powder.diffraction 52, ray.powder 50, resolution.transmission 49, area.electron 38, sem.transmission 36

Triple Word Terms

transmission.electron.microscopy 198, electron.microscopy.tem 127, ray.diffraction.xrd 108, scanning.electron.microscopy 95, electron.microscopy.sem 67, xrd.transmission.electron 60, diffraction.xrd.transmission 57, high.resolution.transmission 49, ray.powder.diffraction 49, resolution.transmission.electron 46, area.electron.diffraction 36, sem.transmission.electron 35, powder.diffraction.xrd 32, microscopy.sem.transmission 30, ray.photoelectron.spectroscopy 27

Term Cliques

66.72% electron.microscopy transmission.electron transmission.electron.microscopy transmiss electron microscopi tem diffract product microscopy.tem diffraction.xrd electron.microscopy.tem rai hydrotherm xrd

Sample Cluster Record Titles

Shape-controlled synthesis of yttria nanocrystals under hydrothermal conditions

Surprising arching sheet-like dendrites growing from BaF2 nanocubes

SnO2 nanowhiskers and their ethanol sensing characteristics

Controllable syntheses of hexagonal and lamellar mesostructured lanthanurn oxide

Synthesis of nanocomposite, (CdxZn1-x)S by gamma-irradiation in an aqueous system

Hydrothermal synthesis of precursors of neodymium oxide nanoparticles

Co-templating synthesis of highly dispersed 1D ZnO nanostructures in amorphous SiO2 under hydrothermal condition

Synthesis of hexagonal close-packed nanocrystalline nickel by a thermal reduction process

Novel polymer-inorganic solid-state reaction for the synthesis of CdS nanocrystallites

Cluster Metrics

Authors

qian, yt 8
liu, yl 6
li, hl 5
hong, jm 5
zhang, yc 4
zhang, jx 4
yuan, ds 4
yang, q 4
tang, kb 4
liu, zm 4
liu, y 4
huang, y 4
hu, xy 4

zou, gf 3
zhu, zk 3

Sources
materials letters 34
journal of physical chemistry b 11
journal of crystal growth 11
journal of solid state chemistry 10
materials chemistry and physics 9
chinese journal of inorganic chemistry 9
nanotechnology 8
chemistry letters 7
materials research bulletin 6
chemistry of materials 6
solid state sciences 5
journal of dispersion science and technology 4
journal of alloys and compounds 4
crystal growth & design 4
solid state communications 3

Keywords
materials science, multidisciplinary 76
growth 48
nanoparticles 46
nanowires 43
chemistry, physical 42
physics, applied 38
nanorods 38
chemistry, inorganic & nuclear 31
nanocrystals 31
materials science, multidisciplinary 30
chemistry, multidisciplinary 28
route 25
nanostructures 24
particles 23
nanotubes 21

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2005 231
2004 29
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Country
peoples r china 184
usa 20
japan 18

france 9
germany 8
taiwan 5
south korea 5
poland 4
israel 4
india 4
brazil 4
switzerland 3
mexico 3
venezuela 2
turkey 2

Institution

chinese acad sci 32
univ sci & technol china 23
shandong univ 12
nanjing univ 11
zhejiang univ 8
lanzhou univ 6
yangzhou univ 5
shanghai jiao tong univ 5
peking univ 5
e china univ sci & technol 5
beijing inst technol 5
ne normal univ 4
nankai univ 4
jinan univ 4
xinjiang univ 3

DataBase

science citation index 270

- # CLUSTER 249
  Hydrothermal/solvothermal synthesis and morphology of nanocrystals, crystalline materials, and nanowires (302 Records)

(Countries: China very dominant, USA, followed by Japan, India. Institutions: University S&T China, CAS. USA includes University of Texas.).

Cluster Syntax Features

Descriptive Terms
synthesi 7.8%, nanocryst 7.6%, hydrotherm 4.3%, crystal 4.0%, nanowir 3.4%, reaction 2.7%, synthes 2.4%, rout 2.2%, single.crystalline 1.2%, morpholog 1.2%, crystallin 1.1%, solvotherm 1.1%, surfact 1.1%, product 1.1%, singl 1.1%

Discriminating Terms
nanocryst 5.5%, synthesi 5.0%, hydrotherm 3.5%, film 2.6%, rout 1.6%, nanowir 1.6%, crystal 1.2%, synthes 1.1%, reaction 1.1%, single.crystalline 1.0%, solvotherm 1.0%, surfac 1.0%, carbon 0.8%, nanotub 0.7%, nanobelt 0.7%

Single Word Terms
synthesi 198, synthes 145, crystal 125, temperatur 115, reaction 115, format 98, structur 97, xrd 92, morpholog 85, singl 81, solut 80, product 80, hydrotherm 76, size 74, mechan 73

Double Word Terms
ray.diffraction 47, electron.microscopy 36, single.crystalline 32, hydrothermal.synthesis 28, room.temperature 27, single.crystal 24, transmission.electron 22, reaction.time 20, low.temperature 19, formation.mechanism 19, diffraction.xrd 19, scanning.electron 18, single.crystals 17, reaction.temperature 16, controlled.synthesis 16

Triple Word Terms
ray.diffraction.xrd 18, transmission.electron.microscopy 16, scanning.electron.microscopy 15, fourier.transform.infrared 10, powder.ray.diffraction 10, synthesis.single.crystalline 9, ray.powder.diffraction 8, electron.microscopy.sem 7, temperature.reaction.time 7, verlag.gmbh.co 7, gmbh.co.kgaa 7, energy.dispersive.ray 7,

synthesized.hydrothermal.treatment 6, high.aspect.ratio 6, vch.verlag.gmbh 6

Term Cliques
14.16% single.crystalline solvotherm surfact singl
24.60% nanowir synthes rout morpholog crystallin solvotherm product
22.89% nanowir synthes rout single.crystalline morpholog crystallin solvotherm singl
26.92% nanowir reaction synthes rout morpholog solvotherm product
18.29% hydrotherm single.crystalline surfact singl
26.96% hydrotherm nanowir synthes rout morpholog crystallin product
24.96% hydrotherm nanowir synthes rout single.crystalline morpholog crystallin singl
31.60% synthesi synthes rout morpholog crystallin solvotherm product
29.01% synthesi synthes rout single.crystalline morpholog crystallin solvotherm singl
33.92% synthesi reaction synthes rout morpholog solvotherm product
36.42% synthesi crystal synthes morpholog solvotherm singl
36.61% synthesi crystal reaction synthes morpholog solvotherm product
33.96% synthesi hydrotherm synthes rout morpholog crystallin product
31.08% synthesi hydrotherm synthes rout single.crystalline morpholog crystallin singl
39.18% synthesi hydrotherm crystal synthes morpholog singl
39.13% synthesi hydrotherm crystal synthes morpholog product
33.07% synthesi nanocryst reaction synthes rout solvotherm product

Sample Cluster Record Titles

Synthesis of single-crystalline beta-Ga2O3 nanoribbons

The effects of synthesis pH and hydrothermal treatment on the formation of zinc aluminum hydrotalcites

Preparation of Mn3O4 nanocrystallites by low-temperature solvothermal treatment of gamma-MnOOH nanowires

A simple method to synthesize nanowires titanium dioxide from layered titanate particles

Synthesis, characterization, and catalytic applications of manganese oxide octahedral molecular sieve (OMS) nanowires with a 2 x 3 tunnel structure

Hydrothermal synthesis of a novel sodium vanadium bronze with single-crystalline nanobelt-like morphology

Shape-controlled synthesis of PbS microcrystals in large yields via a solvothermal process

A green hydrothermal route to copper nanocrystallites

Size-controllable growth of single crystal In(OH)(3) and In2O3 nanocubes

Cluster Metrics

Authors
qian, yt 17
wang, zh 6
korgel, ba 6
gao, l 5
zheng, hg 4
zhang, yc 4
zhang, h 4
yu, wc 4
yu, jc 4
wang, x 4
wang, wz 4
jhung, sh 4
hu, xy 4
gorai, s 4
chaudhuri, s 4

Sources
chemistry letters 18
journal of the american chemical society 15
journal of physical chemistry b 13
journal of crystal growth 13
materials letters 12
materials chemistry and physics 10
crystal growth & design 10
chinese journal of inorganic chemistry 10
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chemical communications 8
angewandte chemie-international edition 8
materials research bulletin 7
langmuir 7
journal of solid state chemistry 7
journal of materials chemistry 7

Keywords
chemistry, multidisciplinary 72
growth 56
materials science, multidisciplinary 48
chemistry, physical 48
nanorods 47
nanoparticles 42
nanowires 40

materials science, multidisciplinary 39
nanotubes 31
chemistry, inorganic & nuclear 30
nanocrystals 29
nanostructures 27
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Country
peoples r china 155
usa 42
japan 22
india 18
germany 13
south korea 12
france 10
england 9
italy 7
australia 6
switzerland 4
russia 4
sweden 3
spain 3
mexico 3

Institution
univ sci & technol china 33
chinese acad sci 28
shandong univ 8
zhejiang univ 7
univ texas 7
tsing hua univ 7
nanjing univ 6
fudan univ 6
jilin univ 5
yangzhou univ 4
peking univ 4
ne normal univ 4
natl inst mat sci 4
korea res inst chem technol 4

indian assoc cultivat sci 4

DataBase
science citation index 302

- # CLUSTER 255
  Reaction, surface, phase, and temperature dynamics/behavior of oxides, systems affected by water, and aqueous solutions (648 Records)

(Countries: USA, China, followed by Japan, France, Germany. Institutions: RAS, CSIC, CAS, CNRS. USA include University of Illinois, UCLA, University of Wisconsin.).

Cluster Syntax Features

Descriptive Terms
oxid 3.3%, water 3.1%, reaction 2.5%, solid 2.0%, product 1.8%, surfac 1.8%, solut 1.7%, phase 1.5%, sampl 1.3%, liquid 1.3%, materi 1.2%, temperatur 1.1%, rai 1.1%, acid 1.0%, hydrat 0.8%

Discriminating Terms
film 3.5%, water 2.9%, reaction 1.8%, product 1.8%, solid 1.7%, oxid 1.6%, nanotub 1.3%, nanoparticl 1.3%, magnet 1.2%, hydrat 1.2%, liquid 1.0%, quantum 0.9%, deposit 0.9%, solut 0.8%, polym 0.7%

Single Word Terms
rai 283, surfac 263, structur 249, temperatur 241, electron 211, diffract 206, oxid 204, reaction 202, high 189, solut 184, spectroscopi 183, materi 182, phase 182, form 171, solid 169

Double Word Terms
ray.diffraction 184, electron.microscopy 131, scanning.electron 109, ray.photoelectron 66, photoelectron.spectroscopy 62, diffraction.xrd 60, transmission.electron 55, solid.state 50, microscopy.sem 45, spectroscopy.xps 42, high.temperature 40, powder.ray

38, energy.dispersive 38, surface.area 37, room.temperature 36

Triple Word Terms

scanning.electron.microscopy 94, ray.photoelectron.spectroscopy 60, ray.diffraction.xrd 54, electron.microscopy.sem 44, transmission.electron.microscopy 41, photoelectron.spectroscopy.xps 40, powder.ray.diffraction 37, fourier.transform.infrared 30, energy.dispersive.ray 27, atomic.force.microscopy 23, solid.state.reaction 18, force.microscopy.afm 16, transform.infrared.spectroscopy 16, ray.powder.diffraction 15, diffraction.scanning.electron 14

Term Cliques

25.80% reaction product surfac liquid acid
25.77% reaction solid solut phase liquid
28.27% reaction solid surfac solut liquid
31.02% reaction solid product sampl materi temperatur rai
27.16% reaction solid product phase liquid temperatur
31.02% reaction solid product phase sampl temperatur rai
27.65% reaction solid product surfac liquid
24.10% water solut rai acid hydrat
18.40% water solut liquid acid hydrat
27.41% water reaction phase liquid temperatur
31.87% water reaction phase sampl temperatur rai
25.65% water reaction solut phase liquid
30.40% water reaction solut phase sampl rai
26.26% water reaction surfac solut liquid acid
30.25% water reaction surfac solut sampl rai acid
31.11% oxid reaction surfac solut sampl rai acid
30.67% oxid reaction product surfac sampl rai acid
30.64% oxid reaction solid solut phase sampl rai
31.89% oxid reaction solid surfac solut sampl materi rai
30.20% oxid reaction solid product phase sampl rai
31.50% oxid reaction solid product surfac sampl materi rai

Sample Cluster Record Titles

Chemistry of rare earth containing oxide-fluoride compounds

Study of wear behavior of MoSi2 under water lubrication

Transient liquid phase bonding of alumina to alumina via boron oxide interlayer

Suggested oxidation state dependence for the activity of submicron structures prepared from tin/tin oxide mixtures

[Electrical-bridge model on the self-organized growth of nanopores in, anodized, aluminum oxide]

[Coupled cation and oxygen-isotope exchange between alkali feldspar and aqueous chloride solution]

[Solution phase synthesis of magnesium hydroxide sulfate hydrate nanoribbons]

[Influence of insoluble elements on the nanostructure of water altered glasses]

[Investigation of the state of water in hydrating layered sodium disilicate in crystalline and amorphous forms by quasi-elastic neutron scattering]

Cluster Metrics

Authors
tebo, bm 4
kaner, rb 4
fernandez-garcia, m 4
zou, zg 3
zhang, l 3
webb, sm 3
thompson, ge 3
stadermann, fj 3
rinnert, e 3
ren, th 3
navrotsky, a 3
liu, zp 3
liu, y 3
liang, ym 3
lanson, b 3

Sources
chemistry of materials 22
journal of physical chemistry b 21
langmuir 12
thermochimica acta 8
on the convergence of bio-information-, environmental-, energy-, space- and nano-technologies, pts 1 and 2 8
journal of alloys and compounds 8
analytical chemistry 8
journal of solid state chemistry 7
journal of materials chemistry 7
journal of chemical physics 7
colloids and surfaces a-physicochemical and engineering aspects 7

materials chemistry and physics 6
geochimica et cosmochimica acta 6
fullerenes nanotubes and carbon nanostructures 6
applied surface science 6

Keywords

chemistry, physical 130
materials science, multidisciplinary 67
materials science, multidisciplinary 60
chemistry, analytical 50
chemistry, multidisciplinary 35
engineering, chemical 34
spectroscopy 33
films 32
water 29
kinetics 29
chemistry, physical 28
surface 26
chemistry, inorganic & nuclear 25
oxidation 25
adsorption 24

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2005 576
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2006 3
2003 1

Country

usa 131
peoples r china 98
japan 74
france 58
germany 48
russia 33
italy 33
spain 30
england 25
india 21
canada 21
south korea 20
australia 15
taiwan 13
switzerland 11

Institution

russian acad sci 17
csic 15
chinese acad sci 15
cnrs 14
natl inst adv ind sci & technol 9
univ tokyo 8
univ illinois 8
shanghai jiao tong univ 8
cnr 8
beijing univ chem technol 7
wuhan univ 6
univ paris 06 6
univ calif los angeles 6
univ wisconsin 5
univ sevilla 5

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- # CLUSTER 173
  Ferrous substances (especially ferrihydrites and iron oxides, namely goethite and hematite), characterized by Mossbauer spectroscopy and used for dechlorination, arsenic removal, and chemical reduction (162 Records)

(Countries: USA, followed by China, France, Germany, Canada. Institutions: CAS, University of New South Wales, RAS, CSIC, CNRS, CNR. USA include UCB, NASA.).

Cluster Syntax Features

Descriptive Terms
iron 34.6%, fe 16.8%, oxid 2.3%, goethit 1.2%, hematit 1.2%, iii 1.0%, ferrihydrit 0.9%, iron.oxides 0.9%, fe.iii 0.7%, dechlorin 0.6%, mossbauer 0.6%, fe2 0.5%, arsen 0.5%, reduct 0.5%, reaction 0.5%

Discriminating Terms
iron 25.0%, fe 10.6%, film 2.1%, goethit 1.0%, hematit 0.9%, ferrihydrit 0.7%,

iron.oxides 0.7%, nanoparticl 0.7%, nanotub 0.6%, fe.iii 0.5%, iii 0.5%, carbon 0.5%, dechlorin 0.5%, quantum 0.5%, deposit 0.4%

Single Word Terms

iron 127, fe 94, rai 85, surfac 84, oxid 74, electron 69, diffract 59, spectroscopi 57, phase 56, concentr 56, structur 54, reaction 53, solut 51, form 49, sampl 47

Double Word Terms

ray.diffraction 49, electron.microscopy 41, scanning.electron 30, mossbauer.spectroscopy 22, diffraction.xrd 21, surface.area 20, ray.photoelectron 20, iron.oxide 19, photoelectron.spectroscopy 19, fe.iii 19, iron.oxides 16, fe.fe 15, powder.ray 14, transmission.electron 13, first.order 12

Triple Word Terms

scanning.electron.microscopy 25, ray.photoelectron.spectroscopy 19, ray.diffraction.xrd 18, powder.ray.diffraction 14, transmission.electron.microscopy 11, energy.dispersive.ray 10, photoelectron.spectroscopy.xps 9, electron.microscopy.sem 9, zero.valent.iron 8, ray.powder.diffraction 8, fourier.transform.infrared 8, pseudo.first.order 7, spectroscopy.ray.diffraction 6, first.order.rate 6, inductively.coupled.plasma 5

Term Cliques

23.46% oxid fe2 arsen reaction
20.37% oxid mossbauer fe2 arsen
20.37% oxid iron.oxides mossbauer arsen
18.64% oxid iii fe.iii fe2 arsen
18.64% oxid iii iron.oxides fe.iii arsen
33.46% fe oxid fe2 reduct reaction
32.22% fe oxid dechlorin reduct reaction
29.51% fe oxid hematit iron.oxides mossbauer
26.13% fe oxid hematit ferrihydrit mossbauer fe2
25.10% fe oxid goethit ferrihydrit dechlorin reduct
25.66% fe oxid goethit iii iron.oxides fe.iii reduct
23.61% fe oxid goethit iii ferrihydrit fe.iii fe2 reduct
25.31% fe oxid goethit hematit iron.oxides fe.iii
23.02% fe oxid goethit hematit ferrihydrit fe.iii fe2
36.30% iron oxid dechlorin reduct reaction
28.50% iron oxid goethit ferrihydrit dechlorin reduct
28.57% iron oxid goethit iii iron.oxides fe.iii reduct
28.48% iron oxid goethit iii ferrihydrit fe.iii reduct
28.70% iron oxid goethit hematit iron.oxides fe.iii
28.60% iron oxid goethit hematit ferrihydrit fe.iii

Sample Cluster Record Titles

XRD and Mossbauer studies of crystallographic and magnetic transformations in synthesized Zn-substituted Cu-Ga-Fe compound

Synthesis of active goethite and maghemite from scrap iron sources

Mossbauer-effect study of local atomic order in bcc Fe100-xTix alloys with x <= 12

Reaction of zinc, copper and iron in air and chlorine mixtures

Removal of arsenic(III) from groundwater by nanoscale zero-valent iron

A new method to produce nanoscale iron for nitrate removal

Chemical reduction of nitrate by nanosized iron: Kinetics and pathways

Ferrihydrite-humic associations: Magnetic hyperfine interactions

Influence of Ni-dopant on the properties of synthetic goethite

Cluster Metrics

Authors
zhang, b 3
pattek-janczyk, a 3
iezzi, g 3
hawthorne, fc 3
doong, ra 3
della ventura, g 3
zheng, mh 2
zhang, y 2
weng, sc 2
weir, m 2
waite, td 2
tsuda, a 2
tee, jks 2
shabashov, va 2
seetharaman, s 2

Sources
environmental science & technology 17
american mineralogist 8
journal of hazardous materials 4
journal of nanoparticle research 3
journal of materials research 3
journal of colloid and interface science 3

geochimica et cosmochimica acta 3
clays and clay minerals 3
chemical geology 3
zeitschrift fur anorganische und allgemeine chemie 2
water research 2
progress in oceanography 2
physical review letters 2
marine chemistry 2
journal of the american chemical society 2

Keywords
iron 25
environmental sciences 25
materials science, multidisciplinary 19
engineering, environmental 19
geochemistry & geophysics 18
chemistry, physical 16
chemistry, multidisciplinary 15
mineralogy 15
kinetics 14
metallurgy & metallurgical engineering 10
materials science, multidisciplinary 10
goethite 10
zero-valent iron 9
spectroscopy 9
reduction 9

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Country
usa 36
peoples r china 20
france 17
germany 16
canada 15
japan 11
italy 10
taiwan 9
russia 9
england 8
australia 8
spain 7
sweden 5

poland 4
india 4

Institution
chinese acad sci 5
univ new s wales 4
russian acad sci 4
csic 4
cnrs 4
cnr 4
univ roma tre 3
univ ottawa 3
univ manitoba 3
univ cambridge 3
univ calif berkeley 3
tsing hua univ 3
royal inst technol 3
natl tsing hua univ 3
nasa 3

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- CLUSTER 233
  Studies on minerals (especially calcite, smectite, illitite, and fly ash), emphasizing leaching/sorption behavior and weathering (260 Records)

(Countries: USA dom, Germany, France, followed by China, Spain, Japan, Canada. Institutions: Stanford, RAS, CNRS, CAS. Other USA include USGS, UCB, University of New Mexico, Washington State University, University of Michigan.).

Cluster Syntax Features

Descriptive Terms

miner 16.9%, soil 8.0%, sediment 4.9%, ash 2.7%, calcit 1.2%, leach 1.2%, sorption 1.1%, rock 1.1%, smectit 1.0%, speci 1.0%, sem 0.8%, weather 0.7%, illit 0.7%, fly.ash 0.6%, sampl 0.6%

Discriminating Terms

miner 13.2%, soil 6.4%, sediment 3.9%, film 2.2%, ash 2.2%, calcit 1.0%, leach 0.9%, rock 0.9%, sorption 0.8%, smectit 0.8%, nanoparticl 0.8%, magnet 0.7%, nanotub 0.7%, weather 0.6%, illit 0.5%

Single Word Terms

electron 137, miner 122, microscopi 122, scan 113, surfac 104, rai 102, sampl 92, sem 87, structur 82, form 81, high 79, composit 78, diffract 71, format 69, phase 68

Double Word Terms

electron.microscopy 110, scanning.electron 107, ray.diffraction 60, microscopy.sem 36, energy.dispersive 32, diffraction.xrd 25, dispersive.ray 23, transmission.electron 21, organic.matter 20, electron.microscope 20, surface.area 13, infrared.spectroscopy 13, fly.ash 13, microscopy.energy 13, fourier.transform 13

Triple Word Terms

scanning.electron.microscopy 89, electron.microscopy.sem 36, energy.dispersive.ray 22, transmission.electron.microscopy 21, ray.diffraction.xrd 20, scanning.electron.microscope 19, microscopy.energy.dispersive 13, fourier.transform.infrared 12, electron.microscopy.energy 12, electron.microscopy.tem 12, inductively.coupled.plasma 9, electron.microscopy.ray 9, powder.ray.diffraction 9, spectroscopy.scanning.electron 8, ray.powder.diffraction 8

Term Cliques

15.92% leach rock weather illit sampl
15.38% leach rock smectit illit sampl
15.77% leach sorption rock illit sampl
18.23% ash sem illit fly.ash sampl
13.46% ash leach illit fly.ash sampl
14.08% ash leach smectit illit sampl
23.08% sediment speci sem
11.92% soil leach weather
13.97% soil leach speci
11.03% soil leach smectit
11.67% soil leach sorption
17.05% soil sediment speci
25.06% miner rock sem weather illit sampl
20.77% miner calcit rock smectit illit sampl

21.09% miner calcit sorption rock illit sampl
26.62% miner ash sem illit sampl
21.54% miner ash smectit illit sampl
28.38% miner sediment sem illit sampl
23.31% miner sediment smectit illit sampl
23.69% miner sediment sorption illit sampl
24.36% miner soil weather
22.31% miner soil sediment smectit
22.79% miner soil sediment sorption

Sample Cluster Record Titles

Mineralogical characterization and genesis of hydrothermal Mn oxides from the flank of the Juan the Fuca Ridge

Structural conformation and leaching from in vitro aged and retrieved Invisalign appliances

Contribution of minerals to the sorption of U(VI) on granite

Scanning electron microscope and energy dispersive X-ray spectrometry studies on the material surface of extruded Polycel((R)) ossicular prostheses

Microscopic scale characterization of ancient building sandstones from Saxony (Germany)

Crystal growth and dissolution processes at the calcite-water interface in the presence of zinc ions

Vitrification of municipal solid waste incinerator fly ash using Brown's gas

Low-temperature illitization of smectite in the late eocene and early oligocene of the Isle of Wight (Hampshire basin), UK

Observation of nano-clustered calcite growth via a transient phase mediated by organic polyanions: A close match for biomineralization

Cluster Metrics

Authors
putnis, a 4
xu, hf 3
marcus, ma 3

manceau, a 3
lee, js 3
balaz, p 3
achimovicova, m 3
tazaki, k 2
tamura, n 2
short, sa 2
shahwan, t 2
sekine, y 2
scott, ja 2
savage, ks 2
reeder, rj 2

Sources

geochimica et cosmochimica acta 9
american mineralogist 8
environmental science & technology 7
journal of hazardous materials 6
clays and clay minerals 6
chemical geology 5
journal of colloid and interface science 4
energy & fuels 4
earth and planetary science letters 4
applied clay science 4
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meteoritics & planetary science 3
journal of the american ceramic society 3
hydrometallurgy 3
geoderma 3

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environmental sciences 20
geosciences, multidisciplinary 17
adsorption 14
geosciences, multidisciplinary 13
mineralogy 12
engineering, chemical 12
chemistry, physical 12
energy & fuels 12
engineering, environmental 11
spectroscopy 9
surface 9

sorption 9

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usa 86
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peoples r china 18
spain 17
japan 16
canada 15
south korea 12
england 11
australia 10
taiwan 9
russia 9
poland 7
italy 7
brazil 7

Institution
stanford univ 7
russian acad sci 7
cnrs 7
chinese acad sci 6
us geol survey 5
univ munster 5
univ calif berkeley 5
univ tokyo 4
univ new mexico 4
nanjing univ 4
csic 4
washington state univ 3
univ paris 06 3
univ new s wales 3
univ michigan 3

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science citation index 260

- # CLUSTER 226
  Biofilms and other biological systems at the nanoscale, focusing on adhesive behavior, applications of/to bacteria, biofilm formation, surface properties, and electron microscopy studies (182 Records)

(Countries: USA dominant, Germany, Japan, England. Institutions: University of Toronto, CAS. USA include USDA ARC, University of Minnesota, University of Massachusetts, Montana State University, Medical College of Wisconsin, Case Western Reserve, USDA, University of Texas.).

Cluster Syntax Features

Descriptive Terms
biofilm 19.4%, adhes 5.0%, bacteria 4.1%, bacteri 3.4%, speci 2.9%, cell 1.5%, muscl 1.5%, isol 1.4%, plant 1.3%, biofilm.formation 1.1%, root 1.0%, microscopi 0.9%, surfac 0.8%, infect 0.8%, ultrastructur 0.8%

Discriminating Terms
biofilm 14.7%, adhes 3.0%, bacteria 3.0%, bacteri 2.4%, film 2.2%, speci 1.7%, muscl 1.1%, plant 0.9%, biofilm.formation 0.8%, isol 0.8%, root 0.7%, nanoparticl 0.7%, temperatur 0.6%, nanotub 0.6%, carbon 0.6%

Single Word Terms
electron 119, microscopi 118, cell 91, scan 86, surfac 83, structur 79, two 53, form 52, speci 49, format 46, transmiss 45, morpholog 41, bacteria 40, bacteri 39, adhes 38

Double Word Terms
electron.microscopy 94, scanning.electron 73, transmission.electron 37, atomic.force 21, force.microscopy 20, biofilm.formation 19, microscopy.sem 14, microscopy.tem 14, electron.microscope 13, first.time 10, microscopy.afm 9, electron.microscopic 9, cell.wall 9, high.resolution 9, electron.dense 8

Triple Word Terms
scanning.electron.microscopy 58, transmission.electron.microscopy 35, atomic.force.microscopy 20, electron.microscopy.sem 14, electron.microscopy.tem 14, scanning.electron.microscope 11, force.microscopy.afm 9, scanning.transmission.electron 7, scanning.electron.microscopic 6, electron.microscope.sem 5, confocal.laser.scanning 5, electron.dense.material 4, self.etch.adhesives 3, sem.transmission.electron 3, extracellular.polymeric.substances 3

Term Cliques
24.84% speci muscl microscopi infect ultrastructur

35.44% speci cell microscopi surfac infect ultrastructur
39.01% speci cell root microscopi surfac
31.98% speci cell plant root microscopi
28.11% bacteria cell isol plant root microscopi
35.16% adhes bacteria cell root microscopi surfac
35.81% biofilm bacteria cell microscopi surfac infect
30.49% biofilm bacteria cell isol microscopi infect
25.98% biofilm bacteria bacteri cell biofilm.formation surfac infect
21.43% biofilm bacteria bacteri cell isol biofilm.formation infect
37.27% biofilm adhes bacteria cell microscopi surfac
27.24% biofilm adhes bacteria bacteri cell biofilm.formation surface

Sample Cluster Record Titles

Electron tomography of biological samples

Adherence and biofilm formation of Staphylococcus epidermidis and Mycobacterium tuberculosis on various spinal implants

Ultrastructure of the cell wall of unbeaten Norway spruce pulp fibre surfaces

The high-resolution architecture and structural dynamics of Bacillus spores

The essential role of exopolymers (EPS) in aquatic systems

Formation of biofilms by Listeria monocytogenes under various growth conditions

Adhesion at calcium oxalate crystal surfaces and the effect of urinary constituents

Role of biopolymers on bacterial adhesion and mineral beneficiation

Isolation and identification of bacteria from marine biofilms

Cluster Metrics

Authors

wesson, ja 3
ward, md 3
sheng, xx 3
tay, fr 2
spolenak, r 2
schreiber, l 2
prati, c 2
poddubnaya, lg 2

pashley, dh 2
morbelli, ma 2
marchand, b 2
koike, k 2
kobayashi, k 2
huber, g 2
grandini, s 2

Sources
journal of morphology 5
microscopy research and technique 4
journal of nanoscience and nanotechnology 3
journal of dental research 3
infection and immunity 3
water science and technology 2
veterinary pathology 2
scanning 2
review of palaeobotany and palynology 2
proceedings of the national academy of sciences of the united states of america 2
polymer 2
laryngoscope 2
journal of the american society of nephrology 2
journal of biomaterials science-polymer edition 2
journal of bacteriology 2

Keywords
microbiology 12
atomic-force microscopy 11
anatomy & morphology 11
ultrastructure 11
microscopy 11
plant sciences 10
microscopy 9
surfaces 9
sem 9
cell biology 8
dentistry, oral surgery & medicine 7
biotechnology & applied microbiology 7
biochemistry & molecular biology 7
plant sciences 7
biofilm 7

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usa 60
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england 15
italy 11
canada 11
peoples r china 10
france 10
russia 5
brazil 5
australia 5
sweden 4
spain 4
india 4
austria 4

Institution

univ toronto 4
chinese acad sci 4
usda ars 3
univ minnesota 3
univ massachusetts 3
russian acad sci 3
natl univ la plata 3
montana state univ 3
med coll wisconsin 3
case western reserve univ 3
usda 2
univ texas 2
univ siena 2
univ saarland 2
univ roma la sapienza 2

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- # CLUSTER 194
  Phosphate and calcium compouns (especially calcium phosphates, such as apatite and hydroxyapatite [HAP]), emphasizing studies on cements, bone and bone-like material, and enamel (226 Records)

(Countries: China, followed by USA, Japan, Germany, England. Institutions: Sichuan University, CAS, University of Bristol. USA includes NIST.).

Cluster Syntax Features

Descriptive Terms
phosphat 18.2%, calcium 15.2%, apatit 5.5%, cement 4.1%, calcium.phosphate 3.6%, bone 3.2%, hydroxyapatit 2.5%, coat 2.2%, enamel 1.5%, hap 1.1%, fluid 0.8%, composit 0.8%, surfac 0.8%, precipit 0.6%, solut 0.6%

Discriminating Terms
phosphat 13.6%, calcium 11.3%, apatit 4.2%, cement 3.1%, calcium.phosphate 2.7%, bone 2.3%, film 2.0%, hydroxyapatit 1.8%, enamel 1.2%, hap 0.9%, nanoparticl 0.7%, nanotub 0.6%, magnet 0.6%, coat 0.6%, quantum 0.5%

Single Word Terms
phosphat 121, calcium 120, surfac 115, rai 101, electron 98, scan 88, microscopi 86, solut 83, composit 82, diffract 81, structur 80, sem 78, form 77, format 74, phase 69

Double Word Terms
scanning.electron 78, electron.microscopy 77, ray.diffraction 68, calcium.phosphate 62, microscopy.sem 35, diffraction.xrd 31, body.fluid 28, simulated.body 28, energy.dispersive 25, fourier.transform 23, transmission.electron 21, infrared.spectroscopy 19, transform.infrared 19, chemical.composition 17, powder.ray 17

Triple Word Terms
scanning.electron.microscopy 65, electron.microscopy.sem 35, ray.diffraction.xrd 27, simulated.body.fluid 26, fourier.transform.infrared 19, transmission.electron.microscopy 18, body.fluid.sbf 16, energy.dispersive.ray 15, powder.ray.diffraction 15,

ray.photoelectron.spectroscopy 13, transform.infrared.spectroscopy 12, microscopy.energy.dispersive 11, electron.microscopy.energy 11, scanning.electron.microscope 10, amorphous.calcium.phosphate 9

Term Cliques
31.27% calcium.phosphate hydroxyapatit enamel composit surfac solut
22.12% calcium.phosphate bone hydroxyapatit coat hap fluid composit precipit
21.50% cement bone hydroxyapatit hap composit
24.39% apatit calcium.phosphate bone hydroxyapatit coat fluid composit precipit
28.32% apatit calcium.phosphate bone hydroxyapatit coat fluid composit surfac
25.94% calcium calcium.phosphate hydroxyapatit coat hap fluid composit precipit
27.61% calcium cement hydroxyapatit hap composit
28.21% calcium apatit calcium.phosphate hydroxyapatit coat fluid composit precipit
32.13% calcium apatit calcium.phosphate hydroxyapatit coat fluid composit surfac
38.05% phosphat calcium calcium.phosphate hydroxyapatit coat composit surfac solut
31.02% phosphat calcium calcium.phosphate hydroxyapatit coat hap composit precipit solut
32.58% phosphat calcium apatit calcium.phosphate hydroxyapatit coat composit precipit
36.50% phosphat calcium apatit calcium.phosphate hydroxyapatit coat composit surface

Sample Cluster Record Titles

Ultrastructural study of calculus-enamel and calculus-root interfaces

Morphology and physical properties of calcium zincate

Nanocrystalline tetracalcium phosphate cement

Effect of thermohydraulic conditions on fouling of calcium oxalate and silica

Microwave accelerated synthesis of nanosized calcium deficient hydroxyapatite

Preparation and characterization of a novel bioactive bone cement: Glass based nanoscale hydroxyapatite bone cement

Properties of nanostructured hydroxyapatite prepared by a spray drying technique

Preparation and comprehensive characterization of a calcium hydroxyapatite reference material

Setting behavior of fast-setting calcium phosphate cement with mineral phase of bone

Cluster Metrics

Authors
zhang, xd 6
ding, cx 4
barralet, je 4
zhou, n 3
zhang, ly 3
wang, dp 3
rey, c 3
parker, dm 3
liu, xy 3
leng, y 3
huang, wh 3
gbureck, u 3
eichert, d 3
drouet, c 3
combes, c 3

Sources
bioceramics 17 16
biomaterials 12
journal of materials science-materials in medicine 10
cement and concrete research 9
high-performance ceramics iii, pts 1 and 2 8
journal of crystal growth 7
journal of biomedical materials research part a 7
journal of non-crystalline solids 4
chemistry of materials 4
materials science & engineering c-biomimetic and supramolecular systems 3
journal of physical chemistry b 3
journal of materials science 3
journal of materials chemistry 3
journal of dental research 3
journal of colloid and interface science 3

Keywords
hydroxyapatite 38
materials science, biomaterials 35
materials science, multidisciplinary 34
engineering, biomedical 31
chemistry, physical 24
dentistry, oral surgery & medicine 17
bone 16
materials science, multidisciplinary 14
apatite 14

materials science, ceramics 12
behavior 12
hydroxyapatite 11
crystallography 11
construction & building technology 11
adsorption 11

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2005 201
2004 25

Country
peoples r china 42
usa 30
japan 28
germany 24
england 24
france 14
india 13
brazil 11
south korea 9
spain 7
poland 7
canada 7
australia 7
italy 6
taiwan 5

Institution
sichuan univ 8
chinese acad sci 7
univ bristol 6
univ birmingham 5
tsing hua univ 5
zhejiang univ 4
univ tokyo 4
univ jena 4
nanyang technol univ 4
mcgill univ 4
kyoto univ 4
univ wurzburg 3
tongji univ 3
seoul natl univ 3
natl inst stand & technol 3

DataBase
science citation index 226

- # CLUSTER 186
  Soot, flame-synthesized particles, and humic substances, emphasizing aggregation, particle size, analysis using fractionation (125 Records)

(Countries: USA dominant, Germany. Institutions: University of Kentucky, University of Naples Federico, University of Delaware, Technical University of Munich, ETH. Other USA include University of Minnesota, ANL, University of Washington, University of Utah.).

Cluster Syntax Features

Descriptive Terms
soot 17.1%, flame 12.4%, particl 8.6%, aggreg 3.4%, fraction 2.0%, size 1.7%, colloid 1.6%, soot.particles 1.4%, flow 1.3%, diesel 1.1%, combust 0.9%, soil 0.9%, concentr 0.8%, matter 0.7%, humic 0.7%

Discriminating Terms
soot 13.6%, flame 9.6%, particl 3.1%, film 2.3%, aggreg 2.0%, fraction 1.2%, soot.particles 1.2%, diesel 0.8%, colloid 0.8%, magnet 0.7%, layer 0.7%, nanotub 0.6%, soil 0.6%, flow 0.6%, structur 0.6%

Single Word Terms
particl 102, size 89, concentr 45, surfac 41, soot 38, sampl 36, fraction 36, aggreg 36, high 35, two 34, model 34, flame 34, experiment 34, electron 33, nanoparticl 33

Double Word Terms

particle.size 32, electron.microscopy 24, transmission.electron 24, soot.particles 23, size.distribution 20, primary.particle 12, organic.matter 11, size.distributions 11, scanning.electron 10, electron.microscope 10, primary.particles 9, diffusion.flame 9, energy.dispersive 9, flow.fractionation 9, field.flow 9

Triple Word Terms

transmission.electron.microscopy 15, scanning.electron.microscopy 9, field.flow.fractionation 9, transmission.electron.microscope 8, energy.dispersive.ray 7, dissolved.organic.matter 7, electron.microscopy.tem 6, electron.microscope.tem 6, primary.particle.size 6, dispersive.ray.spectroscopy 5, flow.field.flow 5, spherical.primary.particles 4, electron.energy.loss 4, resolution.transmission.electron 4, electron.microscopy.sem 4

Term Cliques

12.80% colloid soil matter
16.80% fraction colloid soil
33.60% fraction size flow concentr humic
20.64% aggreg colloid concentr matter humic
23.04% aggreg fraction colloid concentr humic
34.08% aggreg fraction size concentr humic
34.67% particl soil matter
39.40% particl combust concentr matter
33.00% particl diesel combust matter
40.80% particl aggreg concentr matter
34.40% particl aggreg diesel matter
41.37% flame particl fraction size soot.particles flow concentr
32.96% soot particl fraction soot.particles soil
46.13% soot particl aggreg fraction size concentr
41.87% soot particl aggreg fraction size diesel
39.60% soot flame particl fraction size soot.particles combust concentr
36.40% soot flame particl fraction size soot.particles diesel combust

Sample Cluster Record Titles

Synthesis of oxide nanopowders in NanoSpray(SM) diffusion flames

Growth of zirconia particles made by flame spray pyrolysis

Nanoparticle production by UV irradiation of combustion generated soot particles

Effect of ferrocene addition on sooting limits in laminar premixed ethylene-oxygen-argon flames

Morphology, size distribution, and oxidation of diesel soot

[Laser-optical characterization of air-borne nanoparticles by time-resolved laser-induced incandescence (TIRE-LII)]

[A lattice chain model for the thermal restructuring of nanoparticle chain aggregates]

[Inverted co-flow diffusion flame for producing soot]

[Transmission electron microscopy investigation of ultrafine coal fly ash particles]

Cluster Metrics

Authors

shah, n 4
minutolo, p 4
huggins, fe 4
huffman, gp 4
zachariah, mr 3
wang, h 3
chen, yz 3
zhao, b 2
wiggers, h 2
vital, a 2
stipe, cb 2
schmid, hj 2
sawyer, rf 2
roth, p 2
pratsinis, se 2

Sources

environmental science & technology 8
proceedings of the combustion institute 7
journal of nanoparticle research 6
combustion and flame 5
chromatographia 4
marine chemistry 3
langmuir 3
journal of physical chemistry b 3
journal of chromatography a 3
colloids and surfaces a-physicochemical and engineering aspects 3
chemical engineering science 3
atmospheric environment 3
analytica chimica acta 3
water research 2
on the convergence of bio-information-, environmental-, energy-, space- and nano-technologies, pts 1 and 2 2

Keywords

engineering, chemical 25
particles 24
nanoparticles 19
chemistry, analytical 16
growth 15
energy & fuels 15
thermodynamics 13
environmental sciences 13
chemistry, physical 12
chemistry, multidisciplinary 12
engineering, environmental 11
biochemical research methods 11
materials science, multidisciplinary 10
combustion 10
soot 8

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2005 100
2004 19
2006 6

Country

usa 46
germany 22
switzerland 9
italy 8
france 8
india 6
england 6
south korea 5
finland 5
canada 5
japan 4
spain 3
peoples r china 3
australia 3
taiwan 2

Institution

univ kentucky 5
univ naples federico ii 4
univ delaware 4
tech univ munich 4
eth 4

univ minnesota 3
univ erlangen nurnberg 3
univ alberta 3
indian inst technol 3
forschungszentrum karlsruhe 3
cnr 3
argonne natl lab 3
univ washington 2
univ utah 2
univ tokyo 2

DataBase
science citation index 125

- # CLUSTER 126
  Aerosols and other fine/ultrafine particles, with emphasis on nucleation and measuring particle size, mass, and concentration, especially in the atmosphere (251 Records)

(Countries: USA dominant, Germany, followed by Finland, Japan. Institutions: University of Helsinki, followed by University of Minnesota. Other USA include USC, University of Colorado, UCLA, UCD, PNNL.).

Cluster Syntax Features

Descriptive Terms
particl 25.9%, aerosol 23.7%, size 1.8%, mass 1.7%, concentr 1.4%, dust 1.2%, number 1.1%, aerosol.particles 1.1%, atmospher 1.1%, distribut 0.9%, mobil 0.8%, nucleat 0.7%, particle.number 0.6%, ultrafin 0.6%, size.distributions 0.5%

Discriminating Terms
aerosol 17.4%, particl 12.9%, film 2.1%, dust 0.8%, aerosol.particles 0.8%, mass 0.8%,

structur 0.7%, surfac 0.7%, magnet 0.6%, nanotub 0.6%, atmospher 0.6%, layer 0.5%, crystal 0.5%, temperatur 0.5%, number 0.5%

Single Word Terms

particl 236, size 177, aerosol 165, concentr 124, measur 109, distribut 108, number 101, diamet 98, high 95, mass 93, sampl 88, two 80, atmospher 77, composit 69, time 69

Double Word Terms

particle.size 65, size.distributions 58, aerosol.particles 56, size.distribution 48, particle.number 36, electron.microscopy 34, differential.mobility 33, scanning.electron 32, number.concentrations 28, particulate.matter 25, mobility.analyzer 25, mobility.particle 25, particle.mass 25, number.concentration 25, mass.spectrometer 24

Triple Word Terms

particle.size.distributions 26, differential.mobility.analyzer 25, scanning.electron.microscopy 22, scanning.mobility.particle 21, mobility.particle.sizer 18, particle.number.concentrations 16, energy.dispersive.ray 15, particle.size.distribution 15, tandem.differential.mobility 13, transmission.electron.microscopy 13, particle.number.concentration 12, scanning.electron.microscope 11, number.size.distribution 10, microscopy.energy.dispersive 10, electron.microscopy.energy 10

Term Cliques

45.26% particl aerosol dust aerosol.particles atmospher
43.48% particl aerosol size concentr aerosol.particles nucleat particle.number ultrafin
44.87% particl aerosol size concentr aerosol.particles mobil nucleat ultrafin
49.86% particl aerosol size concentr aerosol.particles atmospher nucleat
50.85% particl aerosol size mass concentr atmospher distribut nucleat
42.63% particl aerosol size mass concentr number distribut nucleat particle.number ultrafin size.distributions
43.64% particl aerosol size mass concentr number distribut mobil nucleat ultrafin size.distributions

Sample Cluster Record Titles

Coagulation in bipolar, aerosol chargers

A method for measuring the density of irregularly shaped biological aerosols such as pollen

Generation of aluminum nanoparticles using an atmospheric pressure plasma torch

Aerosol number to volume ratios in Southwest Portugal during ACE-2

Particulates of the surface microlayer of open water in the central Arctic Ocean in summer

[Comparison of aerosol chemistry transport model simulations with lidar and Sun photometer observations at a site near Paris]

[Measurement of ultrafine particle size distributions from coal-, oil-, and gas-fired stationary combustion sources]

[Atmospheric mineral particles collected at Qira in the Taklamakan desert, China]

[Size diffusion for the growth of newly nucleated aerosol]

Cluster Metrics

Authors
kulmala, m 14
sioutas, c 8
wiedensohler, a 7
sakurai, h 6
fine, pm 6
mcmurry, ph 5
kuhn, t 5
hameri, k 5
weingartner, e 4
okuyama, k 4
massling, a 4
lehtinen, kej 4
laaksonen, a 4
kittelson, db 4
kim, cs 4

Sources
aerosol science and technology 31
atmospheric environment 30
journal of geophysical research-atmospheres 19
journal of aerosol science 18
atmospheric chemistry and physics 13
environmental science & technology 9
geophysical research letters 7
journal of environmental monitoring 6
science of the total environment 5
tellus series b-chemical and physical meteorology 4
journal of analytical atomic spectrometry 4
analytical chemistry 4
nature 3
industrial & engineering chemistry research 3

boreal environment research 3

Keywords
environmental sciences 63
meteorology & atmospheric sciences 58
environmental sciences 48
particles 37
engineering, mechanical 34
meteorology & atmospheric sciences 32
engineering, chemical 26
size 24
aerosol 22
particles 18
nanoparticles 18
engineering, mechanical 18
aerosols 17
ultrafine particles 16
chemistry, analytical 15

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2005 226
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Country
usa 90
germany 46
finland 30
japan 29
sweden 16
switzerland 13
england 13
italy 12
peoples r china 11
spain 9
south korea 9
france 9
russia 8
canada 7
norway 6

Institution
univ helsinki 19
univ minnesota 12
univ so calif 8
univ kuopio 7

paul scherrer inst 7
max planck inst chem 7
hiroshima univ 7
finnish meteorol inst 7
univ colorado 5
univ calif los angeles 5
univ calif davis 5
stockholm univ 5
pacific nw natl lab 5
finnish inst occupat hlth 5
univ mainz 4

DataBase
science citation index 251

- CLUSTER 212
  Investigations on particle size, focusing on determination of particle size distribution, particles prepared by precipitation method, dispersion of particles, and barium titanate ($BaTiO_3$) particles and powders (380 Records)

(Countries: USA, China, followed by Japan, Germany, followed by South Korea, Taiwan. Institutions: CAS, Zhejiang University, University

Erlangen Nurnberg. USA include University of Connecticut, Rutgers State University.).

Cluster Syntax Features

Descriptive Terms

particl 28.3%, particle.size 15.0%, size 13.9%, nanoparticl 2.2%, distribut 1.4%, size.distribution 1.3%, particle.size.distribution 1.1%, precipit 1.0%, nanofluid 0.9%, dispers 0.6%, concentr 0.5%, particle.sizes 0.5%, powder 0.5%, solut 0.4%, batio3 0.4%

Discriminating Terms

particl 18.0%, particle.size 12.8%, size 8.3%, film 2.5%, size.distribution 1.0%, particle.size.distribution 1.0%, nanofluid 0.8%, nanotub 0.7%, layer 0.7%, magnet 0.7%, structur 0.6%, surfac 0.6%, precipit 0.5%, carbon 0.5%, distribut 0.5%

Single Word Terms

size 374, particl 372, nanoparticl 175, distribut 153, electron 121, temperatur 111, surfac 100, concentr 100, solut 91, properti 91, high 89, microscopi 84, condit 84, mean 82, control 81

Double Word Terms

particle.size 309, size.distribution 116, electron.microscopy 75, transmission.electron 68, particle.sizes 58, ray.diffraction 47, average.particle 37, scanning.electron 37, mean.particle 35, size.particle 28, microscopy.tem 26, size.size 21, size.distributions 21, particles.size 21, surface.area 18

Triple Word Terms

particle.size.distribution 81, transmission.electron.microscopy 50, average.particle.size 31, mean.particle.size 26, electron.microscopy.tem 25, scanning.electron.microscopy 23, particle.size.particle 20, ray.diffraction.xrd 17, size.particle.size 17, particle.size.distributions 17, narrow.particle.size 16, temperature.particle.size 13, particle.size.size 12, dynamic.light.scattering 12, narrow.size.distribution 11

Term Cliques

38.95% particl nanoparticl nanofluid dispers concentr
42.19% particl size dispers particle.sizes powder batio3
51.74% particl size distribut powder batio3
46.80% particl size nanoparticl dispers particle.sizes batio3
50.83% particl particle.size size precipit dispers powder solut
49.59% particl particle.size size precipit dispers particle.sizes powder
50.89% particl particle.size size distribut size.distribution precipit powder solut
51.88% particl particle.size size distribut size.distribution precipit concentr solut
51.51% particl particle.size size distribut size.distribution particle.size.distribution powder solut
52.50% particl particle.size size distribut size.distribution particle.size.distribution

concentr solut
53.53% particl particle.size size nanoparticl precipit dispers particle.sizes
51.22% particl particle.size size nanoparticl precipit dispers concentr solute

Sample Cluster Record Titles

Mechanical activation of aluminum: 2. Size, shape, and structure of particles

The influence of size scale on the performance of fuel cells

Synthesis and nanodomain patterns of BaTiO3 nanoparticles

Analysis of particle size distribution by particle tracking

Particle size distribution analysis for nano-SiO2 powder by ultra-small angle X-ray scattering (USAXS) using synchrotron radiation

Comparison of micro- and nano-size particle depositions in a human upper airway model

Preparation and characterization of solid lipid nanoparticles (SLN) made of cacao butter and curdlan

Preparation of MgAl2O4 nanopowder by homogeneous precipitation method

Size effects in ultradisperse powders of nickel

Cluster Metrics

Authors
peukert, w 6
kim, cs 4
zhou, jg 3
zhao, fy 3
wang, zh 3
tsung, tt 3
sundmacher, k 3
stenger, f 3
schwarzer, hc 3
okuyama, k 3
lo, ch 3
li, zq 3
kim, ms 3
hong, gy 3

gao, sy 3

Sources

journal of physical chemistry b 11
international journal of pharmaceutics 11
chemical engineering science 9
rare metal materials and engineering 8
colloids and surfaces a-physicochemical and engineering aspects 8
industrial & engineering chemistry research 6
powder technology 5
materials letters 5
langmuir 5
journal of the american ceramic society 5
journal of crystal growth 5
journal of applied physics 5
chinese journal of inorganic chemistry 5
ceramics international 5
solid state ionics 4

Keywords

chemistry, physical 59
nanoparticles 57
materials science, multidisciplinary 50
engineering, chemical 45
particles 42
materials science, multidisciplinary 29
nanoparticles 27
size 27
chemistry, multidisciplinary 25
materials science, ceramics 22
physics, applied 20
particles 20
powders 19
growth 19
nanoparticle 18

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2005 324
2004 48
2006 8

Country

usa 75
peoples r china 65
japan 41
germany 38

south korea 25
taiwan 23
india 18
france 18
england 16
spain 12
italy 11
russia 10
switzerland 8
canada 7
ukraine 6

Institution
chinese acad sci 13
zhejiang univ 7
univ erlangen nurnberg 7
tech univ munich 6
natl inst adv ind sci & technol 6
univ connecticut 5
russian acad sci 5
natl cheng kung univ 5
indian inst technol 5
hanyang univ 5
univ magdeburg 4
rutgers state univ 4
polish acad sci 4
natl chung cheng univ 4
korea inst machinery & mat 4

DataBase
science citation index 380

- # CLUSTER 238
  Studies on nano-sized particles, characterized by size, surface characteristics, shape, and morphology (580 Records)

(Countries: USA, followed by Japan, China, Germany, followed by Korea, France. Institutions: Osaka University, CAS. USA include University of Texas, University of Alabama, University of Maryland.).

Cluster Syntax Features

Descriptive Terms
particl 64.2%, size 1.2%, nanoparticl 0.9%, surfac 0.7%, shape 0.4%, spheric 0.4%, phase 0.3%, metal 0.3%, diamet 0.3%, dispers 0.3%, solut 0.3%, morpholog 0.3%, composit 0.2%, forc 0.2%, water 0.2%

Discriminating Terms
particl 51.7%, film 2.5%, nanotub 0.8%, magnet 0.7%, carbon 0.6%, quantum 0.6%, structur 0.6%, layer 0.6%, si 0.5%, deposit 0.5%, crystal 0.4%, thin 0.4%, dot 0.4%, cell 0.3%, temperatur 0.3%

Single Word Terms
particl 580, size 304, surfac 233, electron 184, nanoparticl 165, microscopi 144, structur 138, temperatur 127, form 127, diamet 124, phase 123, two 122, properti 117, high 115, solut 115

Double Word Terms
electron.microscopy 122, particle.size 96, scanning.electron 86, transmission.electron 82, ray.diffraction 44, microscopy.sem 37, particle.surface 33, surface.area 32, size.distribution 28, size.particles 27, electron.microscope 27, microscopy.tem 26, particles.size 25, particle.morphology 25, particles.formed 24

Triple Word Terms
transmission.electron.microscopy 70, scanning.electron.microscopy 65, electron.microscopy.sem 36, electron.microscopy.tem 26, ray.photoelectron.spectroscopy 18, ray.diffraction.xrd 17, atomic.force.microscopy 17, scanning.electron.microscope 17, energy.dispersive.ray 13, resolution.transmission.electron 12, force.microscopy.afm 12, high.resolution.transmission 11, photoelectron.spectroscopy.xps 11, van.der.waals 10, scanning.transmission.electron 9

Term Cliques
35.46% particl nanoparticl surfac dispers composit forc
36.29% particl nanoparticl surfac diamet dispers forc
35.17% particl nanoparticl surfac spheric composit forc
30.42% particl size shape phase dispers solut morpholog composit water

32.37% particl size shape phase diamet dispers morpholog water
30.23% particl size shape spheric phase solut morpholog composit water
30.79% particl size surfac shape metal dispers solut morpholog composit water
32.57% particl size surfac shape metal diamet dispers morpholog water
32.34% particl size surfac shape spheric solut morpholog composit water
31.44% particl size nanoparticl shape phase dispers solut composit water
33.51% particl size nanoparticl shape phase diamet dispers water
31.25% particl size nanoparticl shape spheric phase solut composit water
31.71% particl size nanoparticl surfac shape metal dispers solut composit water
33.58% particl size nanoparticl surfac shape metal diamet dispers water
33.35% particl size nanoparticl surfac shape spheric solut composit water

Sample Cluster Record Titles

Description of morphological changes of particles along spray drying

Dielectrophoresis of nanoparticles

Thermal stability of Au nanoparticles in O-2 and air on fully oxidized TiO2(110) substrates at elevated pressures. An AFM/XPS study of Au/TiO2 model systems

Combustion synthesis and characterization of nanocrystalline tin and tin oxide (SnOx, x=0-2) particles

On Mo-Ru-Tc-Pd-Rh-Te alloy particles extracted from spent fuel and their leaching behavior under Ar and H-2 atmospheres

Synthesis of hollow nanoparticles by plasma polymerization

Aggregation of paramagnetic particles in the presence of a hydrodynamic shear

Tough and heat resistant: New silicone particles for thermosets

Size-dependent melting of Bi nanoparticles

Cluster Metrics

Authors

roth, p 7
kang, yc 6
yokoyama, h 5
rellinghaus, b 5
okuyama, k 5

nikles, de 5
lee, j 5
jung, ky 5
harrell, jw 5
wiggers, h 4
suzuki, h 4
stark, h 4
mori, h 4
mangeney, c 4
lenggoro, iw 4

Sources
langmuir 19
journal of physical chemistry b 17
journal of colloid and interface science 16
physical review b 14
materials letters 11
journal of applied physics 11
applied physics letters 9
powder technology 8
journal of nanoparticle research 8
colloids and surfaces a-physicochemical and engineering aspects 8
nanotechnology 7
journal of materials science 7
journal of alloys and compounds 7
scripta materialia 6
journal of materials research 6

Keywords
chemistry, physical 92
materials science, multidisciplinary 79
nanoparticles 61
particles 54
physics, applied 45
materials science, multidisciplinary 43
chemistry, multidisciplinary 38
engineering, chemical 35
nanoparticles 30
size 30
growth 27
particles 25
engineering 25
physics, applied 25
metallurgy & metallurgical 25

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2004 57
2006 8

Country
usa 152
japan 95
peoples r china 82
germany 78
south korea 43
france 34
england 25
russia 16
spain 12
india 12
austria 12
australia 12
switzerland 11
denmark 11
sweden 10

Institution
osaka univ 10
chinese acad sci 10
univ texas 8
tsing hua univ 8
tohoku univ 8
russian acad sci 8
univ duisburg essen 7
korea res inst chem technol 7
konkuk univ 7
univ alabama 6
hiroshima univ 6
zhejiang univ 5
univ tokyo 5
univ sci & technol china 5
univ maryland 5

DataBase
science citation index 580

- CLUSTER 164
  Nanoparticles (especially silica [SiO2] and titanium dioxide [TiO2]), emphasizing preparation, surface modification, and core/shell composites (125 Records)

(Countries: China dominant, USA, South Korea. Institutions: CAS, Zhejiang University, Tsing Hua University. USA include US Army, University of New Orleans, University of Maryland, University of Kentucky.).

Cluster Syntax Features

Descriptive Terms

nano 29.2%, particl 17.4%, nano.particles 9.9%, coat 2.8%, sio2 1.9%, size 1.5%, shell 1.5%, core 1.2%, nano.sized 1.0%, nano.particle 1.0%, core.shell 0.8%, tio2 0.8%, composit 0.6%, nano.sio2 0.5%, sio2.particles 0.5%

Discriminating Terms

nano 20.1%, particl 8.3%, nano.particles 7.8%, film 1.9%, sio2 0.9%, coat 0.8%, nano.particle 0.8%, shell 0.7%, nano.sized 0.7%, nanotub 0.6%, carbon 0.6%, structur 0.5%, core 0.5%, crystal 0.5%, core.shell 0.5%

Single Word Terms

particl 121, nano 104, size 72, surfac 49, composit 38, coat 36, properti 36, temperatur 29, structur 29, dispers 28, nanoparticl 28, materi 27, core 27, high 26, mechan 24

Double Word Terms

nano.particles 49, nano.sized 26, particle.size 22, nano.particle 18, core.shell 18, sio2.particles 12, electron.microscopy 10, nano.scale 10, size.distribution 10, ray.diffraction 10, scanning.electron 10, particles.nano 9, sol.gel 9, transmission.electron 9, sized.particles 9

Triple Word Terms

transmission.electron.microscopy 8, nano.sized.particles 8, core.shell.particles 8, core.shell.structure 7, scanning.electron.microscopy 6, electron.microscopy.tem 5, gold.nano.particles 4, particle.size.distribution 4, particles.core.shell 4, scale.nano.scale 4, scanning.electron.microscope 3, ray.diffraction.xrd 3, electron.microscope.sem 3, nano.sio2.particles 3, core.shell.composite 3

Term Cliques
34.13% particl sio2 size nano.sized nano.sio2 sio2.particles
40.32% particl sio2 size core sio2.particles
30.93% particl coat sio2 composit nano.sio2 sio2.particles
29.33% particl coat sio2 nano.sized nano.sio2 sio2.particles
30.53% particl coat sio2 nano.sized tio2 sio2.particles
27.56% particl coat sio2 shell core core.shell tio2 composit sio2.particles
53.60% nano particl composit nano.sio2
47.20% nano particl nano.particle tio2 composit
53.00% nano particl nano.sized tio2
52.48% nano particl size nano.sized nano.sio2
52.80% nano particl nano.particles nano.particle composit

Sample Cluster Record Titles

Self-organized nano-particles for enhanced wetting of hard surfaces

Growth mechanism of nano-sized Titania-coated silica particles prepared from metal alkoxide in a nonionic water-in-oil microemulsion

Preparation and characterization of SiO2/Tio(2) core/shell composite particles using TiO2 nanoparticles via heterocoagulation in a water system

The role of the Al2O3 passivation shell surrounding nano-Al particles in the combustion synthesis of NiAl

Preparation of nano-particle copper by chemical reduction

Preparation of polyaniline/nano-Zno composites via a novel Pickering emulsion route

Synthesis and physical characteristics of ZnAl2O4 nanocrystalline and ZnAl2O4/Eu core-shell structure via hydrothermal route

Effects of nano-diamond particles on the structure and tribological property of Ni-matrix nanocomposite coatings

Removal of nano and microparticles by granular filter media coated with nanoporous aluminium oxide

Cluster Metrics

Authors

xu, bs 4
chen, sy 4
wu, mk 3
chen, ig 3
yu, m 2
yang, h 2
wang, zy 2
wang, x 2
wang, m 2
wang, h 2
wang, cc 2
tu, wy 2
rong, y 2
pantoya, ml 2
lin, ys 2

Sources

rare metal materials and engineering 7
journal of industrial and engineering chemistry 5
polymer 3
materials letters 3
journal of inorganic materials 3
electrochimica acta 3
chinese journal of inorganic chemistry 3
tribology letters 2
surface & coatings technology 2
propellants explosives pyrotechnics 2
pricm 5: the fifth pacific rim international conference on advanced materials and processing, pts 1-5 2
powder technology 2
materials science and engineering a-structural materials properties microstructure and processing 2
materials chemistry and physics 2
journal of sol-gel science and technology 2

Keywords

materials science, multidisciplinary 22
chemistry, multidisciplinary 13
nanoparticles 11
films 11
engineering 10
metallurgy & metallurgical 10
nanoparticles 8

engineering, chemical 8
engineering, chemical 8
growth 7
polymer science 6
materials science, ceramics 6
electrochemistry 6
chemistry, physical 6
chemistry, inorganic & nuclear 6

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2005 106
2004 17
2006 2

Country
peoples r china 59
usa 14
south korea 10
taiwan 8
japan 8
germany 8
australia 4
singapore 2
russia 2
poland 2
india 2
hungary 2
france 2
england 2
wales 1

Institution
chinese acad sci 9
zhejiang univ 6
tsing hua univ 5
shanghai jiao tong univ 3
natl cheng kung univ 3
hanyang univ 3
acad sinica 3
xian jiaotong univ 2
wuhan univ technol 2
usa 2
univ sci & technol china 2
univ paris 06 2
univ new orleans 2
univ maryland 2

univ kentucky 2

DataBase
science citation index 125

- # CLUSTER 228
  Colloidal particles, spheres, suspensions, and crystals, emphasizing particle size, hollow spheres, stabilization, dispersion, and latex materials (258 Records)

(Countries: USA, China, followed by Germany, Japan, South Korea. Institutions: CAS, Rice University, RAS. Other USA include University of Washington, Georgia Institute of Technology, Texas A&M.).

Cluster Syntax Features

Descriptive Terms
colloid 28.8%, particl 11.1%, sphere 4.3%, suspens 3.0%, nanocryst 3.0%, aggreg 1.8%, size 1.4%, hollow 1.1%, stabil 1.0%, dispers 0.9%, latex 0.9%, colloidal.particles 0.9%, solut 0.7%, aqueou 0.6%, concentr 0.6%

Discriminating Terms
colloid 25.1%, particl 5.3%, sphere 3.6%, suspens 2.5%, film 2.2%, nanocryst 1.8%, aggreg 1.1%, hollow 0.8%, colloidal.particles 0.8%, nanotub 0.7%, latex 0.7%, carbon 0.6%, quantum 0.5%, temperatur 0.5%, deposit 0.4%

Single Word Terms
particl 206, colloid 165, size 128, surfac 98, structur 83, form 79, solut 76, concentr 74, stabil 67, dispers 60, suspens 59, nanoparticl 59, system 57, format 56, sphere 54

Double Word Terms
electron.microscopy 35, particle.size 31, colloidal.particles 30, transmission.electron 29,

light.scattering 22, size.distribution 22, scanning.electron 19, zeta.potential 14, self.assembly 14, aqueous.solution 13, latex.particles 13, core.shell 12, colloidal.crystals 12, ray.diffraction 11, aqueous.solutions 10

Triple Word Terms
transmission.electron.microscopy 25, scanning.electron.microscopy 15, dynamic.light.scattering 9, atomic.force.microscopy 8, electron.microscopy.tem 7, angle.ray.scattering 6, small.angle.ray 6, force.microscopy.afm 5, van.der.waals 5, self.assembly.colloidal 5, particle.size.distribution 5, polystyrene.latex.particles 5, photon.correlation.spectroscopy 4, core.shell.spheres 4, electric.field.strength 4

Term Cliques
30.23% nanocryst size stabil solut
13.05% sphere hollow latex
18.41% sphere nanocryst
27.42% particl hollow latex colloidal.particles
31.01% particl hollow stabil latex
33.43% particl aggreg hollow stabil
34.54% particl aggreg size stabil dispers solut aqueou concentr
33.72% particl suspens aggreg size stabil dispers aqueou concentr
30.72% colloid sphere latex concentr
41.18% colloid particl latex colloidal.particles
51.26% colloid particl size colloidal.particles
38.44% colloid particl suspens stabil latex concentr
39.34% colloid particl suspens size stabil dispers aqueou concentr

Sample Cluster Record Titles

Polystyrene/melamine-formaldehyde hollow microsphere composite by self-assembling of latex particles at emulsion droplet interface

Thermal convection in colloidal suspensions with negative separation ratio

Surface clusters of colloid particles produced by deposition on sites

A comparative study on the phase behaviour of highly charged colloidal spheres in a confining wedge geometry

Synthesis of polystyrene beads loaded with dual luminophors for self-referenced oxygen sensing

Isostatic ultra-high-pressure effects on supercooled melts in colloidal triglyceride dispersions

Fabrication of superhydrophobic surfaces from binary colloidal assembly

[Colloidal nanocrystal synthesis and the organic-inorganic interface]

[Colloidal jamming at interfaces: A route to fluid-bicontinuous gels]

Cluster Metrics

Authors
mohwald, h 5
yu, zm 3
yang, sm 3
xia, yn 3
wang, dy 3
wang, bc 3
elaissari, a 3
colvin, vl 3
zhu, ym 2
zhao, l 2
zhang, jh 2
zhang, h 2
zhang, g 2
yoon, ts 2
yang, b 2

Sources
langmuir 20
journal of colloid and interface science 15
journal of physical chemistry b 14
chemistry of materials 12
journal of the american chemical society 9
colloids and surfaces a-physicochemical and engineering aspects 9
colloid and polymer science 5
chemical journal of chinese universities-chinese 5
advanced materials 5
nano letters 4
journal of magnetism and magnetic materials 4
chemical communications 4
talanta 3
physical review letters 3
physical review e 3

Keywords
chemistry, physical 93
chemistry, multidisciplinary 42
nanoparticles 42

particles 35
materials science, multidisciplinary 30
materials science, multidisciplinary 26
growth 21
spheres 19
films 16
silica 15
water 14
particles 13
adsorption 12
surface 11
physics, condensed matter 11

Publication Year
2005 227
2004 26
2006 5

Country
usa 58
peoples r china 51
germany 28
japan 23
south korea 22
france 19
england 14
russia 12
spain 6
singapore 6
netherlands 6
india 6
canada 6
australia 6
turkey 4

Institution
chinese acad sci 10
rice univ 7
russian acad sci 6
univ washington 5
seoul natl univ 5
max planck inst colloids & interfaces 5
korea adv inst sci & technol 5
univ utrecht 4
georgia inst technol 4
yonsei univ 3

univ toronto 3
univ munich 3
univ manchester 3
univ granada 3
texas a&m univ 3

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science citation index 258

- # CLUSTER 179
  Magnetic particles, focusing on ferrites (such as Fe304 and Fe2O3) and ferrofluids, superparamagnetic particles, particle size, and Mossbauer spectroscopy (178 Records)

(Countries: China, USA, Japan. Institutions: CAS, University of Sao Paulo, Indian Institute of Technology, Tohoku University. USA includes University of Alabama.).

Cluster Syntax Features

Descriptive Terms
particl 20.3%, magnet 18.3%, iron 5.1%, magnetit 3.4%, ferrit 2.1%, fe3o4 1.9%, superparamagnet 1.8%, nanoparticl 1.7%, fe 1.5%, size 1.5%, fe2o3 1.4%, fluid 1.1%, mossbauer 1.0%, particle.size 0.9%, ferrofluid 0.9%

Discriminating Terms
particl 10.7%, magnet 9.7%, iron 3.3%, magnetit 2.7%, film 2.2%, ferrit 1.5%, fe3o4 1.5%, superparamagnet 1.4%, fe2o3 1.0%, carbon 0.7%, mossbauer 0.7%, ferrofluid 0.7%, nanotub 0.7%, fluid 0.7%, surfac 0.6%

Single Word Terms
particl 174, magnet 142, size 116, nanoparticl 93, properti 76, temperatur 61, iron 58, structur 57, surfac 52, field 49, electron 48, superparamagnet 47, oxid 46, synthes 46, sampl 45

Double Word Terms
particle.size 53, magnetic.properties 44, transmission.electron 31, electron.microscopy 30, ray.diffraction 29, saturation.magnetization 26, magnetic.particles 25, room.temperature 20, iron.oxide 18, average.particle 18, magnetic.field 17, size.distribution 16, particles.magnetic 16, core.shell 15, sol.gel 15

Triple Word Terms
transmission.electron.microscopy 23, average.particle.size 16, ray.diffraction.xrd 12, electron.microscopy.tem 10, scanning.electron.microscopy 8, iron.oxide.particles 7, vibrating.sample.magnetometer 7, superparamagnetic.iron.oxide 6, electron.microscopy.sem 6, maghemite.gamma.fe2o3 5, fourier.transform.infrared 5, transform.infrared.spectroscopy 5, alpha.fe2o3.particles 5, transmission.electron.microscope 5, particle.size.distribution 5

Term Cliques
40.77% particl nanoparticl size fe2o3 mossbauer particle.size ferrofluid
39.49% particl magnetit nanoparticl size fe2o3 mossbauer ferrofluid
35.58% particl iron fe fe2o3 mossbauer particle.size
44.06% particl iron nanoparticl size fe2o3 mossbauer particle.size
45.75% particl iron superparamagnet nanoparticl size mossbauer particle.size
42.78% particl iron magnetit nanoparticl size fe2o3 mossbauer
44.46% particl iron magnetit superparamagnet nanoparticl size mossbauer
42.46% particl iron magnetit fe3o4 nanoparticl size fe2o3
44.14% particl iron magnetit fe3o4 superparamagnet nanoparticl size
49.21% particl magnet fe mossbauer particle.size
51.12% particl magnet nanoparticl fluid ferrofluid
47.12% particl magnet superparamagnet nanoparticl size mossbauer particle.size ferrofluid
52.02% particl magnet fe3o4 nanoparticl fluid
46.00% particl magnet ferrit nanoparticl size mossbauer particle.size ferrofluid
46.00% particl magnet magnetit superparamagnet nanoparticl size mossbauer ferrofluid
50.88% particl magnet magnetit fe3o4 superparamagnet nanoparticl size

Sample Cluster Record Titles

Preparation of a Langmuir monolayer of CoFe2O4 nanoparticles at the air/water interface

Surface and magnetic interaction effects in Mn3O4 nanoparticles

Structure and magnetic properties of Ni0.7Mn0.3Fe2O4 nanoparticles doped with La2O3

Effect of capping and particle size on Raman laser-induced degradation of gamma-Fe2O3 nanoparticles

Formation of two-dimensional ordered magnetic nanolattices in opal structures

Magnetic properties of NiFe2O4 nanoparticles in SiO2 matrix

Magnetic studies of iron(III) nanoparticles in alginate polymer for drug delivery applications

The role of non-collinear spins on the magnetic properties of uncoupled nanometer-size particles

Mechano-synthesis, characterization, and magnetic properties of nanoparticles of cobalt ferrite, CoFe2O4

Cluster Metrics

Authors

bahadur, d 4
zhang, h 3
yu, jh 3
vaidyanathan, g 3
suzuki, s 3
sendhilnathan, s 3
rehspringer, jl 3
pich, a 3
muramatsu, a 3
morales, mp 3
matsubara, e 3
lopez-lopez, mt 3
liu, hz 3
lee, dw 3
kwon, sk 3

Sources

journal of magnetism and magnetic materials 25
journal of applied physics 13
ieee transactions on magnetics 9
materials letters 5
physica b-condensed matter 4
langmuir 4
polymer 3

journal of solid state chemistry 3
journal of nanoparticle research 3
journal of materials research 3
journal of inorganic materials 3
journal of colloid and interface science 3
journal of thermal analysis and calorimetry 2
journal of physical chemistry b 2
journal of materials science 2

Keywords
materials science, multidisciplinary 54
nanoparticles 38
particles 36
physics, condensed matter 31
nanoparticles 21
chemistry, physical 20
physics, applied 19
physics, applied 15
particles 13
size 11
engineering, electrical & electronic 10
magnetite 9
magnetic properties 9
iron 9
chemistry, multidisciplinary 8

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2005 156
2004 14
2006 8

Country
peoples r china 40
usa 31
japan 20
south korea 16
india 16
france 16
germany 14
brazil 13
spain 9
taiwan 4
czech republic 4
hungary 3
australia 3
ukraine 2

sweden 2

Institution
chinese acad sci 10
univ sao paulo 8
indian inst technol 8
tohoku univ 6
univ paris 06 5
csic 5
univ brasilia 4
acad sci czech republ 4
univ granada 3
univ fed goias 3
univ alabama 3
tokyo inst technol 3
sunmoon univ 3
sri manakula vinayagar engn coll 3
pukyong natl univ 3

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science citation index 178

- # CLUSTER 175
  Magnetic properties of nanoparticles, emphasizing iron oxide (especially magnetite [Fe3O4] and hematite [Fe2O3]) nanoparticles and superparamagnetic particles (237 Records)

(Countries: China, USA, followed by South Korea. Institutions: CAS, University of Brasilia, University S&T China, CNRS. USA includes University of New Orleans.).

Cluster Syntax Features

Descriptive Terms

nanoparticl 27.4%, magnet 16.2%, iron 4.2%, magnetic.nanoparticles 4.1%, magnetit 3.8%, fe3o4 2.8%, fe2o3 1.5%, iron.oxide 1.4%, superparamagnet 1.3%, fe3o4.nanoparticles 1.3%, magnetite.nanoparticles 1.3%, particl 1.2%, ferrit 1.0%, iron.oxide.nanoparticles 0.8%, magnetic.properties 0.8%

Discriminating Terms

nanoparticl 15.2%, magnet 8.1%, magnetic.nanoparticles 3.3%, magnetit 2.9%, iron 2.6%, film 2.3%, fe3o4 2.1%, iron.oxide 1.1%, fe2o3 1.1%, fe3o4.nanoparticles 1.1%, magnetite.nanoparticles 1.0%, superparamagnet 1.0%, ferrit 0.7%, nanotub 0.7%, iron.oxide.nanoparticles 0.7%

Single Word Terms

nanoparticl 236, magnet 192, particl 127, size 103, properti 102, iron 77, temperatur 76, surfac 74, electron 72, structur 71, synthesi 69, oxid 65, synthes 63, microscopi 57, coat 54

Double Word Terms

magnetic.nanoparticles 63, magnetic.properties 60, transmission.electron 52, electron.microscopy 47, iron.oxide 43, magnetite.nanoparticles 34, ray.diffraction 31, fe3o4.nanoparticles 30, oxide.nanoparticles 27, nanoparticles.magnetic 26, nanoparticles.synthesized 24, particle.size 22, magnetic.field 22, gamma.fe2o3 20, ferrite.nanoparticles 20

Triple Word Terms

transmission.electron.microscopy 43, iron.oxide.nanoparticles 24, electron.microscopy.tem 15, superconducting.quantum.interference 12, narrow.size.distribution 11, quantum.interference.device 11, gamma.fe2o3.nanoparticles 10, external.magnetic.field 10, superparamagnetic.iron.oxide 9, ray.diffraction.xrd 8, synthesis.magnetic.properties 8, zero.field.cooled 8, cobalt.ferrite.nanoparticles 7, nanoparticles.magnetic.properties 7, ray.photoelectron.spectroscopy 7

Term Cliques

36.46% nanoparticl iron iron.oxide superparamagnet iron.oxide.nanoparticles
39.94% nanoparticl iron fe2o3 iron.oxide superparamagnet particl
48.95% nanoparticl magnet superparamagnet particl ferrit magnetic.properties
49.23% nanoparticl magnet fe2o3 superparamagnet particl magnetic.properties
48.38% nanoparticl magnet fe3o4 magnetite.nanoparticles particl magnetic.properties
41.56% nanoparticl magnet fe3o4 fe3o4.nanoparticles magnetite.nanoparticles magnetic.properties
49.65% nanoparticl magnet fe3o4 superparamagnet particl magnetic.properties
42.83% nanoparticl magnet fe3o4 superparamagnet fe3o4.nanoparticles magnetic.properties
47.54% nanoparticl magnet magnetit fe3o4 magnetite.nanoparticles particl
40.72% nanoparticl magnet magnetit fe3o4 fe3o4.nanoparticles magnetite.nanoparticles
48.80% nanoparticl magnet magnetit fe3o4 superparamagnet particl

41.98% nanoparticl magnet magnetit fe3o4 superparamagnet fe3o4.nanoparticles
43.04% nanoparticl magnet magnetic.nanoparticles magnetit fe3o4 magnetite.nanoparticles

Sample Cluster Record Titles

Scaling relations for magnetic nanoparticles

gamma-Fe2O3 oriented growth by surfactant molecules in microemulsion

Algal polysaccharide capsule-templated growth of magnetic nanoparticles

Synthesis and magnetic properties of CoO nanoparticles

Electronic structure of nanoscale iron oxide particles measured by scanning tunneling and photoelectron spectroscopies

Advances in magnetic nanoparticles for biotechnology applications

Magnetic properties of Co-Cu nanoparticles dispersed in silica matrix

Effects of biocompatible coating of nanoparticles on acoustics property of the magnetic fluid

Magnetic behavior of iron (III) oxyhydroxy nanoparticles in organic-inorganic hybrid matrices

Cluster Metrics

Authors

morais, pc 10
azevedo, rb 6
lacava, zgm 5
zheng, hg 4
willner, i 4
serna, cj 4
katz, e 4
woo, k 3
soler, mag 3
silva, lp 3
shin, sc 3
sangregorio, c 3
park, j 3
oliveira, ac 3

ni, xm 3

Sources

journal of magnetism and magnetic materials 37
journal of applied physics 18
journal of physical chemistry b 9
ieee transactions on magnetics 9
nanotechnology 8
langmuir 8
chemistry of materials 8
physical review b 6
journal of colloid and interface science 5
chemical communications 5
journal of nanoparticle research 4
physica b-condensed matter 3
materials letters 3
materials chemistry and physics 3
journal of nanoscience and nanotechnology 3

Keywords

particles 64
materials science, multidisciplinary 52
nanoparticles 43
chemistry, physical 42
physics, condensed matter 42
physics, applied 31
chemistry, multidisciplinary 31
materials science, multidisciplinary 31
nanoparticles 25
particles 20
size 17
magnetic-properties 15
physics, applied 15
nanocrystals 12
physics, condensed matter 11

Publication Year

2005 219
2004 15
2006 3

Country

peoples r china 56
usa 52
south korea 21
france 17

japan 15
brazil 13
taiwan 10
india 10
spain 9
russia 9
israel 9
germany 8
poland 6
england 6
italy 5

Institution
chinese acad sci 13
univ brasilia 11
univ sci & technol china 7
cnrs 6
univ paris 06 5
tohoku univ 5
seoul natl univ 5
russian acad sci 5
lanzhou univ 5
korea inst sci & technol 5
korea adv inst sci & technol 5
jilin univ 5
hebrew univ jerusalem 5
univ new orleans 4
univ fed goias 4

DataBase
science citation index 237

- # CLUSTER 70
  Core-shell nanostructures and hollow nanospheres, made of silver (Ag), bimetallic material, and silica (211 Records)

(Countries: China, followed by USA. Institutions: CAS, followed by University S&T China, Nanjing University, National University of Singapore. USA include University of Notre Dame, University of Washington, UCSB, UCB, Northwestern University).

Cluster Syntax Features

Descriptive Terms
shell 34.6%, core 18.6%, core.shell 14.6%, nanoparticl 4.6%, hollow 1.9%, shell.nanoparticles 1.8%, ag 1.5%, core.shell.nanoparticles 1.5%, sphere 1.0%, bimetal 0.6%, silica 0.5%, shell.structure 0.4%, core.shell.structure 0.4%, hollow.spheres 0.3%, particl 0.3%

Discriminating Terms
shell 22.6%, core 11.6%, core.shell 9.8%, film 1.9%, shell.nanoparticles 1.2%, hollow 1.1%, core.shell.nanoparticles 1.0%, nanoparticl 1.0%, nanotub 0.6%, ag 0.5%, surfac 0.5%, carbon 0.5%, sphere 0.5%, temperatur 0.5%, crystal 0.5%

Single Word Terms
shell 197, core 189, nanoparticl 143, structur 108, electron 79, surfac 76, synthesi 70, size 69, particl 67, synthes 64, composit 63, properti 55, transmiss 54, form 53, tem 53

Double Word Terms
core.shell 164, shell.nanoparticles 62, transmission.electron 51, electron.microscopy 49, shell.structure 41, shell.thickness 24, ray.diffraction 22, shell.particles 20, shell.structures 19, microscopy.tem 18, hollow.spheres 17, optical.properties 16, scanning.electron 16, surface.plasmon 15, ag.shell 15

Triple Word Terms
core.shell.nanoparticles 59, transmission.electron.microscopy 45, core.shell.structure 38, electron.microscopy.tem 18, core.shell.particles 18, core.shell.structures 17, formation.core.shell 11, scanning.electron.microscopy 11, surface.plasmon.resonance 10, core.shell.structured 10, nanoparticles.core.shell 10, ray.diffraction.xrd 9, ray.photoelectron.spectroscopy 8, energy.dispersive.ray 8, resolution.transmission.electron 7

Term Cliques
14.57% hollow sphere silica hollow.spheres
28.32% nanoparticl shell.structure core.shell.structure hollow.spheres
27.61% nanoparticl sphere core.shell.structure hollow.spheres

27.37% nanoparticl sphere silica hollow.spheres
62.88% shell core core.shell nanoparticl silica particl
47.82% shell core core.shell nanoparticl shell.nanoparticles ag core.shell.nanoparticles shell.structure core.shell.structure particl
46.07% shell core core.shell nanoparticl shell.nanoparticles ag core.shell.nanoparticles bimetal shell.structure core.shell.structure

Sample Cluster Record Titles

Spontaneous formation of core/shell bimetallic nanoparticles: A calorimetric study

Modification of gold nanoparticle composite nanostructures using thermosensitive core-shell particles as a template

One-pot synthesis of hollow superparamagnetic CoPt nanospheres

Synthesis and magnetic properties of FeNi3/Al2O3 core-shell nanocomposites

A reactive core-shell nanoparticle approach to prepare hybrid nanocomposites: effects of processing variables

Synthesis and characterization of L1(0) FePt nanoparticles from Pt(Au, Ag)/gamma-Fe2O3 core-shell nanoparticles

Synthesis and characterization of copolymer(core)-silver(shell) composite microspheres

Fabrication of core-shell latex spheres with CdS/polyelectrolyte composite multilayers

High-magnetic-moment core-shell-type FeCo-Au/Ag nanoparticles

Cluster Metrics

Authors

zhang, jh 5
morjan, i 5
farle, m 5
alexandrescu, r 5
zhang, js 4
yang, j 4
wang, zl 4
wang, y 4
wang, l 4
voicu, i 4
too, hp 4

schneeweiss, o 4
pizurova, n 4
liu, jb 4
lee, jy 4

Sources
journal of physical chemistry b 16
langmuir 11
journal of the american chemical society 9
chemistry of materials 9
nano letters 7
materials letters 6
journal of materials chemistry 6
physical review b 5
journal of colloid and interface science 5
journal of chemical physics 5
colloids and surfaces a-physicochemical and engineering aspects 5
chemistry letters 5
chemical physics letters 5
chemical journal of chinese universities-chinese 5
advanced materials 5

Keywords
chemistry, physical 63
particles 45
chemistry, multidisciplinary 44
nanoparticles 37
materials science, multidisciplinary 33
materials science, multidisciplinary 26
nanoparticles 25
nanocrystals 23
gold 23
growth 18
spheres 17
silver 17
films 17
core-shell 17
colloids 15

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2005 192
2004 12
2006 7

Country
peoples r china 83

usa 54
germany 13
japan 12
south korea 8
india 8
france 8
taiwan 7
singapore 7
netherlands 6
romania 5
canada 5
israel 4
czech republic 4
spain 3

Institution

chinese acad sci 19
univ sci & technol china 10
nanjing univ 8
natl univ singapore 7
tsing hua univ 5
jilin univ 5
xiamen univ 4
univ notre dame 4
indian inst technol 4
univ washington 3
univ calif santa barbara 3
univ calif berkeley 3
univ british columbia 3
northwestern univ 3
natl tsing hua univ 3

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science citation index 211

- CLUSTER 147

  Titanium dioxide (TiO_2), cadmium sulfide (CdS), cadmium selenide (CdSe), and solid lipid nanoparticles and nanocrystals (138 Records)

(Countries: China, followed by USA, followed by Japan, Germany. Institutions: ANL, Zhejiang University, Tatung University, National Taipei University of Technology, Free University of Berlin. Other USA include UCB, Stanford University.).

Cluster Syntax Features

Descriptive Terms

nanoparticl 22.4%, cd 13.3%, tio2 11.3%, tio2.nanoparticles 8.1%, cds.nanoparticles 5.5%, sln 2.6%, cdse 1.6%, size 1.0%, cadmium 0.8%, nanocryst 0.8%, lipid 0.7%, particl 0.6%, titanium 0.6%, anatas 0.5%, solid.lipid 0.4%

Discriminating Terms

nanoparticl 11.2%, cd 9.6%, tio2 6.6%, tio2.nanoparticles 6.3%, cds.nanoparticles 4.4%, sln 2.1%, film 1.6%, cdse 1.0%, carbon 0.7%, magnet 0.7%, nanotub 0.6%, cadmium 0.6%, structur 0.5%, layer 0.5%, si 0.5%

Single Word Terms

nanoparticl 130, size 70, tio2 60, particl 57, cd 49, surfac 46, electron 46, properti 44, synthesi 41, structur 39, dispers 34, form 33, format 33, spectroscopi 33, absorpt 32

Double Word Terms

tio2.nanoparticles 46, cds.nanoparticles 32, transmission.electron 25, electron.microscopy 23, ray.diffraction 17, particle.size 17, solid.lipid 15, lipid.nanoparticles 14, nanoparticles.synthesized 13, optical.properties 13, titanium.dioxide 12, size.distribution 12, nanoparticles.sln 11, room.temperature 10, tio2.nanoparticle 10

Triple Word Terms

transmission.electron.microscopy 18, solid.lipid.nanoparticles 14, lipid.nanoparticles.sln 11, titanium.dioxide.nanoparticles 8, electron.microscopy.tem 7, high.resolution.transmission 7, resolution.transmission.electron 7, ray.photoelectron.spectroscopy 7, ray.diffraction.xrd 6, transmission.electron.microscope

5, synthesis.cds.nanoparticles 5, properties.cds.nanoparticles 5, cds.nanoparticles.synthesized 5, energy.dispersive.ray 4, diffraction.transmission.electron 4

Term Cliques

24.28% size nanocryst titanium anatas
22.46% cdse cadmium particl
28.99% cd size cadmium nanocryst
19.20% cd cdse cadmium nanocryst
43.48% nanoparticl size particl titanium anatas
36.47% nanoparticl sln size lipid particl solid.lipid
44.78% nanoparticl cds.nanoparticles size cadmium particl
40.58% nanoparticl tio2 tio2.nanoparticles particl titanium anatas
43.62% nanoparticl cd cds.nanoparticles size cadmium

Sample Cluster Record Titles

Preparation and pharmacokinetic evaluation of Tashinone IIA solid lipid nanoparticles

Interaction between CdS nanoparticles and cysteine

Synthesis and spectral studies of cysteine-capped CdS nanoparticles

The effects of organisation, embedding and surfactants on the properties of cadmium chalcogenide (CdS, CdSe and CdS/CdSe) semiconductor nanoparticles

Reactivity of methanol on TiO2 nanoparticles supported on the Au(111) surface

Characterization and body distribution of beta-elemene solid lipid nanoparticles (SLN)

Photocatalytic preparation of encapsulated gold nanoparticles by jingle-bell-shaped cadmium sulfide-silica nanoparticles

Titanium dioxide nanoparticle absorbed by hepatoma cells in vitro

Synthesis of highly soluble TiO2 nanoparticle with narrow size distribution

Cluster Metrics

Authors

tsung, tt 4
saha, a 4
muller, rh 4
lin, hm 4

chen, lc 4
chang, h 4
zhang, zk 3
wissing, sa 3
vione, d 3
sapino, s 3
priyam, a 3
pelizzetti, e 3
lin, ck 3
jwo, cs 3
das, sk 3

Sources

langmuir 6
journal of dispersion science and technology 6
journal of physical chemistry b 5
journal of colloid and interface science 5
materials letters 4
journal of nanoscience and nanotechnology 4
nano letters 3
materials chemistry and physics 3
journal of materials chemistry 3
drug development and industrial pharmacy 3
colloids and surfaces a-physicochemical and engineering aspects 3
bulletin of the korean chemical society 3
acta physico-chimica sinica 3
thin solid films 2
rare metal materials and engineering 2

Keywords

chemistry, physical 39
chemistry, multidisciplinary 23
particles 23
materials science, multidisciplinary 22
nanoparticles 21
materials science, multidisciplinary 15
size 14
nanocrystals 14
nanoparticles 13
clusters 13
tio2 12
growth 12
films 10
quantum dots 9
stability 8

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2004 15
2006 3

Country

peoples r china 42
usa 25
japan 15
germany 14
italy 12
india 12
taiwan 8
south korea 7
france 4
england 4
switzerland 3
ukraine 2
turkey 2
spain 2
south africa 2

Institution

argonne natl lab 5
zhejiang univ 4
tatung univ 4
natl taipei univ technol 4
free univ berlin 4
univ turin 3
tohoku univ 3
nankai univ 3
chinese acad sci 3
wuhan univ 2
univ london imperial coll sci technol & med 2
univ calif berkeley 2
tongji univ 2
tech univ dresden 2
stanford univ 2

DataBase

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- # CLUSTER 239
  Nanoparticles, including particle size, synthesis, metal and silica nanoparticles, surface properties, dispersion, reactions, and stabilization (930 Records)

(Countries: USA, China, followed by Japan, followed by France, Germany. Institutions: CAS dominant, RAS, CNRS, Seoul National University, National University of Singapore. USA include Texas A&M University, University of Illinois.).

Cluster Syntax Features

Descriptive Terms

nanoparticl 66.5%, size 1.5%, particl 1.3%, synthesi 0.6%, metal 0.6%, silica 0.5%, surfac 0.3%, solut 0.3%, dispers 0.3%, water 0.3%, reaction 0.3%, stabil 0.3%, coat 0.3%, metal.nanoparticles 0.2%, synthes 0.2%

Discriminating Terms

nanoparticl 52.9%, film 2.2%, nanotub 0.8%, magnet 0.6%, carbon 0.6%, layer 0.5%, structur 0.5%, quantum 0.5%, si 0.5%, crystal 0.4%, deposit 0.4%, surfac 0.4%, thin 0.3%, field 0.3%, dot 0.3%

Single Word Terms

nanoparticl 929, size 435, particl 406, surfac 280, synthesi 238, electron 225, structur 218, synthes 207, properti 201, solut 196, high 191, temperatur 191, form 189, format 185, metal 179

Double Word Terms

electron.microscopy 146, transmission.electron 146, particle.size 113, ray.diffraction 84, nanoparticles.synthesized 82, size.distribution 64, metal.nanoparticles 59, microscopy.tem 50, room.temperature 45, diffraction.xrd 42, nanoparticles.size 40, oxide.nanoparticles 35, scanning.electron 34, silica.nanoparticles 33, nanoparticle.size 32

Triple Word Terms

transmission.electron.microscopy 119, electron.microscopy.tem 50, ray.diffraction.xrd 36, scanning.electron.microscopy 29, narrow.size.distribution 21, particle.size.distribution 19, ray.photoelectron.spectroscopy 19, xrd.transmission.electron 18, transmission.electron.microscope 17, atomic.force.microscopy 16, diffraction.xrd.transmission 16, fourier.transform.infrared 16, average.particle.size 15, electron.microscopy.sem 13, resolution.transmission.electron 13

Term Cliques

26.53% nanoparticl silica surfac solut dispers water stabil coat
27.57% nanoparticl silica surfac solut dispers water reaction stabil
27.00% nanoparticl synthesi silica solut dispers water reaction stabil
30.81% nanoparticl particl surfac solut dispers water stabil coat
28.03% nanoparticl particl metal surfac solut dispers water reaction stabil metal.nanoparticles
27.58% nanoparticl particl synthesi metal solut dispers water reaction stabil metal.nanoparticles
32.38% nanoparticl size particl surfac solut dispers water reaction stabil synthes
32.08% nanoparticl size particl metal surfac solut dispers water reaction stabil
31.92% nanoparticl size particl synthesi solut dispers water reaction stabil synthes
31.62% nanoparticl size particl synthesi metal solut dispers water reaction stabil

Sample Cluster Record Titles

Nanoparticles of the superconductor MgB2: structural characterization and in situ study of synthesis kinetics

Increase in thermal stability induced by organic coatings on nanoparticles

Formation and optical properties of CuInSe2xTe2(1-x) nanoparticles in a silicate glass matrix

Investigations on the surface modification of ZnO nanoparticle photocatalyst by depositing Pd

Vitamin E nanoparticle for beverage applications

Flame synthesis of nanoparticles - Applications in catalysis and product/process engineering

Physicochemical properties and blood compatibility of acylated chitosan nanoparticles

[AuPd metal nanoparticles as probes of nanoscale thermal transport in aqueous solution]

[Analysis of nanoparticles < 10 nm by analytical ultracentrifugation]

Cluster Metrics

Authors
zhang, j 8
wang, l 8
tenne, r 8
crooks, rm 8
zhang, zj 7
wang, ly 7
chaudret, b 7
wu, zs 6
qi, wh 6
li, y 6
zhang, l 5
yurkov, gy 5
yang, hm 5
wang, x 5
wang, mp 5

Sources
journal of physical chemistry b 43
langmuir 35
journal of the american chemical society 26
chemistry of materials 24
chemical communications 23
nanotechnology 21
advanced materials 20
materials letters 17
journal of colloid and interface science 17
applied physics letters 15
angewandte chemie-international edition 15
nano letters 13
journal of nanoscience and nanotechnology 12
journal of nanoparticle research 12
journal of materials chemistry 11

Keywords
chemistry, physical 200
chemistry, multidisciplinary 169
nanoparticles 143

materials science, multidisciplinary 128
particles 115
materials science, multidisciplinary 113
nanoparticles 93
films 63
physics, applied 61
growth 60
nanocrystals 59
clusters 57
size 54
surface 41
nanoparticle 41

Publication Year

2005 825
2004 98
2006 7

Country

usa 236
peoples r china 225
japan 84
france 63
germany 61
south korea 54
india 50
russia 37
taiwan 29
england 26
spain 23
italy 19
singapore 18
israel 18
canada 18

Institution

chinese acad sci 59
russian acad sci 20
cnrs 15
seoul natl univ 14
natl univ singapore 14
osaka univ 13
texas a&m univ 12
zhejiang univ 11
univ sci & technol china 11
fudan univ 11

peking univ 10
indian inst technol 10
weizmann inst sci 9
univ illinois 9
natl inst mat sci 9

DataBase
science citation index 930

- # CLUSTER 104
  Gold nanoparticles and nanorods, emphasizing plasmon and surface properties, stabilization, synthesis, and application to electrodes (334 Records)

(Countries: USA, China, Japan. Institutions: CAS dominant, University of Tokyo, University of Melbourne, Indian Institute of Technology.).

Cluster Syntax Features

Descriptive Terms
gold 46.8%, gold.nanoparticles 18.6%, nanoparticl 14.2%, gold.nanoparticle 1.0%, particl 0.7%, size 0.5%, nanorod 0.4%, plasmon 0.3%, colloid 0.2%, stabil 0.2%, solut 0.2%, synthesi 0.2%, gold.nanorods 0.2%, electrod 0.2%, surfac 0.2%

Discriminating Terms
gold 30.9%, gold.nanoparticles 13.3%, nanoparticl 5.9%, film 1.5%, gold.nanoparticle 0.7%, structur 0.6%, magnet 0.6%, nanotub 0.6%, layer 0.5%, temperatur 0.5%, carbon 0.5%, crystal 0.5%, quantum 0.4%, surfac 0.4%, si 0.4%

Single Word Terms
gold 334, nanoparticl 297, size 142, surfac 136, particl 132, electron 115, solut 103, synthesi 78, form 78, microscopi 76, control 74, reduct 68, stabil 67, format 67, spectroscopi 66

Double Word Terms
gold.nanoparticles 240, gold.nanoparticle 69, electron.microscopy 64, transmission.electron 52, gold.particles 35, surface.plasmon 27, synthesis.gold 27, aqueous.solution 23, microscopy.tem 22, size.gold 22, plasmon.resonance 21, gold.nanorods 20, ray.diffraction 19, colloidal.gold 19, nanoparticles.gold 19

Triple Word Terms
transmission.electron.microscopy 49, electron.microscopy.tem 21, synthesis.gold.nanoparticles 17, scanning.electron.microscopy 17, surface.plasmon.resonance 15, gold.nanoparticles.gold 13, gold.nanoparticles.synthesized 13, capped.gold.nanoparticles 12, stabilized.gold.nanoparticles 12, gold.nanoparticles.stabilized 12, nanoparticles.gold.nanoparticles 12, size.gold.nanoparticles 12, growth.gold.nanoparticles 11, formation.gold.nanoparticles 11, atomic.force.microscopy 11

Term Cliques
34.22% gold particl nanorod colloid solut gold.nanorods surfac
31.74% gold particl nanorod colloid solut synthesi gold.nanorods
31.91% gold particl nanorod plasmon colloid gold.nanorods surfac
35.16% gold gold.nanoparticle particl nanorod solut gold.nanorods surfac
32.85% gold gold.nanoparticle particl nanorod plasmon gold.nanorods surfac
48.63% gold nanoparticl particl size plasmon colloid surfac
45.68% gold nanoparticl particl size plasmon colloid stabil
50.75% gold nanoparticl gold.nanoparticle particl plasmon surfac
53.94% gold gold.nanoparticles nanoparticl stabil solut electrod
53.56% gold gold.nanoparticles nanoparticl particl size colloid solut surfac
47.90% gold gold.nanoparticles nanoparticl particl size colloid stabil solut synthesi
52.14% gold gold.nanoparticles nanoparticl gold.nanoparticle solut electrod surfac
56.07% gold gold.nanoparticles nanoparticl gold.nanoparticle particl solut surface

Sample Cluster Record Titles

[Interfacial electron transfer at TiO2 nanostructured electrodes modified with capped gold nanoparticles: The photoelectrochemistry of water oxidation]

[Evolution in time of a gold-zirconia nanopowder at room temperature: Nucleation growth of gold nanoparticles]

[Calibration of dynamic molecular rule based on plasmon coupling between gold nanoparticles]

[Controlled growth of gold nanoparticles on silica nanowires]

[Reversible transformations of gold nanoparticle morphology]

[Preparation temperature dependence of size and polydispersity of alkylthiol monolayer protected gold clusters]

[Size-controlled synthesis and characterization of thiol-stabilized gold nanoparticles]

[Size-controlled synthesis of machinable single crystalline gold nanoplates]

[Fabrication of gold nanorod arrays by templating from porous alumina]

Cluster Metrics

Authors

sastry, m 6
oyama, m 5
jiang, l 5
wang, ek 4
sanchez, c 4
perez-juste, j 4
panigrahi, s 4
pal, t 4
ohsaka, t 4
nath, s 4
mulvaney, p 4
liz-marzan, lm 4
lennox, rb 4
kundu, s 4
ghosh, sk 4

Sources

langmuir 26
journal of physical chemistry b 23
chemistry of materials 15

nano letters 11
journal of the american chemical society 9
chemical communications 9
journal of nanoscience and nanotechnology 7
journal of materials chemistry 7
colloids and surfaces a-physicochemical and engineering aspects 7
chemistry letters 7
small 6
nanotechnology 6
journal of colloid and interface science 6
advanced materials 6
electrochemistry communications 5

Keywords
chemistry, physical 114
chemistry, multidisciplinary 63
particles 61
materials science, multidisciplinary 55
nanoparticles 48
size 45
clusters 44
gold nanoparticles 32
nanoparticles 31
materials science, multidisciplinary 31
surface 31
gold nanoparticles 28
nanocrystals 25
physics, applied 24
silver 24

Publication Year
2005 299
2004 31
2006 4

Country
usa 64
peoples r china 61
japan 53
germany 24
france 21
india 20
spain 16
australia 16
taiwan 15
england 12

canada 12
russia 11
italy 9
south korea 8
switzerland 5

Institution

chinese acad sci 26
univ tokyo 9
univ melbourne 8
indian inst technol 8
natl chem lab 7
kyoto univ 7
kyushu univ 6
tokyo inst technol 5
suzhou univ 5
russian acad sci 5
univ padua 4
rmit univ 4
natl univ singapore 4
mcgill univ 4
kinki univ 4

DataBase

science citation index 334

- ## CLUSTER 158
  Gold nanoparticles, focusing on surface properties studied by surface-enhanced Raman scattering (SERS), self-assembly of monolayers and other structures, and electrode applications (221 Records)

(Countries: USA, China, followed by Japan. Institutions: CAS, Seoul National University, Hunan University. USA include University of Washington, University of South Caroline, University of Massachusetts, UCB, Stanford University.).

Cluster Syntax Features

Descriptive Terms
gold 50.9%, gold.nanoparticles 4.0%, nanoparticl 3.8%, ser 2.8%, surfac 1.9%, assembl 1.1%, plasmon 1.0%, monolay 0.9%, gold.nanoparticle 0.9%, molecul 0.7%, colloid 0.6%, gold.surface 0.6%, electrod 0.5%, surface.raman 0.5%, raman 0.5%

Discriminating Terms
gold 35.2%, gold.nanoparticles 2.8%, ser 2.1%, film 1.6%, nanoparticl 0.7%, carbon 0.7%, temperatur 0.7%, gold.nanoparticle 0.6%, nanotub 0.6%, particl 0.5%, structur 0.5%, crystal 0.5%, plasmon 0.5%, phase 0.5%, quantum 0.4%

Single Word Terms
gold 207, surfac 145, nanoparticl 102, assembl 79, monolay 70, molecul 70, solut 65, self 63, spectroscopi 59, structur 52, reson 51, detect 47, plasmon 47, form 46, function 45

Double Word Terms
gold.nanoparticles 70, self.assembled 48, gold.nanoparticle 35, plasmon.resonance 34, gold.surface 33, surface.plasmon 33, surface.raman 29, raman.scattering 27, scattering.sers 24, gold.electrode 20, surface.gold 17, assembled.monolayer 17, density.functional 16, gold.surfaces 15, self.assembly 15

Triple Word Terms
surface.plasmon.resonance 28, surface.raman.scattering 26, raman.scattering.sers 24, self.assembled.monolayer 16, density.functional.theory 14, self.assembled.monolayers 12, plasmon.resonance.spr 12, quartz.crystal.microbalance 10, atomic.force.microscopy 10, self.assembled.gold 10, transmission.electron.microscopy 9, ray.photoelectron.spectroscopy 9, infrared.reflection.absorption 9, reflection.absorption.spectroscopy 8, surface.gold.nanoparticles 8

Term Cliques
35.93% surfac assembl monolay molecul gold.surface
33.41% surfac assembl monolay gold.nanoparticle molecul electrod
25.57% ser surfac gold.nanoparticle molecul surface.raman raman
27.68% nanoparticl ser surfac colloid surface.raman raman
27.98% nanoparticl ser surfac gold.nanoparticle surface.raman raman
26.47% gold.nanoparticles nanoparticl colloid raman
26.92% gold.nanoparticles nanoparticl gold.nanoparticle raman
48.33% gold surfac assembl monolay gold.surface
46.24% gold surfac assembl plasmon gold.surface

45.85% gold nanoparticl surfac assembl colloid electrod
44.09% gold nanoparticl surfac assembl monolay gold.nanoparticle electrod
46.08% gold nanoparticl surfac assembl plasmon colloid
46.38% gold nanoparticl surfac assembl plasmon gold.nanoparticle
40.20% gold gold.nanoparticles nanoparticl assembl colloid electrod
39.24% gold gold.nanoparticles nanoparticl assembl monolay gold.nanoparticle electrod
40.42% gold gold.nanoparticles nanoparticl assembl plasmon colloid
40.72% gold gold.nanoparticles nanoparticl assembl plasmon gold.nanoparticle

Sample Cluster Record Titles

Complex gold nanostructures derived by templating from diatom frustules

SERS studies of the adsorption of guanine derivatives on gold colloidal nanoparticles

Sandwiched structure of Ag/polypyrrole/Au to improve the surfaced-enhanced Raman scattering

Preparation of 1,3,5-trithia-2,4,6-triazapentalenyl films on gold surfaces

Monolayer-protected gold nanoparticle coalescence induced by photogenerated radicals

SERS of gold/C-60 (/C-70) nano-clusters deposited on iron surface

Supramolecular assembly of gold nanoparticles mediated by polypseudorotaxane with thiolated beta-cyclodextrin

Enzymatic synthesis of gold nanoparticles wrapped by glucose oxidase

Electrochemical characterization of polyelectrolyte/gold nanoparticle multilayers self-assembled on gold electrodes

Cluster Metrics

Authors

yu, rq 5
wang, ek 5
shen, gl 5
tang, dp 4
dong, sj 4
zhang, jx 3
yuan, r 3
rotello, vm 3

liu, y 3
hou, sm 3
fu, x 3
chu, x 3
cheng, wl 3
chen, y 3
chai, yq 3

Sources

journal of physical chemistry b 20
journal of the american chemical society 14
langmuir 12
chemical communications 11
analytical chemistry 7
nano letters 6
surface science 5
physical review b 5
sensors and actuators b-chemical 4
journal of raman spectroscopy 4
journal of colloid and interface science 4
chemistry letters 4
chemical physics letters 4
synthetic metals 3
physical chemistry chemical physics 3

Keywords

chemistry, physical 60
chemistry, multidisciplinary 53
self-assembled monolayers 36
spectroscopy 32
nanoparticles 27
gold 25
films 25
chemistry, analytical 23
dna 23
adsorption 22
nanoparticles 20
materials science, multidisciplinary 17
surfaces 15
silver 15
size 14

Publication Year

2005 202
2004 18
2006 1

Country

usa 59
peoples r china 49
japan 23
germany 14
south korea 13
italy 10
england 10
india 8
taiwan 7
sweden 7
spain 7
switzerland 6
canada 6
israel 5
netherlands 4

Institution

chinese acad sci 10
seoul natl univ 7
hunan univ 6
univ washington 5
sw china normal univ 5
nankai univ 4
linkoping univ 4
kyoto univ 4
weizmann inst sci 3
univ s carolina 3
univ neuchatel 3
univ massachusetts 3
univ calif berkeley 3
stanford univ 3
peking univ 3

DataBase

science citation index 221

- # CLUSTER 75
  Silver (Ag) nanoparticles, with emphasis on surface-enhanced Raman scattering (SERS) studies (122 Records)

(Countries: China, USA, South Korea, Japan. Institutions: CAS dominant, Seoul National University, Jilin University. USA include University of Washington, University of Chicago, Purdue University, Penn State University.).

Cluster Syntax Features

Descriptive Terms
ag 56.1%, ag.nanoparticles 8.6%, nanoparticl 6.8%, silver 2.8%, ser 1.3%, colloid 0.9%, surface.raman 0.7%, particl 0.6%, silver.nanoparticles 0.6%, raman 0.5%, surfac 0.4%, ag.particles 0.4%, surface.raman.scattering 0.4%, solut 0.4%, raman.scattering 0.3%

Discriminating Terms
ag 36.7%, ag.nanoparticles 6.1%, nanoparticl 1.9%, silver 1.4%, film 1.4%, ser 0.8%, magnet 0.6%, structur 0.6%, nanotub 0.6%, carbon 0.6%, crystal 0.5%, temperatur 0.5%, layer 0.5%, quantum 0.4%, surface.raman 0.4%

Single Word Terms
ag 119, nanoparticl 93, silver 67, surfac 65, particl 53, size 47, solut 44, electron 43, form 38, microscopi 35, reduct 31, metal 31, structur 29, format 28, spectroscopi 28

Double Word Terms
ag.nanoparticles 61, silver.nanoparticles 27, electron.microscopy 23, raman.scattering 20, surface.raman 19, transmission.electron 18, ag.particles 17, scattering.sers 16, ag.nanoparticle 15, ag.ag 15, ray.diffraction 15, surface.plasmon 12, aqueous.solution 11, size.distribution 11, nanoparticles.ag 10

Triple Word Terms
surface.raman.scattering 18, raman.scattering.sers 16, transmission.electron.microscopy 14, ray.photoelectron.spectroscopy 8, scanning.electron.microscopy 7, surface.plasmon.resonance 6, ag.ag.nanoparticles 6, poly.vinyl.pyrrolidone 6, energy.dispersive.ray 6, electron.microscopy.tem 6, photoelectron.spectroscopy.xps 5, vinyl.pyrrolidone.pvp 5, ray.diffraction.xrd 5, ag.nanoparticles.ag 5, silver.nanoparticles.ag 4

Term Cliques
28.18% nanoparticl ser colloid surface.raman raman surfac surface.raman.scattering raman.scattering

31.15% ag.nanoparticles nanoparticl ser surface.raman silver.nanoparticles raman surfac surface.raman.scattering raman.scattering
48.48% ag nanoparticl silver colloid particl ag.particles solut
54.10% ag nanoparticl silver colloid particl surfac solut
46.21% ag nanoparticl silver ser silver.nanoparticles surfac surface.raman.scattering solut
43.14% ag nanoparticl silver ser colloid surfac surface.raman.scattering raman.scattering
45.59% ag nanoparticl silver ser colloid surfac surface.raman.scattering solut
56.01% ag ag.nanoparticles nanoparticl silver particl ag.particles
62.57% ag ag.nanoparticles nanoparticl silver particl surfac
44.44% ag ag.nanoparticles nanoparticl silver ser silver.nanoparticles surfac surface.raman.scattering raman.scattering

Sample Cluster Record Titles

Preparation of organic fluid containing Ag nanoparticles with extractant Cyanex 301

Ag nanoparticles on highly ordered pyrolytic graphite (HOPG) surfaces studied using STM and XPS

Synthesis of Pt, Pd, Pt/Ag and Pd/Ag nanoparticles by microwave-polyol method

One-step preparation of ultrafine poly(acrylonitrile) fibers containing silver nanoparticles

Preparation of a SERS substrate using vacuum-synthesized silver nanoparticles

Batch preparation of linear Au and Ag nanoparticle chains via wet chemistry

Surface-enhanced Raman spectroscopy of nanodiamond particles on silver

Direct electrochemistry and electrocatalysis of myoglobin immobilized on nano-alumina-gold colloid assembly system

Melting behaviors of nanocrystalline Ag

Cluster Metrics

Authors
kim, k 4
xia, yn 3
li, zy 3
choi, sh 3
chen, jy 3

zhang, k 2
xiong, yj 2
wong, cp 2
wiley, b 2
wang, gf 2
wang, cc 2
van duyne, rp 2
tatsuma, t 2
tang, fq 2
sioss, ja 2

Sources

journal of physical chemistry b 11
langmuir 6
colloids and surfaces a-physicochemical and engineering aspects 5
chemistry of materials 4
nano letters 3
electrochimica acta 3
chemical physics letters 3
chemical communications 3
advanced materials 3
surface science 2
spectrochimica acta part a-molecular and biomolecular spectroscopy 2
radiation physics and chemistry 2
microporous and mesoporous materials 2
materials letters 2
journal of the electrochemical society 2

Keywords

chemistry, physical 43
nanoparticles 18
gold 18
films 17
spectroscopy 15
particles 15
silver 14
chemistry, multidisciplinary 12
materials science, multidisciplinary 11
materials science, multidisciplinary 11
colloids 10
silver nanoparticles 9
reduction 9
nanoparticles 8
size 8

Publication Year

2005 112
2004 8
2006 2

Country
peoples r china 33
usa 23
south korea 16
japan 16
taiwan 6
india 6
germany 5
spain 4
italy 4
france 4
canada 4
russia 3
singapore 2
hungary 2
sweden 1

Institution
chinese acad sci 10
seoul natl univ 4
jilin univ 4
univ washington 3
osaka univ 3
bhabha atom res ctr 3
univ tokyo 2
univ santiago de compostela 2
univ naples federico ii 2
univ konstanz 2
univ chicago 2
russian acad sci 2
purdue univ 2
pukyong natl univ 2
penn state univ 2

DataBase
science citation index 122

- # CLUSTER 56
  Silver (Ag), gold, and gold-silver nanoparticles, including surface-enhanced Raman scattering, reduction behavior, effect of ions, and surface properties (294 Records)

(Countries: China, followed by USA, followed by India. Institutions: CAS dominant, RAS, National Chemical Lab. USA include Clemson University, University of Washington, University of Maryland, ORNL.).

Cluster Syntax Features

Descriptive Terms
silver 67.7%, silver.nanoparticles 8.6%, nanoparticl 5.3%, ag 0.7%, particl 0.6%, gold 0.4%, colloid 0.4%, ser 0.4%, reduct 0.3%, silver.particles 0.3%, size 0.3%, surface.raman 0.2%, ion 0.2%, gold.silver 0.2%, surfac 0.2%

Discriminating Terms
silver 44.6%, silver.nanoparticles 5.8%, film 1.5%, nanoparticl 1.2%, magnet 0.6%, nanotub 0.5%, carbon 0.5%, layer 0.5%, structur 0.5%, temperatur 0.5%, crystal 0.4%, quantum 0.4%, si 0.4%, phase 0.4%, surfac 0.4%

Single Word Terms
silver 294, nanoparticl 206, particl 120, surfac 119, size 108, electron 98, ag 97, format 92, solut 89, microscopi 80, reduct 79, structur 79, metal 74, form 73, synthesi 72

Double Word Terms
silver.nanoparticles 158, electron.microscopy 72, transmission.electron 58, silver.particles 37, silver.ions 28, surface.raman 28, synthesis.silver 28, formation.silver 28, silver.nitrate 24, scanning.electron 24, silver.nanoparticle 24, reduction.silver 23, aqueous.solution 23, size.distribution 22, plasmon.resonance 22

Triple Word Terms
transmission.electron.microscopy 53, scanning.electron.microscopy 23, surface.raman.scattering 22, electron.microscopy.tem 21, raman.scattering.sers 15, formation.silver.nanoparticles 14, surface.plasmon.resonance 13,

spherical.silver.nanoparticles 12, synthesis.silver.nanoparticles 11, gold.silver.nanoparticles 11, reduction.silver.ions 9, energy.dispersive.ray 9, ray.photoelectron.spectroscopy 9, surface.raman.spectroscopy 8, ray.diffraction.xrd 8

Term Cliques
40.31% silver nanoparticl gold ser surface.raman surfac
33.58% silver nanoparticl gold ser reduct surface.raman gold.silver
40.57% silver nanoparticl particl colloid ser surface.raman surfac
38.63% silver nanoparticl particl colloid ser reduct surface.raman
44.44% silver nanoparticl ag gold surface.raman surfac
48.98% silver nanoparticl ag gold size surfac
37.12% silver nanoparticl ag gold reduct surface.raman gold.silver
41.01% silver nanoparticl ag gold reduct size gold.silver
48.98% silver nanoparticl ag particl surface.raman surfac
46.71% silver nanoparticl ag particl reduct surface.raman
43.65% silver silver.nanoparticles nanoparticl particl colloid silver.particles size ion surfac
42.14% silver silver.nanoparticles nanoparticl particl colloid reduct silver.particles size ion
46.74% silver silver.nanoparticles nanoparticl ag reduct size gold.silver
45.65% silver silver.nanoparticles nanoparticl ag particl silver.particles size ion surfac
44.14% silver silver.nanoparticles nanoparticl ag particl reduct silver.particles size ion

Sample Cluster Record Titles

Synthesis of polysaccharide-stabilized gold and silver nanoparticles: a green method

Amperometric sensor used for determination of thiocyanate with a silver nanoparticles modified electrode

Effect of silver nanoparticles on the electron transfer reactivity and the catalytic activity of myoglobin

Silver nanoparticles and polymeric medical devices: a new approach to prevention of infection?

One-step synthesis of ordered two-dimensional assemblies of silver nanoparticles by the spontaneous reduction of silver ions by pentadecylphenol Langmuir monolayers

Surface-enhanced fluorescence and reverse saturable absorption on silver nanoparticles

Surface-enhanced Raman scattering of pi-conjugated "push-pull" molecules - Part I. p-Nitroaniline adsorbed on silver nanoparticles

Silver nanoclusters in mesoporous silica, as obtained by visible-laser irradiation

[Assessment of growth of silver nanoparticles synthesized from an ethylene glycol-silver nitrate-polyvinylpyrrolidone solution]

Cluster Metrics

Authors
sastry, m 8
mukherjee, t 6
kapoor, s 6
zhang, y 4
xia, yn 4
wiley, b 4
patakfalvi, r 4
chumanov, g 4
yang, xr 3
wu, qs 3
whitcomb, dr 3
swami, a 3
sun, yp 3
sun, yg 3
sarkar, a 3

Sources
journal of physical chemistry b 25
journal of colloid and interface science 13
materials letters 10
langmuir 10
nanotechnology 8
materials chemistry and physics 8
nano letters 5
colloid journal 5
chemistry of materials 5
chemistry letters 5
surface science 4
chemical physics letters 4
applied physics letters 4
spectroscopy and spectral analysis 3
research on chemical intermediates 3

Keywords
chemistry, physical 86
particles 61
nanoparticles 55
chemistry, multidisciplinary 41

materials science, multidisciplinary 40
silver 38
gold 35
size 32
spectroscopy 30
nanowires 29
films 28
nanoparticles 27
materials science, multidisciplinary 27
growth 22
clusters 20

Publication Year
2005 262
2004 31
2006 1

Country
peoples r china 76
usa 58
india 25
japan 19
south korea 17
germany 16
russia 15
taiwan 11
mexico 9
spain 7
italy 7
france 7
england 7
brazil 7
hungary 5

Institution
chinese acad sci 16
russian acad sci 8
natl chem lab 8
nanjing univ 7
clemson univ 7
bhabha atom res ctr 7
natl tsing hua univ 5
zhejiang univ 4
univ washington 4
univ szeged 4
univ sci & technol china 4

univ nacl autonoma mexico 4
univ maryland 4
shanghai jiao tong univ 4
oak ridge natl lab 4

DataBase
science citation index 294

CATEGORY 14 - 509B1b ***(35 leaf clusters)***

Polymers, Composites, and Metal Complexes (8423 REC)

THRUST
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- Poly(ethylene oxide) (PEO), poly(ethylene glycol) (PEG), and poly(lactic acid) (PLA), focusing on films and surfaces made from these polymers (168 Records) Cluster 63
- Micelles, emphasizing polymer and block micelles, core-shell nanostructures, drug delivery/release applications, and light-scattering studies (148 Records) Cluster 44
- Synthesis and characterization of block copolymers (including di-, tri-, and star-block copolymers), focusing on polystyrene block copolymers, morphology, differential scanning calorimetry studies, and atom transfer radical polymerization (294 Records) Cluster 77

- Copolymers, emphasizing graft, diblock, and triblock copolymers; polymers made of styrene and methacrylate; and differential scanning calorimetry (DSC) studies (341 Records) Cluster 143
- Poly(methyl methacrylate) (PMMA) and poly(2-hydroxyethyl methacrylate) (PHEMA) (121 Records) Cluster 88
- Latex particles, hydrogels, microgels, core-shell particles, and substances made of acrylate poly(N-isopropylacrylamide) (PNIPAM) (135 Records) Cluster 151
- Creation of polymers by means of atom transfer radical polymerization, emulsion polymerization, and ring-opening polymerization (295 Records) Cluster 202
- Graft polymers, including synthesis, grafting of polymer brushes to surfaces, grafted silica, and polyethylene terephthalate (PET) (132 Records) Cluster 69
- Molecular and structural properties of starches (including flour, potatoes, corn, wheat, and rice and banana starches), emphasizing characteristics of starch granules and biodegradation of starch and substances based on starches (49 Records) Cluster 1
- Dendrimers, emphasizing poly(amidoamine) (PAMAM), porphyrin, and carbosilane dendrimers; changes over generations; and dendrimers with mesogenic terminal groups (49 Records) Cluster 3
- Hybrid materials and composites (especially polymers and films), including polyurethane, polyimides, poly(dimethylsiloxane) (PDMS), organic-inorganic materials, and silica-based substances (273 Records) Cluster 248
- Differential scanning calorimetry (DSC) to characterize materials (especially polymers), including effects of molecular weight, studies on glass transitions, and phase behavior (268 Records) Cluster 232
- Polymer properties, focusing on conducting polymers, polymer surfaces and films, influence of nanoparticles, and liquid crystals (694 Records) Cluster 235
- Polymer electrolytes, emphasizing poly(ethylene oxide) (PEO) and poly(3,4-ethylenedioxythiophene) (PEDOT), conductivity studies, and application to lithium batteries (113 Records) Cluster 73
- Polyaniline (PANI) focusing on dodecylbenzene sulfonic acid doped polyaniline (PANI-DBSA), synthesis of conducting PANI materials, and nanofibers of PANI (67 Records) Cluster 15
- Polymer blends (especially poly(vinyl chloride) (PVC), poly(vinyl alcohol) (PVA), and poly(styrene) blends), emphasizing morphology,

miscibility, melt blending, and shear studies (150 Records) Cluster 114

- Rubber and other elastomeric blends, emphasizing nitrile-butadiene rubber (NBR), ethylene-propylene diene terpolymer (EPDM) blends, rubber/silica nanocomposites, nano-calcium carbonate (CaCO3) composites, and measurement/comparison of mechanical properties (117 Records) Cluster 84
- Strengthening and improvement of mechanical and tensile properties of nanocomposites (especially polypropylene) by using filler and reinforcing with fibers (237 Records) Cluster 206
- Investigation of resin-dentin interfaces and other studies on adhesive resin cements, including determination of bond strength and factors affecting self-etching primer bonding systems (85 Records) Cluster 35
- Epoxy resins and composites, including polyhedral oligomeric silsesquioxane (POSS) composites and reinforced epoxy resins, as well as bisphenol-A glycidol ether (DGEBA) epoxy resin (129 Records) Cluster 38
- Clay materials and nanocomposites (including montmorillonites, organoclays, layered silica nanocomposites, and polypropylene- and epoxy-clay nanocomposites), emphasizing exfoliation degree and mechanism, preparation by melt intercalation, dispersion, and mechanical properties (429 Records) Cluster 43
- Montmorillonites (MMTs) (especially MMT nanocomposites), emphasizing intercalation, exfoliation, and thermal properties (133 Records) Cluster 21
- Nanocomposites (including layered silicate and layered double hydroxide [LDH] nanocomposites), organoclays, and organic montmorillonites (OMMTs), emphasizing preparation, exfoliation, intercalation, and enhanced properties, especially thermal properties (445 Records) Cluster 188
- Phase formation, transitions, and behavior in powders, cubic solids, and crystals, as explored by x-ray powder diffraction (296 Records) Cluster 241
- Structural studies, emphasizing crystal structure, x-ray powder diffraction, and structure refinement (278 Records) Cluster 220
- Crystal structure, examined by x-ray diffraction and single crystal methods (388 Records) Cluster 240
- Structure, synthesis, and characterization of compounds (especially diterpenoids, cyclodextrin, and peptides), with emphasis on isolation

from other materials, crystal structure, x-ray diffraction studies, and preferred conformations (102 Records) Cluster 127

- Structural characterization and synthesis of compounds, emphasizing crystallography (especially single crystal x-ray diffraction) and NMR spectroscopy (280 Records) Cluster 203
- Crystal structure at the resolution of a few angstroms using single crystal x-ray diffraction (574 Records) Cluster 108
- Crystal and bond structure of coordination polymers, complexes, hydrates, and other compounds, emphasizing studies on hydrogen bonds and single crystal x-ray diffraction (306 Records) Cluster 148
- Metal complexes and coordination polymers, especially copper (Cu), cadmium (Cd), and pyridyl compounds, with emphasis on synthesis and crystal structure (205 Records) Cluster 125
- Metal complexes and coordination polymers, focusing on structure and reactivity, especially of nickel (Ni) complexes, chelates, and pyridines (237 Records) Cluster 136
- Metal complexes and coordination polymers, emphasizing structure, reactivity, NMR spectroscopy, and synthesis, especially of platinum (Pt) and chlorine (Cl) complexes (647 Records) Cluster 207
- Structure, reactions, and synthesis of metal complexes, especially arene complexes and those containing chlorine (Cl), the hemilabile ligand, amines, and zirconium (Zr) (126 Records) Cluster 23
- Ruthenium (Ru) complexes (especially those containing bipyridine, triphenylphosphine [PPh3], and chlorine [Cl]), including investigations of structure, reactivity, and synthesis, as well as x-ray diffraction studies (112 Records) Cluster 45

- ## CLUSTER 63

  Poly(ethylene oxide) (PEO), poly(ethylene glycol) (PEG), and poly(lactic acid) (PLA), focusing on films and surfaces made from these polymers (168 Records)

(Countries: USA, China, followed by Germany, Korea. Korea Research Institute Chemical Technology, Max Planck Institute Polymer Research, CAS. USA include University of Massachusetts, SUNY Buffalo.).

Cluster Syntax Features

Descriptive Terms
peo 16.5%, poli 9.9%, poly.ethylene 9.0%, ethylen 7.9%, ethylene.oxide 6.0%, copolym 5.3%, poly.ethylene.oxide 5.3%, block 3.3%, peg 2.3%, oxid 1.4%, glycol 1.4%, poly.ethylene.glycol 1.4%, ethylene.glycol 1.2%, pla 0.8%, oxide.poly 0.8%

Discriminating Terms
peo 10.8%, poly.ethylene 5.8%, poli 5.1%, ethylen 4.8%, ethylene.oxide 3.9%, poly.ethylene.oxide 3.5%, copolym 2.7%, block 1.7%, film 1.4%, peg 1.3%, poly.ethylene.glycol 0.9%, glycol 0.8%, ethylene.glycol 0.7%, surfac 0.6%, carbon 0.5%

Single Word Terms
poli 163, ethylen 151, copolym 112, oxid 107, block 84, peo 77, solut 62, polym 62, structur 61, form 59, glycol 56, size 54, microscopi 52, water 52, scatter 50

Double Word Terms
poly.ethylene 149, ethylene.oxide 100, ethylene.glycol 50, oxide.peo 46, poly.propylene 37, propylene.oxide 35, light.scattering 34, electron.microscopy 33, transmission.electron 31, oxide.poly 30, block.copolymer 30, block.poly 28, block.copolymers 26, dynamic.light 24, oxide.block 21

Triple Word Terms
poly.ethylene.oxide 99, poly.ethylene.glycol 49, ethylene.oxide.peo 41, poly.propylene.oxide 33, ethylene.oxide.poly 30, transmission.electron.microscopy 24, dynamic.light.scattering 23, oxide.poly.propylene 21, propylene.oxide.poly 18, ethylene.oxide.block 18, oxide.poly.ethylene 18, ethylene.glycol.peg 17, block.poly.ethylene 16, ring.opening.polymerization 15, ethylene.glycol.poly 14

Term Cliques
40.22% poli copolym peg glycol poly.ethylene.glycol ethylene.glycol pla
55.21% poli copolym block pla
56.62% poli poly.ethylene ethylen copolym peg glycol poly.ethylene.glycol ethylene.glycol
63.81% peo poli poly.ethylene ethylen ethylene.oxide copolym poly.ethylene.oxide block oxid oxide.poly

Sample Cluster Record Titles

A novel inorganic-organic polymer electrolyte with a high conductivity: insertion of poly(ethylene) oxide into LiV3O8 in one step

Catalytic conversions in aqueous media: a novel and efficient hydrogenation of polybutadiene-1,4-block-poly(ethylene oxide) catalyzed by Rh/TPPTS complexes in mixed micellar nanoreactors

Innovative approach for stabilizing poly(ethylene oxide)-b-poly(propylene oxide)-b-poly(ethylene oxide) micelles by forming nano-sized networks in the micelle

Adsorption of poly(ethylene oxide)-b-poly(is an element of-caprolactone) copolymers at the silica-water interface

Poly(ethylene oxide)-modified poly(epsilon-caprolactone) nanoparticles for targeted delivery of tamoxifen in breast cancer

Effect of chain lengths of PEO-PPO-PEO on small unilamellar liposome morphology and stability: an AFM investigation

Poly(ethylene oxide)-b-poly(N-isopropylacrylamide) nanoparticles with cross-linked cores as drug carriers

Preparation of a PLA-PEG block copolymer using a PLA derivative with a formyl terminal group and its application to nanoparticulate formulation

Synthesis and hydrolysis of alpha,omega-perfluoroalkyl-functionalized derivatives of poly(ethylene oxide)

Cluster Metrics

Authors

zhang, y 4
alexandridis, p 4
zhuang, wc 3
yuk, sh 3
tam, kc 3
kim, d 3
chen, x 3
zhuo, rx 2
zhou, qf 2
yao, cm 2
yang, cj 2
xu, lm 2
wu, c 2
wang, ly 2
wang, cc 2

Sources

macromolecules 15
langmuir 15
polymer 9
journal of controlled release 8
colloids and surfaces a-physicochemical and engineering aspects 7
journal of polymer science part a-polymer chemistry 6
journal of physical chemistry b 6
biomaterials 6
journal of polymer science part b-polymer physics 4
journal of applied polymer science 4
international journal of pharmaceutics 4
chemical journal of chinese universities-chinese 4
biomacromolecules 4
journal of colloid and interface science 3
colloid and polymer science 3

Keywords
polymer science 55
chemistry, physical 42
nanoparticles 26
chemistry, multidisciplinary 23
micelles 16
water 15
drug-delivery 15
block-copolymers 15
polymers 13
poly(ethylene oxide) 12
delivery 12
block-copolymers 11
engineering, biomedical 10
materials science, biomaterials 10
triblock copolymers 9

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Country
usa 43
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germany 19
south korea 18
japan 12
france 8
canada 8

singapore 6
netherlands 6
taiwan 4
switzerland 4
sweden 4
russia 4
belgium 4
poland 3

Institution

korea res inst chem technol 6
max planck inst polymer res 5
chinese acad sci 5
univ massachusetts 4
suny buffalo 4
shandong univ 4
natl univ singapore 4
nankai univ 4
wuhan univ 3
univ tokyo 3
univ sci & technol china 3
univ groningen 3
univ bordeaux 1 3
tokyo inst technol 3
tianjin univ 3

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- # CLUSTER 44
  Micelles, emphasizing polymer and block micelles, core-shell

nanostructures, drug delivery/release applications, and light-scattering studies (148 Records)

(Countries: USA, China. Institutions: CAS, Washington University, University S&T China, Seoul National University, Kyoto Institute of Technology.).

Cluster Syntax Features

Descriptive Terms

micel 56.6%, copolym 4.9%, block 2.6%, poli 1.6%, surfact 1.6%, aggreg 1.2%, diblock 1.0%, core 0.8%, drug 0.8%, micellar 0.7%, shell 0.6%, polymer 0.5%, amphiphil 0.5%, polymeric.micelles 0.5%, scatter 0.5%

Discriminating Terms

micel 36.3%, copolym 2.4%, film 1.7%, block 1.2%, surfac 0.7%, surfact 0.7%, carbon 0.6%, diblock 0.6%, nanotub 0.5%, layer 0.5%, magnet 0.5%, crystal 0.5%, poli 0.5%, aggreg 0.5%, deposit 0.5%

Single Word Terms

micel 143, copolym 98, poli 88, block 77, solut 74, form 71, concentr 64, scatter 61, core 56, structur 55, aggreg 54, microscopi 54, size 54, light 52, self 50

Double Word Terms

light.scattering 50, electron.microscopy 40, transmission.electron 40, block.copolymer 36, dynamic.light 34, poly.ethylene 32, critical.micelle 28, copolymer.micelles 25, core.shell 24, micelle.concentration 23, self.assembly 22, diblock.copolymers 22, ethylene.glycol 20, block.copolymers 19, block.poly 19

Triple Word Terms

transmission.electron.microscopy 34, dynamic.light.scattering 34, critical.micelle.concentration 21, block.copolymer.micelles 18, poly.ethylene.glycol 17, electron.microscopy.tem 17, atomic.force.microscopy 17, micelle.concentration.cmc 15, light.scattering.dls 15, poly.ethylene.oxide 14, small.angle.neutron 11, angle.neutron.scattering 11, force.microscopy.afm 11, poly.acrylic.acid 10, neutron.scattering.sans 9

Term Cliques

42.57% micel surfact diblock micellar scatter
44.86% micel surfact aggreg micellar scatter
50.79% micel copolym block aggreg micellar amphiphil
51.35% micel copolym block aggreg core micellar scatter
45.65% micel copolym block poli diblock micellar shell polymer amphiphil
41.22% micel copolym block poli diblock drug shell polymer amphiphil

polymeric.micelles
48.05% micel copolym block poli diblock core micellar shell scatter
47.15% micel copolym block poli diblock core micellar shell polymer
45.95% micel copolym block poli diblock core drug shell polymer

Sample Cluster Record Titles

Self-organization of amphiphilic copolymers into nanoparticles: Study by H-1 NMR longitudinal relaxation time

Structural transformations of reverse micelles of oxyethylated surfactants during the injection solubilization of HCl solutions

Characterization of polybutadiene-poly(ethyleneoxide) aggregates in aqueous solution: A light-scattering and small-angle neutron-scattering study

Distribution kinetics of a micelle-forming block copolymer Pluronic P85

Polyelectrolyte behavior of polystyrene-block-poly(methacrylic acid) micelles in aqueous solutions at low ionic strength

Shear banding fluctuations and nematic order in wormlike micelles

Zeta-potentials of self-assembled surface micelles of ionic surfactants adsorbed at hydrophobic graphite surfaces

Block copolymer micelles as a solution for drug delivery problems

Spherical polyelectrolyte block copolymer micelles: Structural change in presence of monovalent salt

Cluster Metrics

Authors
wooley, kl 5
yoshida, e 4
prochazka, k 4
humpolickova, j 4
zhang, y 3
xu, jp 3
taboada, p 3
stepanek, m 3
shen, jc 3
mosquera, v 3

matejicek, p 3
joralemon, mj 3
ji, j 3
hellweg, t 3
findenegg, gh 3

Sources
macromolecules 18
langmuir 14
journal of the american chemical society 7
journal of controlled release 7
colloid and polymer science 7
biomacromolecules 4
macromolecular chemistry and physics 3
macromolecular bioscience 3
journal of physical chemistry b 3
journal of colloid and interface science 3
colloids and surfaces b-biointerfaces 3
colloids and surfaces a-physicochemical and engineering aspects 3
advanced materials 3
acta polymerica sinica 3
polymer 2

Keywords
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chemistry, physical 43
nanoparticles 28
micelles 27
chemistry, multidisciplinary 26
nanoparticles 15
block-copolymer micelles 15
copolymers 14
self-assembly 14
polymers 14
polymer science 14
light-scattering 14
drug-delivery 14
block-copolymers 14
water 13

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usa 38
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japan 14
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south korea 12
france 12
canada 8
england 5
czech republic 5
singapore 4
australia 4
taiwan 3
switzerland 3
sweden 3
spain 3

Institution
chinese acad sci 8
washington univ 5
univ sci & technol china 5
seoul natl univ 5
kyoto inst technol 5
zhejiang univ 4
toyohashi univ technol 4
inst max von laue paul langevin 4
fudan univ 4
charles univ 4
acad sci czech republ 4
univ santiago de compostela 3
univ penn 3
univ catholique louvain 3
technion israel inst technol 3

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- CLUSTER 77
  Synthesis and characterization of block copolymers (including di-, tri-, and star-block copolymers), focusing on polystyrene block copolymers, morphology, differential scanning calorimetry studies, and atom transfer radical polymerization (294 Records)

(Countries: USA dominant, China, Japan, Germany, Korea. Institutions: University of Minnesota, University of Massachusetts, Tokyo Institute of Technology, CAS. Other USA include UCB, University of Southern Mississippi, UCSB.).

Cluster Syntax Features

Descriptive Terms
block 32.4%, copolym 27.5%, block.copolymers 6.3%, block.copolymer 4.4%, poli 2.2%, diblock 0.9%, polystyren 0.7%, styren 0.7%, polymer 0.7%, polym 0.5%, triblock 0.5%, morpholog 0.4%, nanoparticl 0.3%, star 0.3%, micel 0.3%

Discriminating Terms
block 21.1%, copolym 17.2%, block.copolymers 4.3%, block.copolymer 3.0%, film 1.2%, poli 0.8%, carbon 0.6%, nanotub 0.6%, diblock 0.5%, surfac 0.5%, deposit 0.5%, magnet 0.5%, particl 0.4%, layer 0.4%, electron 0.4%

Single Word Terms
block 294, copolym 281, poli 172, structur 128, polym 106, polymer 101, morpholog 95, form 89, polystyren 84, synthes 83, assembl 82, self 82, temperatur 82, microscopi 81, solut 75

Double Word Terms
block.copolymers 171, block.copolymer 143, electron.microscopy 51, differential.scanning 50, molecular.weight 50, scanning.calorimetry 46, transmission.electron 44, radical.polymerization 42, angle.ray 40, diblock.copolymer 39, poly.styrene 39, self.assembly 39, diblock.copolymers 36, small.angle 36, block.poly 35

Triple Word Terms
differential.scanning.calorimetry 46, transmission.electron.microscopy 37, atom.transfer.radical 34, angle.ray.scattering 33, small.angle.ray 32,

transfer.radical.polymerization 32, scanning.calorimetry.dsc 25, atomic.force.microscopy 21, ring.opening.polymerization 20, poly.methyl.methacrylate 20, ray.scattering.saxs 20, electron.microscopy.tem 18, radical.polymerization.atrp 18, amphiphilic.block.copolymers 17, block.copolymers.poly 16

Term Cliques
46.36% block copolym polystyren styren polymer polym star
50.34% block copolym poli polystyren styren triblock morpholog
48.81% block copolym poli polystyren styren polymer polym triblock
54.59% block copolym poli diblock polymer micel
52.33% block copolym poli diblock polystyren styren polymer
49.38% block copolym block.copolymer morpholog star micel
47.86% block copolym block.copolymer polystyren styren morpholog star
48.40% block copolym block.copolymer polystyren styren polym star
59.35% block copolym block.copolymer poli polym nanoparticl
55.88% block copolym block.copolymer poli polystyren styren polym
53.45% block copolym block.copolymer poli diblock morpholog micel
53.98% block copolym block.copolymer poli diblock morpholog nanoparticl
51.62% block copolym block.copolymer poli diblock polystyren styren morpholog
50.96% block copolym block.copolymers morpholog star micel
51.30% block copolym block.copolymers polymer star micel
52.66% block copolym block.copolymers styren morpholog star
50.58% block copolym block.copolymers styren polymer polym star
59.69% block copolym block.copolymers poli morpholog micel
60.03% block copolym block.copolymers poli polymer micel
54.57% block copolym block.copolymers poli styren triblock morpholog
52.51% block copolym block.copolymers poli styren polymer polym triblock

Sample Cluster Record Titles

Surface morphology and wetting properties of surfaces coated with an amphiphilic diblock copolymer

Micellar aggregates of amylose-block-polystyrene rod-coil block copolymers in water and THF

Novel inorganic-organic hybrid block copolymers as pore generators for nanoporous ultralow-dielectric-constant films

Lateral assembly of metal nanoparticles directed by nanodomain control in block copolymer thin films

New polyphenylene-g-polystyrene and polyphenylene-g-polystyrene/poly(epsilon-caprolactone) copolymers by combined controlled polymerization and cross-coupling processes

[Crystallization of polystyrene-block-[Syndiotactic poly(propylene)] block copolymers from confinement to breakout]

[Asymmetric PS-block-(PS-co-PB)-block-PS block copolymers: morphology and deformation behavior of star block copolymer/PS blends]

[Semiconducting block copolymers - synthesis and nanostructure formation]

[Phase behavior of the melt of polystyrene-poly(ethylene oxide) metallo-supramolecular diblock copolymer with bulky counterions]

Cluster Metrics

Authors

russell, tp 8
schubert, us 6
hamley, iw 6
yokoyama, h 5
takano, a 5
matsushita, y 5
kim, kj 5
taton, ta 4
mauritz, ka 4
hillmyer, ma 4
hadjichristidis, n 4
castelletto, v 4
zhang, hl 3
wooley, kl 3
wang, xz 3

Sources

macromolecules 48
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journal of polymer science part a-polymer chemistry 18
journal of polymer science part b-polymer physics 8
advanced materials 8
journal of the american chemical society 7
european polymer journal 7
macromolecular rapid communications 6
journal of applied polymer science 6
chemistry of materials 6
biomacromolecules 6
nano letters 5

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macromolecular symposia 4

Keywords

polymer science 150
chemistry, physical 47
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chemistry, multidisciplinary 27
block copolymers 27
materials science, multidisciplinary 26
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materials science, multidisciplinary 23
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south korea 25
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england 16
canada 16
taiwan 13
netherlands 11
belgium 10
switzerland 7
singapore 7
italy 7
greece 6

Institution

univ minnesota 12
univ massachusetts 10
tokyo inst technol 10
chinese acad sci 9

eindhoven univ technol 8
yonsei univ 6
univ calif berkeley 6
natl inst adv ind sci & technol 6
univ so mississippi 5
univ sci & technol china 5
univ leeds 5
univ calif santa barbara 5
seoul natl univ 5
natl tsing hua univ 5
nagoya univ 5

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- CLUSTER 143
  Copolymers, emphasizing graft, diblock, and triblock copolymers; polymers made of styrene and methacrylate; and differential scanning calorimetry (DSC) studies (341 Records)

(Countries: China, followed by USA, followed by Japan. Institutions: CAS Zhejiang University. USA include ANL, VPI, University of Minnesota.).

Cluster Syntax Features

Descriptive Terms
copolym 61.2%, graft 1.8%, poli 1.6%, diblock 1.1%, polymer 1.0%, copolymer 0.9%, methacryl 0.9%, styren 0.8%, chain 0.5%, polym 0.5%, monom 0.5%, acryl 0.4%, blend 0.4%, graft.copolymers 0.4%, triblock 0.4%

Discriminating Terms
copolym 42.0%, film 1.3%, graft 1.0%, diblock 0.7%, copolymer 0.6%, surfac 0.6%, nanotub 0.6%, magnet 0.6%, carbon 0.6%, layer 0.5%, poli 0.5%, deposit 0.5%, methacryl 0.5%, styren 0.5%, quantum 0.4%

Single Word Terms
copolym 341, poli 168, structur 130, scan 127, polym 119, synthes 119, polymer 117, properti 108, synthesi 98, chain 97, temperatur 96, calorimetri 89, differenti 89, composit 89, solut 86

Double Word Terms
differential.scanning 88, scanning.calorimetry 83, electron.microscopy 50,

molecular.weight 47, radical.polymerization 43, ray.diffraction 40, scanning.electron 35, transmission.electron 34, free.radical 31, angle.ray 31, poly.ethylene 30, calorimetry.dsc 30, atomic.force 29, fourier.transform 29, methyl.methacrylate 28

Triple Word Terms

differential.scanning.calorimetry 83, scanning.calorimetry.dsc 30, transmission.electron.microscopy 28, gel.permeation.chromatography 27, scanning.electron.microscopy 26, atom.transfer.radical 26, fourier.transform.infrared 26, atomic.force.microscopy 25, transfer.radical.polymerization 23, wide.angle.ray 20, poly.methyl.methacrylate 17, angle.ray.diffraction 16, ring.opening.polymerization 15, ray.photoelectron.spectroscopy 15, free.radical.polymerization 15

Term Cliques

40.53% copolym poli polym blend triblock
37.01% copolym poli styren blend triblock
45.28% copolym poli polymer polym triblock
36.80% copolym poli polymer styren acryl triblock
36.71% copolym poli diblock styren chain blend
38.00% copolym poli diblock polymer methacryl styren chain
40.03% copolym graft poli chain polym blend
37.10% copolym graft poli styren chain blend
31.80% copolym graft poli polymer copolymer methacryl monom acryl graft.copolymers
32.71% copolym graft poli polymer copolymer methacryl chain acryl graft.copolymers
38.71% copolym graft poli polymer copolymer methacryl chain polym
32.88% copolym graft poli polymer copolymer methacryl styren monom acryl
33.79% copolym graft poli polymer copolymer methacryl styren chain acryl

Sample Cluster Record Titles

Copolymers from oligosiloxane methacrylates as a plasticizer-free membrane matrix for ion-selective sensors

Copolymers of (2-oxo-2-tert-butylamino)ethylene methacrylate and styrene: synthesis, characterization and monomer reactivity ratios

Surface study of block and graft copolymers of polystyrene-polydimethylsiloxane

Monitoring surface thermal transitions of ABA triblock copolymers with crystalline segments using phase contrast tapping mode atomic force microscopy

Preparation of densely grafted poly(aniline-2-sulfonic acid-co-aniline)s as novel water-soluble conducting

Formation of [60]fullerene nanoclusters with controlled size and morphology through the aid of supramolecular rod-coil diblock copolymers

[Synthesis of amphiphilic poly(ethylene oxide)-b-poly(methyl methacrylate) - Diblock copolymers via atom transfer radical polymerization utilizing halide exchange technique]

[Surface properties and structures of diblock copolymer and homopolymer with perfluoroalkyl side chains]

[Computer simulation of block copolymer/nanoparticle composites]

Cluster Metrics

Authors
wang, cc 6
neoh, kg 5
kang, et 5
zhou, qf 4
thiyagarajan, p 4
matyjaszewski, k 4
liu, y 4
chen, cy 4
cao, y 4
zhu, db 3
yilgor, e 3
yao, kd 3
wilkes, gl 3
terano, m 3
seifert, s 3

Sources
macromolecules 37
polymer 36
journal of applied polymer science 31
journal of polymer science part a-polymer chemistry 26
langmuir 16
journal of polymer science part b-polymer physics 8
european polymer journal 8
journal of physical chemistry b 7
polymer international 5
polymer bulletin 5
journal of materials science 5
macromolecular rapid communications 4
macromolecular chemistry and physics 4
journal of macromolecular science-pure and applied chemistry 4
journal of colloid and interface science 4

Keywords
polymer science 202
polymers 52
chemistry, physical 42
block-copolymers 29
morphology 25
films 25
materials science, multidisciplinary 24
block-copolymers 23
polymerization 22
polymers 18
blends 17
behavior 17
copolymers 16
styrene 15
copolymer 15

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Country
peoples r china 102
usa 63
japan 32
south korea 20
turkey 18
france 18
taiwan 16
india 14
germany 13
italy 11
singapore 10
england 8
brazil 6
russia 5
poland 5

Institution
chinese acad sci 20
zhejiang univ 14
so taiwan univ technol 7
nanjing univ 7
s china univ technol 6
hacettepe univ 6

tokyo inst technol 5
peking univ 5
natl univ singapore 5
argonne natl lab 5
wuhan univ 4
virginia polytech inst & state univ 4
univ minnesota 4
toyohashi univ technol 4
shandong univ 4

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- # CLUSTER 88
  Poly(methyl methacrylate) (PMMA) and poly(2-hydroxyethyl methacrylate) (PHEMA) (121 Records)

Countries: USA, followed by China, Japan. Institutions: University of Southern Mississippi. Other USA include Georgia Institute of Technology, University of Massachusetts, University of Illinois.).

Cluster Syntax Features

Descriptive Terms
methacryl 17.7%, pmma 14.2%, methyl.methacrylate 10.6%, methyl 9.3%, poly.methyl 6.4%, poly.methyl.methacrylate 5.8%, poli 4.6%, polymer 1.2%, methacrylate.pmma 1.2%, methyl.methacrylate.pmma 1.1%, mma 0.8%, polym 0.8%, particl 0.6%, phema 0.4%, blend 0.4%

Discriminating Terms
methacryl 11.9%, pmma 9.6%, methyl.methacrylate 7.3%, methyl 5.9%, poly.methyl 4.4%, poly.methyl.methacrylate 4.0%, poli 2.0%, film 1.3%, methacrylate.pmma 0.8%, methyl.methacrylate.pmma 0.8%, structur 0.6%, nanotub 0.6%, mma 0.6%, carbon 0.5%, crystal 0.5%

Single Word Terms

methacryl 113, poli 103, methyl 103, pmma 59, polymer 53, polym 52, surfac 46, particl 40, high 38, properti 37, size 35, microscopi 34, scan 33, structur 32, electron 32

Double Word Terms
methyl.methacrylate 93, poly.methyl 77, methacrylate.pmma 51, scanning.electron 20, methacrylate.mma 19, electron.microscopy 18, glass.transition 15, atomic.force 15, force.microscopy 15, differential.scanning 15, scanning.calorimetry 14, hydroxyethyl.methacrylate 11, transition.temperature 11, fourier.transform 11, transform.infrared 10

Triple Word Terms
poly.methyl.methacrylate 74, methyl.methacrylate.pmma 49, methyl.methacrylate.mma 17, atomic.force.microscopy 14, differential.scanning.calorimetry 14, glass.transition.temperature 11, scanning.electron.microscopy 11, polymerization.methyl.methacrylate 10, fourier.transform.infrared 10, electron.microscopy.sem 9, poly.hydroxyethyl.methacrylate 9, force.microscopy.afm 8, transmission.electron.microscopy 8, hydroxyethyl.methacrylate.phema 7, atom.transfer.radical 7

Term Cliques
41.32% methacryl mma phema
61.71% methacryl poli phema
56.57% methacryl pmma methyl.methacrylate methyl poly.methyl.methacrylate polymer mma polym particl
59.67% methacryl pmma methyl.methacrylate methyl poly.methyl poly.methyl.methacrylate poli methyl.methacrylate.pmma particl blend
60.58% methacryl pmma methyl.methacrylate methyl poly.methyl poly.methyl.methacrylate poli methacrylate.pmma methyl.methacrylate.pmma blend
61.31% methacryl pmma methyl.methacrylate methyl poly.methyl poly.methyl.methacrylate poli polymer methyl.methacrylate.pmma polym particl
62.13% methacryl pmma methyl.methacrylate methyl poly.methyl poly.methyl.methacrylate poli polymer methacrylate.pmma methyl.methacrylate.pmma polym

Sample Cluster Record Titles

Persistent interactions between hydroxylated nanoballs and atactic poly(2-hydroxyethyl methacrylate) (PHEMA)

Morphological characterization of PMMA/PAN composite particles in nano to submicro size

Surface and chemical properties of surface-modified UHMWPE powder and mechanical and thermal properties of it impregnated PMMA bone cement, III: effect of various ratios of initiator/inhibitor on the surface modification of UHMWPE powder

Initiated CVD of poly(methyl methacrylate) thin films

Low temperature bonding of poly(methylmethacrylate) electrophoresis microchips by in situ polymerisation

Synthesis of nano-ZnO/poly(methyl methacrylate) composite microsphere through emulsion polymerization and its UV-shielding property

Quantitative chemical mapping of nanostructured "onionlike" poly(methyl methacrylate)/polystyrene composite particles by soft X-ray microscopy

Dispersion of gold nanoparticles above the poly(methyl methacrylate) surface by the use of fluoroalkyl end-capped oligomeric aggregates

Thermal properties of the gamma-Fe2O3/poly(methyl methacrylate) core/shell nanoparticles

Cluster Metrics

Authors

urban, mw 5
ueno, k 3
sawada, h 3
lestage, dj 3
hamazaki, k 3
thomann, r 2
takahashi, h 2
mulhaupt, r 2
matisons, j 2
kwok, dy 2
kawase, t 2
dreher, wr 2
choudhury, nr 2
ahmad, s 2
zubris, m 1

Sources

macromolecules 14
langmuir 9
polymer 6
journal of applied polymer science 5
colloid and polymer science 4
journal of physical chemistry b 3

journal of chromatography a 3
biomacromolecules 3
synthetic metals 2
polymers for advanced technologies 2
polymer engineering and science 2
polymer degradation and stability 2
macromolecular rapid communications 2
journal of sol-gel science and technology 2
journal of biomaterials science-polymer edition 2

Keywords

polymer science 48
chemistry, physical 22
particles 16
polymers 14
pmma 12
polymer science 11
chemistry, analytical 10
poly(methyl methacrylate) 10
nanocomposites 9
films 9
behavior 8
materials science, multidisciplinary 7
polymerization 7
polymer 7
polystyrene 6

Publication Year

2005 110
2004 10
2006 1

Country

usa 27
peoples r china 18
japan 16
germany 10
canada 9
taiwan 8
south korea 8
france 5
spain 4
russia 4
italy 4
india 3
czech republic 3

turkey 2
israel 2

Institution
univ so mississippi 6
univ sci & technol china 3
univ freiburg 3
kyoto univ 3
hirosaki univ 3
georgia inst technol 3
csic 3
asahi glass co ltd 3
univ s australia 2
univ massachusetts 2
univ illinois 2
univ alberta 2
seoul natl univ 2
russian acad sci 2
natl taiwan univ 2

DataBase
science citation index 121

- # CLUSTER 151
  Latex particles, hydrogels, microgels, core-shell particles, and substances made of acrylate poly(N-isopropylacrylamide) (PNIPAM) (135 Records)

(Countries: China dominant, USA. Institutions: University S&T China, Max Planck Institute Colloids and Interfaces, Fudan University, CAS. USA include Cornell University, University of Notre Dame.).

Cluster Syntax Features

Descriptive Terms
latex 16.7%, shell 7.1%, particl 4.7%, acryl 4.4%, core 4.3%, poli 3.5%, hydrogel 3.3%,

core.shell 2.8%, latex.particles 2.3%, microgel 2.1%, polymer 1.6%, methacryl 1.4%, emuls 1.2%, pnipam 0.9%, seed 0.8%

Discriminating Terms

latex 12.5%, shell 4.4%, acryl 3.1%, core 2.4%, hydrogel 2.3%, core.shell 1.8%, latex.particles 1.7%, microgel 1.6%, poli 1.6%, film 1.2%, particl 1.1%, methacryl 0.9%, emuls 0.8%, pnipam 0.7%, polymer 0.7%

Single Word Terms

poli 85, particl 79, polymer 69, electron 65, surfac 60, microscopi 56, shell 55, size 53, core 53, polym 52, structur 52, acryl 52, properti 49, scan 48, latex 48

Double Word Terms

electron.microscopy 50, core.shell 46, scanning.electron 34, latex.particles 33, transmission.electron 32, emulsion.polymerization 30, particle.size 24, acrylic.acid 18, microscopy.tem 18, methyl.methacrylate 18, light.scattering 15, poly.isopropylacrylamide 15, microscopy.sem 15, cross.linked 14, differential.scanning 12

Triple Word Terms

scanning.electron.microscopy 28, transmission.electron.microscopy 27, electron.microscopy.tem 17, electron.microscopy.sem 15, poly.acrylic.acid 12, seeded.emulsion.polymerization 11, differential.scanning.calorimetry 11, core.shell.particles 9, fourier.transform.infrared 8, core.shell.structure 8, poly.methyl.methacrylate 8, composite.latex.particles 8, scanning.calorimetry.dsc 7, poly.vinyl.alcohol 7, poly.isopropylacrylamide.pnipam 7

Term Cliques

24.44% poli hydrogel microgel pnipam
35.00% poli hydrogel microgel polymer
35.00% particl poli microgel pnipam
42.81% particl poli microgel polymer methacryl
40.74% shell particl core poli core.shell pnipam
40.25% shell particl core poli core.shell polymer methacryl emuls seed
35.31% latex particl acryl core.shell latex.particles polymer methacryl emuls seed
36.17% latex shell particl core core.shell pnipam
35.93% latex shell particl core core.shell latex.particles polymer methacryl emuls seed

Sample Cluster Record Titles

Organic-dye-coupted magnetic nanoparticles encaged inside thermoresponsive PNIPAM microcapsutes

Investigation of fluorinated polyacrylate latex with core-shell structure

Synthesis and swelling behaviour of interpenetrating network polymers of poly(vinyl alcohol) and poly(acrylamide-co-potassium methacrylate)

Vinyl ether/acrylic acid terpolymer hydrogels synthesized by gamma-radiation: characterization, thermosensitivity and pH-sensitivity

Particle morphology and NMR structure of polymethylmethacrylate/polystyrene emulsifier-free core-shell cationic latices in the presence of DBMEA

Poly (ferrocenyldimethylsilane-b-dimethylsiloxane) microsphere with shell thickness controllable structure prepared through self-assembly

Polyurethane latex modified with polyaniline

Engineering temperature-sensitive hydrogel nanoparticles entrapping hemoglobin as a novel type of oxygen carrier

Latex produced with carboxylic acid comonomer for waterborne coatings: Particle morphology variations with changing pH

Cluster Metrics

Authors
mohwald, h 6
zhang, zc 4
ge, xw 4
zou, mx 3
sukhorukov, gb 3
shchukin, dg 3
kawaguchi, h 3
chen, yj 3
zhuo, rx 2
zhang, xz 2
zhang, xh 2
zhang, cc 2
yu, sh 2
wei, gs 2
wang, lx 2

Sources
langmuir 12
polymer 10
macromolecules 7
colloid and polymer science 7
journal of applied polymer science 6

european polymer journal 6
polymer international 5
journal of polymer science part a-polymer chemistry 5
radiation physics and chemistry 3
journal of physical chemistry b 3
journal of materials chemistry 3
colloids and surfaces a-physicochemical and engineering aspects 3
chemistry of materials 3
biomacromolecules 3
synthetic metals 2

Keywords
polymer science 58
chemistry, physical 37
polymers 12
particles 12
polymer science 11
polymer 11
nanoparticles 11
materials science, multidisciplinary 11
chemistry, multidisciplinary 10
polymerization 10
morphology 9
gels 9
films 9
emulsion polymerization 8
water 8

Publication Year
2005 119
2004 12
2006 4

Country
peoples r china 48
usa 25
germany 12
south korea 9
japan 9
france 6
england 5
canada 5
india 4
taiwan 3
spain 3
italy 3

turkey 2
sweden 2
singapore 2

Institution
univ sci & technol china 8
max planck inst colloids & interfaces 8
fudan univ 5
chinese acad sci 5
wuhan univ 3
nanyang technol univ 3
keio univ 3
jilin univ 3
hebei univ technol 3
cornell univ 3
wuhan univ technol 2
univ toronto 2
univ notre dame 2
tsing hua univ 2
sungkyunkwan univ 2

DataBase
science citation index 135

- # CLUSTER 202
  Creation of polymers by means of atom transfer radical polymerization, emulsion polymerization, and ring-opening polymerization (295 Records)

(Countries: China, followed by USA, followed by Japan. Institutions: Eindhoven University of Technology, National University of Singapore, CAS.).

Cluster Syntax Features

Descriptive Terms

polymer 38.0%, emuls 3.7%, monom 2.9%, initi 2.9%, radic 2.9%, polym 2.5%, radical.polymerization 1.5%, poli 1.0%, transfer.radical 1.0%, atom.transfer 0.9%, microspher 0.9%, atom.transfer.radical 0.9%, particl 0.8%, emulsion.polymerization 0.8%, transfer.radical.polymerization 0.8%

Discriminating Terms

polymer 27.4%, emuls 2.7%, monom 2.0%, radic 1.9%, film 1.7%, initi 1.7%, radical.polymerization 1.1%, transfer.radical 0.7%, atom.transfer 0.7%, atom.transfer.radical 0.7%, nanotub 0.6%, polym 0.6%, emulsion.polymerization 0.6%, transfer.radical.polymerization 0.6%, carbon 0.6%

Single Word Terms

polymer 271, polym 135, initi 132, monom 103, surfac 103, poli 97, particl 87, radic 87, structur 80, size 79, reaction 77, synthes 75, high 72, electron 69, water 69

Double Word Terms

radical.polymerization 63, electron.microscopy 49, transfer.radical 42, atom.transfer 41, emulsion.polymerization 37, molecular.weight 34, scanning.electron 34, surface.initiated 31, differential.scanning 31, scanning.calorimetry 31, transmission.electron 28, polymerization.atrp 24, ring.opening 22, core.shell 20, ray.diffraction 19

Triple Word Terms

atom.transfer.radical 41, transfer.radical.polymerization 40, differential.scanning.calorimetry 31, scanning.electron.microscopy 27, transmission.electron.microscopy 25, radical.polymerization.atrp 24, initiated.atom.transfer 18, surface.initiated.atom 18, ray.photoelectron.spectroscopy 15, ring.opening.polymerization 14, fourier.transform.infrared 13, atomic.force.microscopy 12, free.radical.polymerization 11, electron.microscopy.sem 11, scanning.calorimetry.dsc 11

Term Cliques

22.88% emuls monom microspher particl
28.61% emuls monom polym particl emulsion.polymerization
32.17% polymer initi radic polym radical.polymerization poli transfer.radical atom.transfer atom.transfer.radical transfer.radical.polymerization
42.92% polymer monom polym particl emulsion.polymerization
40.11% polymer monom initi poli microspher particl
46.61% polymer monom initi polym poli particl

Sample Cluster Record Titles

Atom transfer radical polymerization of N-(omega '-alkylcarbazolyl)methacrylates via the use of novel heteroleptic Ru(II) polypyridyl initiator

Ring-opening polymerization of L-lactide by rare-earth tris(4-tert-butylphenolate) single-component initiators

Fabrication of chemically tethered binary polymer-brush pattern through two-step surface-initiated atomic-transfer radical polymerization

Well-defined (Co)polymers with 5-vinyltetrazole units via combination of atom transfer radical (Co)polymerization of acrylonitrile and "click chemistry"-type postpolymerization modification

Polymerization of sulfopropyl methacrylate, a surface active monomer, within layered double hydroxide

Synthesis of acid-sensitive latices by ring-opening metathesis polymerization

From free radical to Atom Transfer Radical Polymerization of poly(ethylene oxide) macromonomers in nanostructured media

Accelerating the living polymerization of 2-nonyl-2-oxazoline by implementing a microwave synthesizer into a high-throughput experimentation worknow

An approach towards nano-size crystals of poly(acrylic acid): Polymerization using layered double hydroxides as template

Cluster Metrics

Authors
schubert, us 8
kang, et 8
neoh, kg 7
hoogenboom, r 6
yu, j 4
yang, b 4
wiesbrock, f 4
meier, mar 4
liu, p 4
guo, zx 4
zhang, k 3

yi, cf 3
yang, wl 3
xu, zs 3
suh, kd 3

Sources
macromolecules 26
polymer 20
journal of polymer science part a-polymer chemistry 20
journal of applied polymer science 13
macromolecular rapid communications 10
langmuir 10
journal of the american chemical society 8
chemical journal of chinese universities-chinese 7
acta polymerica sinica 7
journal of physical chemistry b 6
european polymer journal 6
chemistry of materials 6
polymer international 5
macromolecular chemistry and physics 5
journal of colloid and interface science 5

Keywords
polymer science 137
chemistry, physical 47
polymerization 46
chemistry, multidisciplinary 34
polymers 29
styrene 25
particles 25
nanoparticles 23
nanoparticles 20
materials science, multidisciplinary 20
polymerization 20
transfer radical polymerization 16
methyl-methacrylate 16
polystyrene 15
water 14

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2005 270
2004 22
2006 3

Country
peoples r china 74

usa 49
japan 32
france 21
germany 20
south korea 19
netherlands 15
singapore 12
india 11
england 10
canada 8
italy 7
taiwan 6
mexico 6
australia 6

Institution

eindhoven univ technol 13
natl univ singapore 11
chinese acad sci 8
univ sci & technol china 7
tsing hua univ 7
jilin univ 7
dutch polymer inst 6
zhejiang univ 5
shanghai jiao tong univ 5
hubei univ 5
fudan univ 5
univ queensland 4
univ bordeaux 1 4
tokyo inst technol 4
tohoku univ 4

DataBase

science citation index 295

- # CLUSTER 69
  Graft polymers, including synthesis, grafting of polymer brushes to surfaces, grafted silica, and polyethylene terephthalate (PET) (132 Records)

(Countries: China dominant, Japan, France, USA. Institutions: CAS, Hebei University, Niigata University.).

Cluster Syntax Features

Descriptive Terms
graft 64.1%, brush 2.0%, polymer 1.3%, polym 1.3%, silica 1.3%, initi 1.3%, surfac 1.1%, poli 0.9%, grafted.silica 0.6%, chain 0.5%, monom 0.4%, acryl 0.4%, radic 0.4%, graft.polymerization 0.4%, pet 0.3%

Discriminating Terms
graft 41.4%, brush 1.2%, film 1.1%, structur 0.5%, nanotub 0.5%, magnet 0.5%, initi 0.5%, carbon 0.5%, crystal 0.5%, deposit 0.5%, polymer 0.4%, quantum 0.4%, temperatur 0.4%, layer 0.4%, grafted.silica 0.4%

Single Word Terms
graft 129, surfac 91, polym 66, polymer 62, poli 62, initi 55, reaction 50, electron 45, chain 44, spectroscopi 44, scan 43, monom 40, properti 40, temperatur 37, acid 36

Double Word Terms
scanning.electron 35, electron.microscopy 30, graft.polymerization 21, infrared.spectroscopy 20, fourier.transform 19, contact.angle 19, transform.infrared 17, photoelectron.spectroscopy 17, ray.photoelectron 17, grafted.silica 16, radical.polymerization 16, poly.ethylene 16, differential.scanning 15, grafted.polymer 15, molecular.weight 14

Triple Word Terms
scanning.electron.microscopy 26, fourier.transform.infrared 17, ray.photoelectron.spectroscopy 17, differential.scanning.calorimetry 13, electron.microscopy.sem 12, transform.infrared.spectroscopy 11, contact.angle.measurements 10, transfer.radical.polymerization 10, atom.transfer.radical 10, photoelectron.spectroscopy.xps 9, scanning.calorimetry.dsc 8, graft.copolymerization.methyl 7, poly.acrylic.acid 7, poly.ethylene.terephthalate 7, radical.polymerization.atrp 6

Term Cliques

39.39% brush polymer polym surfac poli chain graft.polymerization
35.28% brush polymer polym silica surfac chain graft.polymerization
39.24% graft poli acryl radic pet
47.88% graft surfac poli acryl pet
45.30% graft polym poli radic pet
53.94% graft polym surfac poli pet
39.18% graft polymer initi grafted.silica monom acryl radic
43.61% graft polymer initi poli monom radic graft.polymerization
44.16% graft polymer initi poli monom acryl radic
45.35% graft polymer initi surfac grafted.silica monom acryl
50.32% graft polymer initi surfac poli monom acryl
47.73% graft polymer initi surfac poli chain monom graft.polymerization
36.08% graft polymer silica initi grafted.silica monom radic graft.polymerization
40.57% graft polymer silica initi surfac grafted.silica chain monom graft.polymerization
46.43% graft polymer polym initi poli radic graft.polymerization
50.19% graft polymer polym initi surfac poli chain graft.polymerization
38.54% graft polymer polym silica initi grafted.silica radic graft.polymerization
42.76% graft polymer polym silica initi surfac grafted.silica chain graft.polymerization

Sample Cluster Record Titles

Hemocompatibility of PET (polyethylene terephthalate) films grafted PEG (polyethylene glycol) by plasma surface modification

Motion of nano-objects on polymer brushes

Tailoring bulk and surface grafting of poly(acrylic acid) in electron-irradiated PVDF

Reverse ATRP grafting from silica surface to prepare well-defined organic/inorganic hybrid nanocomposite

New syntheses of hyperbranched polyamine grafts

Microwave promoted synthesis of chitosan-graft-poly(acrylonitrile)

Graft copolymerization of methyl acrylate onto sodium alginate initiated by potassium diperiodatocuprate(III)

Collapse and swelling of thermally sensitive Poly(N-isopropylacrylamide) brushes monitored with a quartz crystal microbalance

Photografting of polymers onto nanosized silica surface initiated by eosin moieties immobilized onto the surface

Cluster Metrics

Authors
liu, yh 6
tsubokawa, n 5
yamauchi, t 4
wang, j 4
ruhe, j 4
bourgeat-lami, e 4
yang, ly 3
trivedi, jh 3
trivedi, hc 3
sun, h 3
shirai, k 3
saitoh, h 3
qiu, xy 3
patel, nk 3
liu, yw 3

Sources
macromolecules 11
polymer 10
journal of applied polymer science 9
langmuir 5
journal of macromolecular science-pure and applied chemistry 5
macromolecular rapid communications 4
nuclear instruments & methods in physics research section b-beam interactions with materials and atoms 3
materials letters 3
journal of polymer science part a-polymer chemistry 3
iranian polymer journal 3
european polymer journal 3
carbohydrate polymers 3
biomacromolecules 3
polymers & polymer composites 2
polymer degradation and stability 2

Keywords
polymer science 66
polymers 17
polymerization 16
chemistry, physical 16
surface 15
particles 12
transfer radical polymerization 11
self-assembled monolayers 11

copolymers 11
brushes 11
surface modification 10
polymer science 10
chemistry, multidisciplinary 9
adsorption 9
films 8

Publication Year
2005 122
2004 10

Country
peoples r china 41
japan 18
france 15
usa 13
germany 9
india 7
south korea 6
england 6
turkey 2
switzerland 2
sweden 2
netherlands 2
mexico 2
malaysia 2
iran 2

Institution
chinese acad sci 10
hebei univ 6
niigata univ 5
univ freiburg 4
cnrs 4
zhongshan univ 3
waseda univ 3
sw jiaotong univ 3
shanghai jiao tong univ 3
sardar patel univ 3
lanzhou univ 3
cea saclay 3
univ sci & technol china 2
univ pau & pays adour 2
univ montpellier 2 2

DataBase
science citation index 132

- # CLUSTER 1
  Molecular and structural properties of starches (including flour, potatoes, corn, wheat, and rice and banana starches), emphasizing characteristics of starch granules and biodegradation of starch and substances based on starches (49 Records)

(Countries: China, Poland, France. Institutions: Polish Academy of Science, RAS, CSIC, CAS. USA includes Washington State University.).

Cluster Syntax Features

Descriptive Terms
starch 75.1%, granul 5.1%, flour 1.4%, starch.granules 1.3%, potato 1.2%, potato.starch 0.7%, rice 0.6%, blend 0.4%, gelatin 0.4%, corn 0.4%, biodegrad 0.3%, content 0.3%, wheat 0.2%, banana 0.2%, amylopectin 0.2%

Discriminating Terms
starch 42.6%, granul 2.8%, film 1.6%, flour 0.8%, starch.granules 0.7%, potato 0.7%, surfac 0.6%, nanoparticl 0.6%, carbon 0.5%, layer 0.5%, magnet 0.5%, nanotub 0.5%, particl 0.5%, crystal 0.4%, oxid 0.4%

Single Word Terms
starch 46, scan 30, structur 27, granul 25, properti 25, microscopi 24, electron 24, sem 19, surfac 18, temperatur 18, content 18, high 17, differenti 16, water 16, calorimetri 15

Double Word Terms
scanning.electron 22, electron.microscopy 21, starch.granules 19, differential.scanning 16, scanning.calorimetry 14, potato.starch 10, microscopy.sem 10, mechanical.properties 8, calorimetry.dsc 8, ray.diffraction 7, moisture.content 5, properties.starch 5, amylose.content 4, physical.properties 4, rice.starch 4

Triple Word Terms

scanning.electron.microscopy 20, differential.scanning.calorimetry 14, electron.microscopy.sem 10, scanning.calorimetry.dsc 8, small.angle.ray 3, fourier.transform.infrared 3, light.scanning.electron 3, magic.angle.spinning 3, microcrystalline.cellulose.mcc 2, sem.scanning.electron 2, cross.polarization.magic 2, polarization.magic.angle 2, solid.state.nmr 2, spinning.mas.nmr 2, dsc.differential.scanning 2

Term Cliques
17.69% content wheat amylopectin
19.05% corn content amylopectin
25.85% potato potato.starch content
18.37% flour content wheat
18.37% flour blend corn biodegrad content
24.49% granul flour corn
26.53% granul flour starch.granules gelatin wheat
26.53% granul flour starch.granules rice gelatin
34.69% starch blend corn biodegrad
41.33% starch granul corn amylopectin
37.14% starch granul gelatin wheat amylopectin
37.14% starch granul rice gelatin amylopectin
42.45% starch granul starch.granules gelatin banana
43.27% starch granul starch.granules gelatin wheat
43.27% starch granul starch.granules rice gelatin
41.50% starch granul starch.granules potato potato.starch gelatin

Sample Cluster Record Titles

From sucrose to starch granule to starch physical behaviour: a focus on rice starch

Biodegradation studies of starch based composite superabsorbents

Structure and mechanical behaviour of corn flour and starch-zein based materials in the glassy state

Determination of the molecular and structural characteristics of Okenia, Mango, and banana starches

Effect of high pressure on the structure of potato starch

A novel approach to grafting polymerization of epsilon-caprolactone onto starch granules

Pressure-induced changes in the structure of corn starches with different amylose content

Innovative plasticized. starch films modified with waterborne polyurethane from renewable resources

Molecular structure and gelatinization properties of turnip starch (Brassica rapa L.)

Cluster Metrics

Authors
blaszczak, w 5
fornal, j 4
yuryev, vp 2
xu, k 2
wang, px 2
valverde, s 2
krivandin, av 2
kiseleva, vi 2
bello-perez, la 2
zhuang, xl 1
zhou, hp 1
zhao, yf 1
zhang, z 1
zhang, wd 1
yue, ym 1

Sources
carbohydrate polymers 7
nihon reoroji gakkaishi 2
journal of thermal analysis and calorimetry 2
journal of agricultural and food chemistry 2
food hydrocolloids 2
cereal chemistry 2
carbohydrate research 2
ultramicroscopy 1
transactions of nonferrous metals society of china 1
starch-starke 1
powder technology 1
polymers & polymer composites 1
polymer testing 1
polymer international 1
polymer degradation and stability 1

Keywords
chemistry, applied 14
polymer science 11
starch 9
chemistry, organic 9
polymer science 7

food science & technology 7
starch 6
food science & technology 6
amylopectin 6
chain-length 5
x-ray diffraction 4
water 4
gelatinization 4
physicochemical properties 3
pharmacology & pharmacy 3

Publication Year

2005 43
2004 4
2006 2

Country

peoples r china 10
poland 7
france 5
usa 4
japan 4
spain 3
russia 3
india 3
england 3
south korea 2
nigeria 2
mexico 2
germany 2
brazil 2
belgium 2

Institution

polish acad sci 5
russian acad sci 3
csic 3
chinese acad sci 3
univ reims 2
tianjin univ 2
ne normal univ 2
ipn 2
zhengzhou univ 1
zhengzhou inst technol 1
xiamen univ 1
womens coll niigata 1

washington state univ 1
utkal univ 1
univ strasbourg 1 1

DataBase
science citation index 49

- ## CLUSTER 3
  Dendrimers, emphasizing poly(amidoamine) (PAMAM), porphyrin, and carbosilane dendrimers; changes over generations; and dendrimers with mesogenic terminal groups (49 Records)

(Countries: USA dominant, France, Japan, Germany. Institutions: University of Michigan, Central Michigan University, Montana State University.).

Cluster Syntax Features

Descriptive Terms
dendrim 78.6%, dendrit 2.1%, pamam 1.0%, termin 0.6%, core 0.6%, pamam.dendrimers 0.6%, gener 0.4%, aggreg 0.3%, molecul 0.3%, porphyrin 0.3%, macromolecul 0.3%, peripheri 0.2%, function 0.2%, mesogen 0.2%, carbosilan 0.2%

Discriminating Terms
dendrim 45.7%, film 1.5%, dendrit 1.1%, particl 0.6%, pamam 0.6%, temperatur 0.6%, carbon 0.5%, magnet 0.5%, surfac 0.5%, crystal 0.5%, nanotub 0.5%, layer 0.4%, nanoparticl 0.4%, electron 0.4%, structur 0.4%

Single Word Terms
dendrim 48, gener 22, surfac 21, function 19, molecul 19, core 18, dendrit 18, structur 18, termin 17, properti 14, poli 14, atom 13, form 13, molecular 12, microscopi 12

Double Word Terms
atomic.force 11, pamam.dendrimers 9, force.microscopy 9, microscopy.afm 7,

poly.amidoamine 6, terminated.dendrimers 5, amidoamine.dendrimers 5, core.shell 5, self.assembled 5, amine.terminated 4, maldi.tof 4, dendrimers.surface 4, gel.electrophoresis 4, polyacrylamide.gel 4, dendritic.molecules 4

Triple Word Terms

atomic.force.microscopy 9, force.microscopy.afm 7, poly.amidoamine.dendrimers 5, polyacrylamide.gel.electrophoresis 4, poly.amidoamine.pamam 3, transmission.electron.microscopy 3, mode.atomic.force 3, tapping.mode.atomic 3, polyamidoamine.pamam.dendrimers 3, amidoamine.pamam.dendrimers 2, acid.base.titration 2, size.exclusion.chromatography 2, air.water.interface 2, adenosine.triphosphate.atp 2, exclusion.chromatography.sec 2

Term Cliques

23.13% pamam porphyrin function
15.65% pamam aggreg porphyrin
25.00% dendrit porphyrin peripheri function
19.90% dendrit porphyrin macromolecul peripheri
46.12% dendrim gener molecul function carbosilan
38.78% dendrim termin gener molecul mesogen carbosilan
46.53% dendrim termin gener aggreg molecul
37.41% dendrim termin core molecul mesogen carbosilan
44.90% dendrim termin core aggreg molecul
44.49% dendrim pamam pamam.dendrimers gener function
39.12% dendrim pamam termin pamam.dendrimers gener aggreg
37.76% dendrim pamam termin core pamam.dendrimers aggreg
40.00% dendrim dendrit peripheri function carbosilan
44.49% dendrim dendrit molecul function carbosilan
34.01% dendrim dendrit core peripheri mesogen carbosilan
35.37% dendrim dendrit core macromolecul peripheri mesogen
37.76% dendrim dendrit core molecul mesogen carbosilan

Sample Cluster Record Titles

Direct observation of lipid bilayer disruption by poly(amidoamine) dendrimers

Towards a selective functionalization of amino-terminated dendrimers

Where organometallics and dendrimers merge: the incorporation of organometallic species into dendritic molecules

Mannose/glucose-functionalized dendrimers to investigate the predictable tunability of multivalent interactions

Organized monolayers of carbosilane dendrimers with mesogenic terminal groups

Equilibrium structure of dendrimers - Results and open questions

Functionalised polyphenylene dendrimers and their applications

Assembly and mechanical properties of phosphorus dendrimer/polyelectrolyte multilayer microcapsules

Hydrophobic dendrimer-derived nanoparticles

Cluster Metrics

Authors

baker, jr 5
shi, xy 4
islam, mt 4
mullen, k 3
kwon, ys 3
kim, c 3
balogh, lp 3
astruc, d 3
aranzaes, jr 3
singh, b 2
shin, hk 2
sharma, a 2
majoral, jp 2
lesniak, w 2
lebedeva, ov 2

Sources

langmuir 4
molecular crystals and liquid crystals 3
journal of the american chemical society 3
journal of materials chemistry 3
progress in polymer science 2
polymer 2
organic letters 2
macromolecules 2
functional molecular nanostructures 2
electrophoresis 2
angewandte chemie-international edition 2
soft matter 1
small 1
russian chemical bulletin 1
journal of polymer science part a-polymer chemistry 1

Keywords

dendrimers 25
chemistry, physical 10
polymer science 8
chemistry, multidisciplinary 8
dendritic macromolecules 7
chemistry 7
dendrimer 6
starburst dendrimers 6
chemistry, analytical 5
poly(propylene imine) dendrimers 4
chemistry, organic 4
atomic-force microscopy 4
separation 4
polymers 4
poly(amidoamine) 4

Publication Year

2005 42
2004 7

Country

usa 20
france 8
japan 6
germany 6
south korea 4
england 3
russia 2
netherlands 2
hungary 2
switzerland 1
spain 1
peoples r china 1
india 1
finland 1
czech republic 1

Institution

univ michigan 5
max planck inst polymer res 4
univ bordeaux 1 3
dong a univ 3
cent michigan univ 3
univ toulouse 3 2
univ london 2

moscow mv lomonosov state univ 2
montana state univ 2
japan sci & technol agcy 2
dendrit nanotechnol inc 2
debrecen univ med 2
cnrs 2
univ zaragoza 1
univ utrecht 1

DataBase
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- # CLUSTER 248
  Hybrid materials and composites (especially polymers and films), including polyurethane, polyimides, poly(dimethylsiloxane) (PDMS), organic-inorganic materials, and silica-based substances (273 Records)

(Countries: USA, China, followed by South Korea, Japan, Taiwan. Institutions: CAS, followed by Zhejiang University, Yonsei University, University S&T China, Tatung University. USA include VPI, University of Missouri.).

Cluster Syntax Features

Descriptive Terms
hybrid 6.3%, poli 5.7%, water 2.9%, polyurethan 2.5%, polyimid 2.0%, segment 1.9%, solvent 1.8%, organ 1.6%, inorgan 1.5%, silica 1.4%, surfac 1.3%, film 1.1%, polym 1.1%, hybrid.materials 0.8%, pdm 0.8%

Discriminating Terms
hybrid 5.1%, poli 4.0%, polyurethan 2.4%, polyimid 1.9%, segment 1.7%, water 1.4%, solvent 1.2%, inorgan 1.1%, hybrid.materials 0.8%, nanotub 0.8%, magnet 0.8%, pdm 0.7%, organic.inorganic 0.7%, organ 0.7%, nanoparticl 0.7%

Single Word Terms
poli 140, properti 111, surfac 110, structur 100, film 97, polym 96, organ 86, temperatur 85, water 83, thermal 75, materi 72, spectroscopi 71, microscopi 71, high 70, mechan 70

Double Word Terms
electron.microscopy 42, scanning.electron 38, atomic.force 34, sol.gel 34, contact.angle 32, fourier.transform 31, force.microscopy 31, organic.inorganic 31, glass.transition 30, transform.infrared 26, ray.photoelectron 25, photoelectron.spectroscopy 25, mechanical.properties 24, differential.scanning 23, scanning.calorimetry 23

Triple Word Terms
scanning.electron.microscopy 32, atomic.force.microscopy 30, fourier.transform.infrared 26, ray.photoelectron.spectroscopy 25, differential.scanning.calorimetry 23, organic.inorganic.hybrid 20, glass.transition.temperature 19, electron.microscopy.sem 17, contact.angle.measurements 15, force.microscopy.afm 15, photoelectron.spectroscopy.xps 15, transform.infrared.spectroscopy 13, poly.ethylene.glycol 13, scanning.calorimetry.dsc 11, poly.epsilon.caprolactone 11

Term Cliques
15.75% silica polym hybrid.materials pdm
26.28% solvent organ silica polym
16.58% polyimid silica polym hybrid.materials
25.73% polyimid solvent film polym
20.60% polyimid solvent silica polym
31.14% water solvent film polym
30.13% water solvent organ polym
25.12% water polyurethan segment surfac film polym pdm
33.55% poli surfac film polym pdm
29.45% poli silica surfac polym pdm
32.69% poli polyimid film polym
27.56% poli polyimid silica polym
22.49% hybrid organ silica polym hybrid.materials
18.75% hybrid organ inorgan silica hybrid.materials
31.23% hybrid poli silica polym

Sample Cluster Record Titles

Aliphatic poly(oxytetramethylene) ionenes: effect of counter-anion on the properties and morphology

Hyperbranched fluoropolymer and linear poly(ethylene glycol) based Amphiphilic crosslinked networks as efficient antifouling coatings: An insight into the surface compositions, topographies, and morphologies

Thermowetting embossing nanoimprinting of the organic-inorganic hybrid materials

[Synthesis and characterization of new poly [phenylquinoxaline(ether)imides]]

[Effect of component ratios on the performance of UV curing organic/inorganic coating]

[Unusual inorganic phase formation in ultraviolet-curable organic-inorganic hybrid films]

[Temperature dependence of free volume in pure and silica-filled poly(dimethyl siloxane) from positron lifetime and PVT experiments]

[Polyurethane foam with a negative Poisson's ratio for diabetic shoes]

[Conductive copolymers of polyaniline, polypyrrole and poly (dimethylsiloxane)]

Cluster Metrics

Authors
yang, cp 5
kingshott, p 5
turri, s 4
nie, km 4
kim, ws 4
ghanbari-siahkali, a 4
zhu, bk 3
yang, sy 3
xu, yy 3
vernet, jl 3
su, yy 3
shi, wf 3
perrin, fx 3
nguyen, vn 3
mitra, s 3

Sources
polymer 21
journal of applied polymer science 15
macromolecules 12
langmuir 10
journal of polymer science part a-polymer chemistry 9
macromolecular chemistry and physics 7
journal of materials chemistry 7
european polymer journal 7
advanced materials 6
polymers for advanced technologies 5
macromolecular symposia 5

journal of physical chemistry b 5
journal of colloid and interface science 5
macromolecular rapid communications 4
applied surface science 4

Keywords
polymer science 117
chemistry, physical 48
polymers 33
morphology 23
films 23
chemistry, multidisciplinary 21
materials science, multidisciplinary 19
nanocomposites 19
materials science, multidisciplinary 18
copolymers 17
nanocomposites 15
behavior 15
silica 14
water 13
surface 11

Publication Year
2005 242
2004 27
2006 4

Country
usa 53
peoples r china 43
south korea 27
japan 27
taiwan 23
france 17
england 16
germany 14
italy 11
canada 9
india 8
turkey 5
romania 5
poland 5
netherlands 5

Institution
chinese acad sci 11

zhejiang univ 6
yonsei univ 6
univ sci & technol china 6
tatung univ 6
riso natl lab 5
korea adv inst sci & technol 5
anhui univ 5
virginia polytech inst & state univ 4
nagoya univ 4
univ missouri 3
univ halle wittenberg 3
tsing hua univ 3
sichuan univ 3
shanghai jiao tong univ 3

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science citation index 273

- # CLUSTER 232
  Differential scanning calorimetry (DSC) to characterize materials (especially polymers), including effects of molecular weight, studies on glass transitions, and phase behavior (268 Records)

(Countries: USA, China, Japan, Germany. Institutions: CAS, University of Paris, University of Akron, Tokyo Institute of Technology. Other USA include UCSB, University of Cincinnati.).

Cluster Syntax Features

Descriptive Terms
dsc 4.3%, calorimetri 3.9%, differential.scanning 3.9%, scanning.calorimetry 3.8%, differential.scanning.calorimetry 3.8%, weight 3.1%, differenti 2.9%, molecular.weight 2.4%, liquid 2.1%, polym 2.1%, transit 1.9%, molecular 1.7%, phase 1.7%, temperatur

1.5%, glass 1.5%

Discriminating Terms
dsc 3.6%, differential.scanning 3.3%, calorimetri 3.3%, scanning.calorimetry 3.2%, differential.scanning.calorimetry 3.2%, weight 2.3%, differenti 2.1%, film 2.0%, molecular.weight 2.0%, glass.transition 1.2%, scanning.calorimetry.dsc 1.1%, calorimetry.dsc 1.1%, liquid 1.1%, nanoparticl 0.8%, melt 0.8%

Single Word Terms
scan 185, differenti 170, calorimetri 166, temperatur 161, structur 124, dsc 116, polym 113, molecular 103, transit 97, rai 96, phase 89, crystal 81, properti 79, form 77, weight 75

Double Word Terms
differential.scanning 169, scanning.calorimetry 163, calorimetry.dsc 91, molecular.weight 63, glass.transition 55, ray.diffraction 52, transition.temperature 48, angle.ray 46, liquid.crystalline 31, wide.angle 30, small.angle 28, ray.scattering 28, optical.microscopy 25, scanning.electron 23, electron.microscopy 22

Triple Word Terms
differential.scanning.calorimetry 163, scanning.calorimetry.dsc 91, glass.transition.temperature 40, wide.angle.ray 30, angle.ray.scattering 26, angle.ray.diffraction 23, fourier.transform.infrared 21, small.angle.ray 20, low.molecular.weight 19, scanning.electron.microscopy 18, gel.permeation.chromatography 16, high.molecular.weight 15, transform.infrared.spectroscopy 14, nuclear.magnetic.resonance 13, spectroscopy.differential.scanning 13

Term Cliques
40.22% polym transit molecular temperatur glass
38.62% liquid transit phase temperatur
33.81% weight polym transit molecular glass
31.27% weight molecular.weight polym molecular glass
52.53% calorimetri differential.scanning scanning.calorimetry differential.scanning.calorimetry differenti polym transit temperatur glass
52.65% dsc calorimetri differential.scanning scanning.calorimetry differential.scanning.calorimetry differenti transit temperatur glass
53.65% dsc calorimetri differential.scanning scanning.calorimetry differential.scanning.calorimetry differenti transit phase temperature

Sample Cluster Record Titles

[Synthesis and characterization of a combined main-chain/side-chain liquid-crystalline polymer exhibiting both thermotropic and lyotropic characteristics and its lyotropic phase behavior]

[Influence of molecular weight of polyethylene glycol on microvia filling by copper electroplating]

[Calorimetric study of the nematic to smectic-A and smectic-A to smectic-C phase transitions in liquid-crystal-aerosil dispersions]

[Synthesis and characterization of new polyamides based on diphenylaminoisosorbide]

[Measurement of surface glass transition temperature of amorphous cefditoren pivoxil granules by inverse gas chromatography]

[Polyester and polyamide 6 fibres thermally and hydrothermally treated - Characterization through DSC]

[State diagram of freeze-dried garlic powder by differential scanning calorimetry and cooling curve methods]

[Study of glass transition temperatures in sugar mixtures]

[Melting properties of some structured lipids native to high stearic acid soybean oil]

Cluster Metrics

Authors

lesieur, p 4
sagalowicz, l 3
ollivon, m 3
kumar, a 3
zorn, r 2
ziani, n 2
zhou, gy 2
zhao, jh 2
zhang, qz 2
zentel, r 2
zeng, j 2
yin, bl 2
yang, ys 2
yang, j 2
yang, g 2

Sources

macromolecules 19
polymer 16
journal of applied polymer science 15
journal of polymer science part a-polymer chemistry 11
langmuir 8
journal of polymer science part b-polymer physics 7
journal of thermal analysis and calorimetry 5
polymer international 4
polymer degradation and stability 4
journal of pharmaceutical sciences 4
journal of macromolecular science-physics 4
journal of chemical physics 4
thermochimica acta 3
physical review e 3
macromolecular rapid communications 3

Keywords

polymer science 105
chemistry, physical 34
polymers 31
dsc 19
behavior 19
crystallization 15
materials science, multidisciplinary 14
materials science, multidisciplinary 13
chemistry, analytical 13
water 13
morphology 13
crystallization 12
chemistry, multidisciplinary 11
transition 11
polymer science 11

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2005 244
2004 19
2006 5

Country

usa 51
peoples r china 39
japan 37
germany 32
france 22
india 16
england 10

brazil 10
south korea 9
taiwan 8
canada 8
spain 7
netherlands 7
australia 7
poland 6

Institution

chinese acad sci 9
univ paris 11 6
univ akron 6
tokyo inst technol 6
univ calif santa barbara 5
shandong univ 5
cnrs 5
univ freiburg 4
petru poni inst macromol chem 4
natl acad sci ukraine 4
max planck inst polymer res 4
hiroshima univ 4
univ nottingham 3
univ laval 3
univ cincinnati 3

DataBase

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- # CLUSTER 235

  Polymer properties, focusing on conducting polymers, polymer surfaces and films, influence of nanoparticles, and liquid crystals (694 Records)

(Countries: USA dominant, Japan, China, Germany. Institutions: Kyoto University, CAS, RAS, Max Planck Institute Polymer Research, Eindhoven University of Technology: USA include MIT, University of Massachusetts, Georgia Institute of Technology.).

Cluster Syntax Features

Descriptive Terms
polym 59.6%, poli 1.8%, polymer 0.9%, chain 0.7%, materi 0.6%, composit 0.6%, conduct 0.5%, surfac 0.5%, nanoparticl 0.5%, solvent 0.5%, solut 0.5%, film 0.4%, monom 0.4%, properti 0.3%, liquid 0.3%

Discriminating Terms
polym 50.1%, film 1.1%, poli 0.9%, nanotub 0.8%, magnet 0.7%, carbon 0.6%, quantum 0.5%, si 0.5%, deposit 0.4%, layer 0.4%, dot 0.4%, polymer 0.4%, growth 0.4%, temperatur 0.4%, electron 0.3%

Single Word Terms
polym 691, poli 250, structur 248, properti 235, surfac 205, materi 194, polymer 175, film 174, solut 171, electron 164, form 155, high 153, microscopi 149, chain 149, temperatur 139

Double Word Terms
electron.microscopy 85, scanning.electron 84, molecular.weight 60, atomic.force 51, force.microscopy 46, differential.scanning 44, scanning.calorimetry 42, ray.diffraction 40, thermal.stability 36, polymer.matrix 35, polymer.films 35, conducting.polymer 34, polymer.poly 34, polymer.chains 33, glass.transition 31

Triple Word Terms
scanning.electron.microscopy 66, atomic.force.microscopy 44, differential.scanning.calorimetry 42, ray.photoelectron.spectroscopy 27, glass.transition.temperature 25, transmission.electron.microscopy 25, electron.microscopy.sem 23, poly.methyl.methacrylate 21, fourier.transform.infrared 20, gel.permeation.chromatography 16, poly.acrylic.acid 16, photoelectron.spectroscopy.xps 13, soluble.organic.solvents 13, force.microscopy.afm 13, methyl.methacrylate.pmma 12

Term Cliques
39.68% polym polymer surfac properti liquid
35.68% polym polymer surfac nanoparticl liquid
30.21% polym polymer composit conduct solvent solut film monom properti
35.01% polym polymer materi monom properti liquid

33.45% polym polymer materi composit conduct monom properti
31.37% polym polymer chain solvent monom properti liquid
32.38% polym polymer chain solvent solut film monom properti
31.05% polym polymer chain nanoparticl solvent liquid
38.14% polym poli polymer surfac nanoparticl solut
36.73% polym poli polymer composit surfac solut film properti
32.74% polym poli polymer composit conduct solvent solut film properti
35.23% polym poli polymer chain solvent solut film properti
33.82% polym poli polymer chain nanoparticl solvent solute

Sample Cluster Record Titles

Morphological studies of holographically formed polymer dispersed ferroelectric liquid crystals using elevated temperature exposure

Probing the microenvironment of an oligo-(p-phenylene vinylene) derivative encapsulated in polymer-impregnated sol-gel silica matrix

Surfactants, polymers and their nanoparticles for personal care applications

Conjugated polymer/molten salt blends: The relationship between morphology and electrical aging

Thermal and tribological properties of fullerene-containing composite systems. Part 2. Formation of tribo-polymer films during boundary sliding friction in the presence of fullerene C-60

Polymer-supported anisotropic submicrometer-patterned electrodes for displays

Patterning a poly(3,4-ethylenedioxythiophene) thin film using a liquid crystalline network

Nanocrystals of coordination polymers

Predicting the mechanical properties of spider silk as a model nanostructured polymer

Cluster Metrics

Authors
chujo, y 8
schubert, us 7
ogoshi, t 6
marquez, m 5

lee, jh 5
huck, wts 5
zhang, jl 4
wang, y 4
wang, l 4
shimomura, m 4
pogreb, r 4
kim, sh 4
egbe, dam 4
crawford, gp 4
bormashenko, y 4

Sources

langmuir 37
polymer 32
macromolecules 30
journal of polymer science part a-polymer chemistry 30
synthetic metals 19
journal of applied polymer science 17
chemistry of materials 17
advanced materials 17
molecular crystals and liquid crystals 14
journal of physical chemistry b 12
advanced functional materials 11
journal of photopolymer science and technology 10
physical review e 9
nanotechnology 9
macromolecular rapid communications 9

Keywords

polymer science 217
chemistry, physical 125
films 76
materials science, multidisciplinary 75
materials science, multidisciplinary 73
chemistry, multidisciplinary 53
polymers 45
physics, condensed matter 39
nanoparticles 38
polymers 35
physics, applied 31
polymer 28
physics, applied 25
physics, 25
polymerization 24

Publication Year
2005 614
2004 75
2006 5

Country
usa 175
japan 79
peoples r china 76
germany 61
south korea 47
france 42
england 32
canada 28
india 26
italy 21
taiwan 19
spain 19
russia 19
australia 16
netherlands 15

Institution
kyoto univ 16
chinese acad sci 14
russian acad sci 11
max planck inst polymer res 11
eindhoven univ technol 11
mit 10
cnr 9
zhejiang univ 8
univ cambridge 8
univ massachusetts 7
tokyo inst technol 7
sci univ tokyo 7
georgia inst technol 7
cnrs 7
acad sci czech republ 7

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science citation index 694

- # CLUSTER 73
  Polymer electrolytes, emphasizing poly(ethylene oxide) (PEO) and poly(3,4-ethylenedioxythiophene) (PEDOT), conductivity studies, and application to lithium batteries (113 Records)

(Countries: USA, China, South Korea. Institutions: Korea Advanced Institute of S&T, Zhejiang University, Shanghai Jiao Tong University. USA includes University of Tulsa.).

Cluster Syntax Features

Descriptive Terms
electrolyt 21.9%, polym 9.5%, polymer.electrolytes 5.6%, peo 5.4%, polymer.electrolyte 5.3%, conduct 4.7%, ionic 4.2%, lithium 3.1%, pedot 2.8%, ionic.conductivity 1.9%, poli 1.8%, li 0.8%, ethylen 0.7%, ion 0.6%, electrochem 0.6%

Discriminating Terms
electrolyt 14.3%, polym 4.0%, polymer.electrolytes 3.9%, polymer.electrolyte 3.7%, peo 3.5%, ionic 2.5%, pedot 1.9%, conduct 1.8%, lithium 1.8%, ionic.conductivity 1.3%, film 0.9%, surfac 0.6%, structur 0.6%, magnet 0.6%, poli 0.6%

Single Word Terms
polym 97, electrolyt 88, conduct 87, poli 70, ionic 66, oxid 49, ion 46, film 46, lithium 46, electrochem 46, temperatur 43, ethylen 42, composit 41, peo 35, salt 35

Double Word Terms
polymer.electrolyte 47, polymer.electrolytes 46, ionic.conductivity 42, poly.ethylene 32, ethylene.oxide 29, room.temperature 23, oxide.peo 23, solid.polymer 19, ray.diffraction 17, composite.polymer 16, solid.state 15, poly.ethylenedioxythiophene 15, transference.number 14, scanning.electron 14, differential.scanning 13

Triple Word Terms
poly.ethylene.oxide 24, ethylene.oxide.peo 15, differential.scanning.calorimetry 12, ray.diffraction.xrd 11, solid.polymer.electrolytes 11, scanning.electron.microscopy 10, composite.polymer.electrolyte 10, poly.ethylenedioxythiophene.pedot 9,

solid.polymer.electrolyte 9, poly.ethylene.glycol 9, ionic.conductivity.lithium 8, polyethylene.oxide.peo 8, composite.polymer.electrolytes 8, poly.vinylidene.fluoride 7, peo.polymer.electrolytes 6

Term Cliques

51.62% conduct pedot poli
51.25% electrolyt polym peo polymer.electrolyte conduct ionic lithium poli li ethylen ion electrochem
48.54% electrolyt polym polymer.electrolytes peo polymer.electrolyte conduct ionic lithium ionic.conductivity li ethylen ion electrochem

Sample Cluster Record Titles

Study on ionic transport mechanism and interactions between salt and polymer chain in PAN based solid polymer electrolytes containing LiCF3SO3

On the mechanism of conductivity enhancement in poly (3,4-ethylenedioxythiophene): poly(styrene sulfonate) film through solvent treatment

NMR studies of nanoscale organization and dynamics in polymer electrolytes

Effect of nanocrystalline materials on ionic interactions in polymer electrolytes

Possible use of methylbenzenes as electrolyte additives for improving the overcharge tolerances of Li-ion batteries

Nanoscale lithium ion conducting polyethylene oxide with self-attached insulating layers

Morphological, rheological and electrochemical studies of Poly(ethylene oxide) electrolytes containing fumed silica nanoparticles

Polymer electrolytes confined in nanopores: using water as a means to explore the interfacial impedance at the nanoscale

Physical and ionic transport studies on poly(ethylene oxide)-NaNO3 polymer electrolyte system

Cluster Metrics

Authors

xi, jy 4

tang, xz 4
passerini, s 4
shin, jh 3
peled, e 3
officer, dl 3
macfarlane, dr 3
kovarsky, r 3
golodnitsky, d 3
best, as 3
appetecchi, gb 3
zhu, wt 2
zhao, y 2
yang, cm 2
xie, jb 2

Sources

solid state ionics 13
electrochimica acta 12
journal of the electrochemical society 6
polymer 5
synthetic metals 4
materials chemistry and physics 4
macromolecules 4
journal of physical chemistry b 4
electrochemical and solid state letters 4
journal of electroanalytical chemistry 3
ionics 3
chemistry of materials 3
chemical communications 3
polymer-korea 2
materials letters 2

Keywords

chemistry, physical 27
polymer science 22
physics, condensed matter 22
materials science, multidisciplinary 20
electrochemistry 18
electrochemistry 17
conductivity 15
poly(ethylene oxide) 14
ionic conductivity 13
batteries 13
chemistry, multidisciplinary 12
polymer electrolyte 10
ionic-conductivity 10

transport 9
lithium 9

Publication Year
2005 101
2004 10
2006 2

Country
usa 21
peoples r china 20
south korea 15
italy 10
india 10
japan 8
germany 8
taiwan 6
australia 6
poland 4
netherlands 4
france 4
canada 4
israel 3
switzerland 2

Institution
korea adv inst sci & technol 5
zhejiang univ 4
shanghai jiao tong univ 4
tel aviv univ 3
monash univ 3
korea univ 3
fudan univ 3
delft univ technol 3
warsaw univ 2
univ wollongong 2
univ tulsa 2
univ padua 2
univ montreal 2
univ cambridge 2
tsing hua univ 2

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science citation index 113

- ## CLUSTER 15

  Polyaniline (PANI) focusing on dodecylbenzene sulfonic acid doped polyaniline (PANI-DBSA), synthesis of conducting PANI materials, and nanofibers of PANI (67 Records)

(Countries: China, USA, India. Institutions: Drexel University, Xinjiang University, National Central University, Jilin University. Other USA include University of Texas, UCLA.).

Cluster Syntax Features

Descriptive Terms

pani 46.4%, polyanilin 24.8%, dbsa 2.1%, conduct 1.7%, anilin 1.6%, polyaniline.pani 1.2%, pani.dbsa 0.9%, polymer 0.8%, acid 0.6%, composit 0.6%, pan 0.5%, dope 0.4%, nanofib 0.3%, blend 0.3%, paa 0.3%

Discriminating Terms

pani 28.7%, polyanilin 15.1%, dbsa 1.3%, film 1.1%, anilin 1.0%, surfac 0.8%, polyaniline.pani 0.8%, pani.dbsa 0.6%, carbon 0.5%, magnet 0.5%, nanoparticl 0.5%, nanotub 0.5%, structur 0.5%, crystal 0.5%, layer 0.5%

Single Word Terms

polyanilin 65, pani 48, conduct 43, acid 36, polymer 34, oxid 29, polym 29, chemic 27, structur 26, electron 26, anilin 25, synthesi 24, synthes 24, properti 23, scan 21

Double Word Terms

polyaniline.pani 35, scanning.electron 17, electron.microscopy 16, ray.diffraction 11, sulfonic.acid 10, polymerization.aniline 8, transform.infrared 7, fourier.transform 7, synthesis.polyaniline 7, pani.poly 6, conductivity.pani 6, polyaniline.poly 6, pani.dbsa 6, conducting.polyaniline 6, oxidative.polymerization 6

Triple Word Terms

scanning.electron.microscopy 12, fourier.transform.infrared 7, conducting.polyaniline.pani 4, chemical.oxidative.polymerization 4, electron.microscopy.sem 4, spectra.ray.diffraction 4, oxidative.polymerization.aniline 4, toluene.sulfonic.acid 4, acid.doped.polyaniline 4, doped.polyaniline.pani 4, ray.diffraction.patterns 4, dodecylbenzene.sulfonic.acid 4, scanning.electron.microscope 4, poly.acrylic.acid 4, acrylic.acid.paa 4

Term Cliques

48.51% polyanilin polyaniline.pani polymer acid dope nanofib
50.00% polyanilin anilin polyaniline.pani polymer acid nanofib
50.50% polyanilin conduct polymer acid dope nanofib
33.21% polyanilin dbsa conduct pani.dbsa composit pan dope blend
36.01% polyanilin dbsa conduct pani.dbsa acid pan dope blend
55.22% pani polyanilin polyaniline.pani polymer composit dope
58.96% pani polyanilin polyaniline.pani polymer acid dope
49.50% pani polyanilin anilin polyaniline.pani composit paa
53.23% pani polyanilin anilin polyaniline.pani acid paa
56.72% pani polyanilin anilin polyaniline.pani polymer composit
60.45% pani polyanilin anilin polyaniline.pani polymer acid
57.21% pani polyanilin conduct polymer composit dope
60.95% pani polyanilin conduct polymer acid dope
39.55% pani polyanilin dbsa polyaniline.pani pani.dbsa composit dope blend
42.35% pani polyanilin dbsa polyaniline.pani pani.dbsa acid dope blend
41.04% pani polyanilin dbsa conduct pani.dbsa composit dope blend
43.84% pani polyanilin dbsa conduct pani.dbsa acid dope blend

Sample Cluster Record Titles

Nanofibers of self-doped polyaniline

Formation of polyaniline nanorod/liquid crystalline epoxy composite nanowires using a temperature-gradient method

Structural and conductivity changes during the pyrolysis of polyaniline base

Absolute molecular weight of polyaniline

Conductive composites of polyaniline and polypyrrole with MoO3

Polystyrene/polyaniline nanoblends for sensing of aliphatic alcohols

Enhanced photo-luminescence effect of nano-CdS in the nano-CdS/PANI composite films by PANI

Absorbance behavior of polyaniline-poly(styrenesulfonic acid) complexes and tungsten oxide

Composite of polyaniline containing iron oxides

Cluster Metrics

Authors

wei, y 4
zhang, wj 3
lu, xf 3
zhong, wb 2
yang, ys 2
yang, wt 2
yang, sm 2
yang, sl 2
xiao-gang, z 2
sathyanarayana, dn 2
reynaud, s 2
pan, w 2
lin, ds 2
li, g 2
kaner, rb 2

Sources

synthetic metals 4
polymer 4
journal of applied polymer science 4
sensors and actuators b-chemical 3
materials letters 3
macromolecular rapid communications 3
chemistry of materials 3
thin solid films 2
nanotechnology 2
materials chemistry and physics 2
journal of polymer science part b-polymer physics 2
electrochimica acta 2
chemical journal of chinese universities-chinese 2
advanced functional materials 2
reviews on advanced materials science 1

Keywords

polymer science 26
polyaniline 21
polyaniline 20
films 18
materials science, multidisciplinary 14
polymerization 12
polymers 11
nanofibers 11
aniline 11
chemistry, physical 10
materials science, multidisciplinary 9
conducting polyaniline 8
chemistry, multidisciplinary 8
conductivity 8
polypyrrole 7

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2005 61
2004 4
2006 2

Country

peoples r china 21
usa 15
india 9
south korea 7
taiwan 5
japan 3
france 3
russia 2
germany 2
argentina 2
vietnam 1
spain 1
poland 1
israel 1
iran 1

Institution

drexel univ 4
xinjiang univ 3
natl cent univ 3
jilin univ 3
univ texas 2
univ sci & technol china 2
univ calif los angeles 2

ne normal univ 2
moscow mv lomonosov state univ 2
minist educ 2
lpcp 2
indian inst sci 2
donghua univ 2
chinese acad sci 2
beijing univ chem technol 2

DataBase
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- ## CLUSTER 114
  Polymer blends (especially poly(vinyl chloride) (PVC), poly(vinyl alcohol) (PVA), and poly(styrene) blends), emphasizing morphology, miscibility, melt blending, and shear studies (150 Records)

(Countries: China, USA, Japan. Institutions: CAS, Sichuan University, Tsing Hua University, CNR.).

Cluster Syntax Features

Descriptive Terms
blend 58.0%, poli 1.9%, polym 1.8%, pvc 1.6%, morpholog 1.1%, miscibl 0.9%, pva 0.8%, phase 0.8%, polymer.blends 0.8%, melt 0.5%, film 0.5%, vinyl 0.5%, poly.vinyl 0.5%, shear 0.4%, polystyren 0.4%

Discriminating Terms
blend 39.8%, pvc 1.1%, film 0.7%, poli 0.6%, miscibl 0.6%, nanotub 0.6%, carbon 0.6%, magnet 0.6%, nanoparticl 0.6%, layer 0.6%, polymer.blends 0.5%, pva 0.5%, deposit 0.5%, particl 0.5%, surfac 0.5%

Single Word Terms

blend 137, poli 89, polym 83, scan 77, morpholog 72, microscopi 67, phase 67, properti 61, temperatur 61, structur 57, mechan 51, electron 51, differenti 50, composit 50, film 49

Double Word Terms
differential.scanning 50, scanning.calorimetry 48, electron.microscopy 38, polymer.blends 34, scanning.electron 33, poly.vinyl 28, calorimetry.dsc 25, force.microscopy 24, ray.diffraction 24, atomic.force 21, phase.separation 19, microscopy.sem 18, dynamic.mechanical 18, molecular.weight 17, mechanical.properties 17

Triple Word Terms
differential.scanning.calorimetry 48, scanning.electron.microscopy 27, scanning.calorimetry.dsc 25, atomic.force.microscopy 20, electron.microscopy.sem 17, fourier.transform.infrared 15, glass.transition.temperature 14, wide.angle.ray 14, angle.ray.diffraction 13, transmission.electron.microscopy 11, poly.vinyl.chloride 10, force.microscopy.afm 10, poly.vinyl.alcohol 10, electron.microscopy.tem 9, transform.infrared.spectroscopy 8

Term Cliques
14.17% pva vinyl poly.vinyl shear
14.00% pva melt shear
13.78% pvc pva melt
24.78% polym miscibl polymer.blends vinyl poly.vinyl shear
29.67% polym pvc miscibl phase polymer.blends melt
34.11% polym pvc morpholog phase polymer.blends melt
27.87% poli pva film vinyl poly.vinyl
23.07% poli pvc pva vinyl poly.vinyl
29.62% poli polym pvc miscibl polymer.blends vinyl poly.vinyl
35.33% poli polym pvc miscibl phase polymer.blends
39.78% poli polym pvc morpholog phase polymer.blends
35.42% blend polym miscibl phase polymer.blends melt shear polystyren
42.95% blend polym morpholog phase polymer.blends melt polystyren
55.20% blend poli morpholog phase film
44.00% blend poli polym miscibl phase polymer.blends polystyren
47.81% blend poli polym morpholog phase polymer.blends polystyrene

Sample Cluster Record Titles

Effect of fillers on the phase stability of binary polymer blends: A dynamic shear rheology study

Compatibility effect on the thermal degradation behaviour of polypropylene blends with polyamide 6, ethylene propylene diene copolymer and polyurethane

Poly(ethylene oxide) and its blends with sodium alginate

Formation of nanoparticles during melt mixing a thermotropic liquid crystalline polyester and sulfonated polystyrene ionomers: Morphology and origin of formation

Studies on the morphology and thermal behaviour of polystyrene/polybutadiene blends

Nanoimprint and lift-off process using poly(vinyl alcohol)

Linear viscoelastic characteristics of poly(trimethylene terephthalate)/polycarbonate blends in the melt state

Correlation between solid-state structures and enzymatic degradability of cocrystallized blends

Bioartificial materials based on blends of dextran and poly(vinyl alcohol-co-acrylic acid)

Cluster Metrics

Authors
tol, rt 3
mathot, vbf 3
groeninckx, g 3
zhang, jm 2
yoo, yj 2
yang, y 2
yamamoto, k 2
wu, g 2
won, jc 2
white, jr 2
weng, lt 2
wang, y 2
tsen, wc 2
thomas, s 2
shu, yc 2

Sources
polymer 18
journal of applied polymer science 18
macromolecules 9
langmuir 5
european polymer journal 5
polymer engineering and science 4
journal of polymer science part b-polymer physics 4
journal of materials chemistry 4

polymer degradation and stability 3
journal of physical chemistry b 3
synthetic metals 2
polymers for advanced technologies 2
polymer-plastics technology and engineering 2
polymer-korea 2
polymer testing 2

Keywords

polymer science 86
morphology 35
blends 20
blends 17
behavior 17
chemistry, physical 15
polymer science 14
miscibility 13
crystallization 13
polymer blends 11
materials science, multidisciplinary 10
polystyrene 10
degradation 10
composites 10
mechanical-properties 9

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Country

peoples r china 33
usa 25
japan 22
south korea 9
italy 8
canada 8
poland 7
india 7
turkey 5
germany 5
france 5
england 5
brazil 5
belgium 5
iran 4

Institution
chinese acad sci 9
sichuan univ 7
tsing hua univ 4
cnr 4
tokyo inst technol 3
natl univ singapore 3
kyoto univ 3
catholic univ louvain 3
cairo univ 3
yamagata univ 2
wuhan univ 2
univ tokyo 2
univ sci & technol china 2
univ pisa 2
univ newcastle upon tyne 2

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science citation index 150

- CLUSTER 84
  Rubber and other elastomeric blends, emphasizing nitrile-butadiene rubber (NBR), ethylene-propylene diene terpolymer (EPDM) blends, rubber/silica nanocomposites, nano-calcium carbonate (CaCO3) composites, and measurement/comparison of mechanical properties (117 Records)

(Countries: China dominant, India, USA. Institutions: Indian Institute of Technology, Beijing University of Chemical Technology, CAS, University Sains Malaysia. USA includes SUNY Stony Brook.).

Cluster Syntax Features

Descriptive Terms

rubber 36.2%, blend 9.0%, caco3 3.2%, nbr 2.7%, nano.caco3 2.0%, natural.rubber 1.4%, nylon 1.3%, silica 1.3%, butadien 1.2%, filler 1.1%, composit 1.0%, epdm 0.9%, butadiene.rubber 0.9%, elastom 0.9%, mechan 0.8%

Discriminating Terms

rubber 23.8%, blend 5.3%, caco3 2.1%, film 1.8%, nbr 1.8%, nano.caco3 1.3%, natural.rubber 0.9%, nylon 0.9%, butadien 0.7%, filler 0.6%, butadiene.rubber 0.6%, epdm 0.6%, nanoparticl 0.6%, magnet 0.6%, nanotub 0.5%

Single Word Terms

properti 88, rubber 81, mechan 78, microscopi 53, scan 52, electron 52, matrix 51, blend 50, strength 49, composit 49, particl 47, dispers 45, temperatur 44, structur 43, morpholog 42

Double Word Terms

mechanical.properties 50, electron.microscopy 44, scanning.electron 39, butadiene.rubber 25, tensile.strength 24, dynamic.mechanical 20, ray.diffraction 20, differential.scanning 18, natural.rubber 18, microscopy.sem 17, transmission.electron 17, scanning.calorimetry 17, styrene.butadiene 16, elongation.break 15, storage.modulus 14

Triple Word Terms

scanning.electron.microscopy 33, electron.microscopy.sem 17, differential.scanning.calorimetry 17, transmission.electron.microscopy 14, styrene.butadiene.rubber 12, scanning.calorimetry.dsc 11, butadiene.rubber.nbr 11, ethylene.propylene.diene 10, acrylonitrile.butadiene.rubber 10, glass.transition.temperature 9, dynamic.mechanical.properties 9, atomic.force.microscopy 9, butadiene.rubber.sbr 9, strength.elongation.break 8, electron.microscopy.tem 8

Term Cliques

30.77% silica filler composit butadiene.rubber elastom mechan
27.24% caco3 nano.caco3 butadien filler composit butadiene.rubber elastom mechan
38.12% blend composit butadiene.rubber elastom mechan
28.21% blend composit epdm elastom
39.03% blend nylon mechan
20.23% blend nylon epdm
34.19% rubber natural.rubber composit epdm
38.32% rubber natural.rubber silica filler composit mechan
33.97% rubber nbr composit epdm
37.36% rubber nbr butadien filler composit butadiene.rubber mechan
35.78% rubber nbr silica filler composit butadiene.rubber mechan

Sample Cluster Record Titles

[Water-based chlorination treatment of SBS rubber soles to improve their adhesion to waterborne polyurethane adhesives in the footwear industry]

[Microporous polyvinyl chloride: novel reactor for PVC/CaCO3 nanocomposites]

[Effect of high-energy vibromilling on interfacial interaction and mechanical properties of PVC/nano-CaCO3 composites]

[Maleated natural rubber as a coupling agent for paper sludge filled natural rubber composites]

[Ultrafine full-vulcanized powdered rubbers/PVC compounds with higher toughness and higher heat resistance]

[Solvent freezing point depression as a new tool to evaluate rubber compound properties]

[Structure factors of dispersible units of carbon black filler in rubbers]

[Probing the properties of particle-matrix interphase in reactive rubber-grafted polybenzoxazine resins by atomic force microscopy]

[Impact of treatment on the properties of rubber]

Cluster Metrics

Authors

zhang, lq 8
bhowmick, ak 6
liu, l 5
yang, c 4
tian, m 4
mishra, s 4
lu, yl 4
ismail, h 4
de sarkar, m 4
bandyopadhyay, a 4
zhang, w 3
pandey, kn 3
nah, c 3
mathur, gn 3
martin-martinez, jm 3

Sources

journal of applied polymer science 17

polymer engineering and science 7
journal of polymer science part b-polymer physics 6
rubber chemistry and technology 5
polymer international 4
polymer 4
acta polymerica sinica 4
polymers & polymer composites 3
polymer journal 3
macromolecules 3
macromolecular materials and engineering 3
kgk-kautschuk gummi kunststoffe 3
polymer-plastics technology and engineering 2
journal of materials science & technology 2
journal of materials science 2

Keywords
polymer science 64
morphology 22
polymer science 20
nanocomposites 16
materials science, multidisciplinary 13
rubber 13
mechanical-properties 13
polypropylene 12
polypropylene 11
engineering, chemical 11
mechanical properties 10
elastomers 10
composites 10
blends 10
composites 9

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Country
peoples r china 35
india 18
usa 11
malaysia 7
japan 7
germany 7
south korea 6
france 5

taiwan 4
spain 4
poland 3
canada 3
ukraine 2
thailand 2
serbia monteneg 2

Institution
indian inst technol 9
beijing univ chem technol 8
chinese acad sci 7
univ sains malaysia 6
n maharashtra univ 4
univ kaiserslautern 3
univ alicante 3
suny stony brook 3
sichuan univ 3
kyoto univ 3
kyoto inst technol 3
chonbuk natl univ 3
zhongshan univ 2
vinca inst nucl sci 2
univ grenoble 1 2

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science citation index 117

- # CLUSTER 206
  Strengthening and improvement of mechanical and tensile properties of nanocomposites (especially polypropylene) by using filler and reinforcing with fibers (237 Records)

(Countries: China, USA. Institutions: University of Wisconsin, SUNY Stony Brook, Michigan State University, University of Cincinnati.).

Cluster Syntax Features

Descriptive Terms
composit 10.3%, filler 7.0%, fibr 7.0%, reinforc 5.5%, strength 3.1%, fiber 2.8%, tensil 2.8%, mechanical.properties 2.4%, matrix 2.2%, mechan 2.1%, properti 2.1%, modulu 1.6%, polypropylen 1.5%, nanocomposit 1.4%, ipp 1.1%

Discriminating Terms
filler 5.5%, fibr 5.3%, composit 5.1%, reinforc 4.2%, film 1.9%, tensil 1.9%, strength 1.8%, mechanical.properties 1.6%, fiber 1.5%, polypropylen 1.1%, matrix 1.1%, modulu 1.0%, ipp 0.9%, magnet 0.7%, nanotub 0.7%

Single Word Terms
properti 166, composit 163, mechan 143, matrix 111, strength 110, surfac 101, scan 94, electron 92, reinforc 86, tensil 85, modulu 80, microscopi 78, sem 73, filler 70, test 69

Double Word Terms
mechanical.properties 93, scanning.electron 82, electron.microscopy 63, tensile.strength 48, microscopy.sem 28, ray.diffraction 23, dynamic.mechanical 22, electron.microscope 22, young.modulus 21, impact.strength 20, tensile.properties 18, differential.scanning 17, fiber.reinforced 17, elastic.modulus 16, properties.composites 15

Triple Word Terms
scanning.electron.microscopy 58, electron.microscopy.sem 27, scanning.electron.microscope 20, electron.microscope.sem 15, differential.scanning.calorimetry 14, atomic.force.microscopy 12, wide.angle.ray 11, scanning.calorimetry.dsc 10, isotactic.polypropylene.ipp 9, silane.coupling.agent 8, angle.ray.diffraction 8, composites.mechanical.properties 8, tensile.strength.elongation 8, modulus.tensile.strength 8, mechanical.properties.composites 8

Term Cliques
23.49% matrix polypropylen ipp
40.08% strength tensil mechanical.properties matrix mechan modulu polypropylen
31.65% fibr strength matrix polypropylen
37.97% filler mechanical.properties matrix mechan modulu polypropylen
48.62% composit reinforc strength tensil mechanical.properties matrix mechan properti modulu
43.41% composit reinforc strength fiber tensil matrix mechan modulu
47.26% composit fibr reinforc strength matrix properti
45.71% composit filler reinforc mechanical.properties matrix mechan properti modulu nanocomposit

Sample Cluster Record Titles

Long fibre reinforced ceramics with active fillers and a modified intra-matrix bond based on the LPI process

Friction and wear properties of UHMWPE composites reinforced with carbon fiber

Study on preparation of polymer composites based on polypropylene reinforced by jute fibers

Fibre-matrix adhesion in glass-fibre reinforced polyamide-6 silicate nanocomposites

Bulk and surface composition of ECF bleached hardwood kraft pulp fibres

Influence of fibre surface oxidation treatment on mechanical interfacial properties of carbon fibre/polyarylacetylene composites

Polypropylene/SiO2 nanocomposites with improved mechanical properties

Improvement of interfacial adhesion between wood and polypropylene in wood-polypropylene composites

Integrated compounding and injection moulding of short fibre reinforced composites

Cluster Metrics

Authors

turng, ls 4
hsiao, bs 4
zhou, sx 3
wu, lm 3
vlasveld, dpn 3
somani, rh 3
picken, sj 3
marom, g 3
huang, y 3
ha, cs 3
errico, me 3
dufresne, a 3
drzal, lt 3
bersee, hen 3
avila-orta, ca 3

Sources

polymer 16
journal of applied polymer science 16
journal of materials science 10
polymer engineering and science 8
composites science and technology 8
materials science and engineering a-structural materials properties microstructure and processing 7
wear 6
polymer degradation and stability 6
macromolecular materials and engineering 6
composites part a-applied science and manufacturing 5
polymer testing 4
materials letters 4
macromolecular symposia 4
journal of polymers and the environment 4
european polymer journal 4

Keywords
polymer science 68
materials science, multidisciplinary 44
polymer science 38
composites 35
morphology 29
mechanical-properties 29
behavior 29
nanocomposites 27
mechanical properties 26
composites 25
materials science, composites 23
materials science, multidisciplinary 20
nanocomposites 18
mechanical-properties 16
silica 14

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2005 207
2004 25
2006 4
2003 1

Country
peoples r china 55
usa 45
south korea 18
germany 15
india 12

france 11
england 11
japan 10
italy 9
taiwan 7
singapore 7
spain 6
portugal 6
netherlands 6
australia 5

Institution
chinese acad sci 7
univ wisconsin 5
suny stony brook 5
sichuan univ 5
indian inst technol 5
harbin inst technol 5
fudan univ 5
cnr 5
univ sains malaysia 4
pusan natl univ 4
natl univ singapore 4
michigan state univ 4
zhejiang univ 3
univ twente 3
univ cincinnati 3

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science citation index 237

- # CLUSTER 35
  Investigation of resin-dentin interfaces and other studies on adhesive resin cements, including determination of bond strength and factors affecting self-etching primer bonding systems (85 Records)

(Countries: USA, Japan, China. Institutions: Tokyo Medical and Dental University, Medical College of Georgia, University of Hong Kong, University of Turku. Other USA includes UCSF.).

Cluster Syntax Features

Descriptive Terms
resin 24.6%, dentin 21.0%, bond 5.5%, strength 4.0%, bond.strength 3.8%, adhes 3.6%, cure 3.2%, cement 2.1%, specimen 1.4%, shear.bond 0.7%, teeth 0.6%, enamel 0.6%, primer 0.6%, mpa 0.6%, etch 0.5%

Discriminating Terms
resin 14.9%, dentin 13.1%, bond.strength 2.3%, bond 2.3%, strength 1.9%, cure 1.8%, film 1.8%, adhes 1.7%, cement 1.2%, specimen 0.7%, structur 0.6%, magnet 0.5%, carbon 0.5%, nanotub 0.5%, nanoparticl 0.5%

Single Word Terms
resin 70, surfac 60, strength 56, bond 52, sem 46, adhes 42, electron 41, test 40, specimen 40, scan 38, composit 35, two 34, dentin 34, layer 31, water 28

Double Word Terms
scanning.electron 33, bond.strength 31, electron.microscopy 24, bond.strengths 16, microtensile.bond 13, shear.bond 13, electron.microscope 12, self.etching 11, extracted.human 11, resin.composite 11, adhesive.resin 10, dentin.surfaces 10, mechanical.properties 9, hybrid.layer 9, microscopy.sem 9

Triple Word Terms
scanning.electron.microscopy 18, scanning.electron.microscope 11, microtensile.bond.strength 11, shear.bond.strength 10, electron.microscopy.sem 9, electron.microscope.sem 8, transmission.electron.microscopy 7, shear.bond.strengths 6, human.third.molars 6, differential.scanning.calorimetry 5, glass.ionomer.cements 5, glass.ionomer.cement 5, 600.grit.sic 5, self.etching.primer 5, bond.strength.mpa 5

Term Cliques
40.13% dentin bond strength bond.strength adhes specimen teeth enamel etch
39.22% dentin bond strength bond.strength adhes specimen shear.bond enamel etch

43.53% resin strength cure teeth primer
45.65% resin strength cure cement teeth
42.57% resin dentin bond strength bond.strength adhes specimen teeth primer mpa etch
41.82% resin dentin bond strength bond.strength adhes specimen shear.bond primer mpa etch
43.53% resin dentin bond strength bond.strength adhes cement specimen teeth mpa etch
42.78% resin dentin bond strength bond.strength adhes cement specimen shear.bond mpa etch

Sample Cluster Record Titles

Water concentration in self-etching primers affects their aggressiveness and bonding efficacy to dentin

Effects of multiple coatings of two all-in-one adhesives on dentin bonding

Comparison of depth of dentin etching and resin infiltration with single-step adhesive systems

The shear bond strength of bidirectional and random-oriented fibre-reinforced composite to tooth structure

Influence of ceramic thickness and polymerization mode of a resin luting agent on early bond strength and durability with a lithium disilicate-based ceramic system

The effect of chemical surface treatments of different denture base resins on the shear bond strength of denture repair

Preparation and characterization of polyester/silica nanocomposite resins

Evaluation of the adhesion of fiber posts to intraradicular dentin

Effect of elastomeric nanoparticles on properties of phenolic resin

Cluster Metrics

Authors
tagami, j 8
tay, fr 7
pashley, dh 7
lassila, lvj 6
vallittu, pk 5
sidhu, sk 3
nikaido, t 3

nakajima, m 3
matinlinna, jp 3
king, nm 3
foxton, rm 3
zhou, sx 2
zhang, xh 2
yiu, cky 2
yap, auj 2

Sources

operative dentistry 10
journal of prosthetic dentistry 6
journal of oral rehabilitation 5
journal of dentistry 5
dental materials 5
journal of dental research 4
journal of biomedical materials research part b-applied biomaterials 4
polymer engineering and science 3
journal of adhesive dentistry 3
dental materials journal 3
polymer degradation and stability 2
polimery 2
american journal of dentistry 2
acta polymerica sinica 2
soldering & surface mount technology 1

Keywords

dentistry, oral surgery & medicine 48
materials science, biomaterials 13
polymer science 12
strength 11
enamel 9
dentin 8
composite 7
adhesion 7
engineering, biomedical 6
systems 6
engineering, chemical 5
adhesion 5
water 5
teeth 5
resin 5

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Country
usa 24
japan 18
peoples r china 17
england 8
turkey 7
finland 6
brazil 6
thailand 4
south korea 4
netherlands 4
spain 3
singapore 3
poland 3
canada 3
taiwan 2

Institution
tokyo med & dent univ 9
med coll georgia 8
univ hong kong 7
univ turku 6
natl univ singapore 3
nagasaki univ 3
vivoxid ltd 2
univ newcastle upon tyne 2
univ london kings coll 2
univ calif san francisco 2
univ british columbia 2
selcuk univ 2
peking univ 2
ondokuz mayis univ 2
nihon univ 2

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science citation index 85

- CLUSTER 38
  Epoxy resins and composites, including polyhedral oligomeric silsesquioxane (POSS) composites and reinforced epoxy resins, as well as bisphenol-A glycidol ether (DGEBA) epoxy resin (129 Records)

(Countries: China dominant, USA, Italy, Germany. Institutions: Shanghai Jiao Tong University, University S&T China, Iran Polymer and Petrochemical Institute. USA include Georgia Institute of Technology, Case Western Reserve University, Michigan State University.).

Cluster Syntax Features

Descriptive Terms
epoxi 46.3%, resin 7.8%, poss 7.3%, cure 5.5%, epoxy.resin 5.1%, nanocomposit 1.6%, hybrid 1.4%, composit 0.8%, dgeba 0.5%, nanoclai 0.4%, epoxy.composites 0.4%, polyhedral.oligomeric 0.4%, silica 0.4%, silsesquioxan 0.4%, polyhedr 0.3%

Discriminating Terms
epoxi 29.3%, resin 4.7%, poss 4.7%, cure 3.3%, epoxy.resin 3.2%, film 1.8%, surfac 0.6%, magnet 0.5%, nanotub 0.5%, layer 0.5%, hybrid 0.5%, deposit 0.5%, structur 0.5%, oxid 0.4%, crystal 0.4%

Single Word Terms
epoxi 111, resin 79, properti 78, mechan 67, composit 58, cure 57, nanocomposit 51, thermal 50, structur 48, scan 47, temperatur 47, matrix 44, surfac 44, microscopi 44, electron 43

Double Word Terms
epoxy.resin 57, mechanical.properties 33, electron.microscopy 32, scanning.electron 29, glass.transition 29, microscopy.sem 21, epoxy.matrix 20, polyhedral.oligomeric 20, transition.temperature 20, epoxy.composites 20, dynamic.mechanical 19, sol.gel 17,

differential.scanning 17, scanning.calorimetry 17, oligomeric.silsesquioxane 15

Triple Word Terms
scanning.electron.microscopy 23, glass.transition.temperature 20, electron.microscopy.sem 18, differential.scanning.calorimetry 17, polyhedral.oligomeric.silsesquioxane 15, diglycidyl.ether.bisphenol 11, scanning.calorimetry.dsc 11, transmission.electron.microscopy 10, oligomeric.silsesquioxane.poss 10, atomic.force.microscopy 8, electron.microscopy.tem 8, ether.bisphenol.dgeba 8, organic.inorganic.hybrid 7, force.microscopy.afm 7, glass.transition.temperatures 7

Term Cliques
31.59% cure nanocomposit hybrid silica
13.95% poss nanoclai polyhedral.oligomeric silsesquioxan polyhedr
15.81% poss dgeba polyhedral.oligomeric silsesquioxan polyhedr
22.09% poss nanocomposit hybrid polyhedral.oligomeric silsesquioxan polyhedr
37.79% epoxi composit nanoclai epoxy.composites
51.55% epoxi resin cure silica
49.92% epoxi resin cure epoxy.resin dgeba

Sample Cluster Record Titles

Studying on the curing kinetics of a DGEBA/EMI-2,4/nano-sized carborundum system with two curing kinetic methods

Epoxy-silica nanocomposites: Preparation, experimental characterization, and modeling

Synthesis of functionalized polyhedral oligomeric silsesquioxane (POSS) macromers by microwave assisted 1,3-dipolar cycloaddition

Thermodynamic and transport properties of polyhedral oligomeric sislesquioxanes in poly(dimethylsiloxane)

The effect of surface treatment of F-12 aramid fibers with rare earths on the interlaminar shear strength of aramid/epoxy composites

Toughness of syndiotactic polystyrene/epoxy polymer blends: microstructure and toughening mechanisms

Polypropylene-polyhedral oligomeric silsesquioxanes (POSS) nanocomposites

Mechanistic kinetic model of an epoxy resin cured with a mixture of amines of different functionalities

Time-temperature and time-irradiation intensity superposition for photopolymerization of an epoxy based resin

Cluster Metrics

Authors
he, ps 5
zheng, sx 4
schiraldi, da 4
rahimi, a 4
cheng, yy 4
zhang, mq 3
sangermano, m 3
rong, mz 3
priola, a 3
mondragon, i 3
malucelli, g 3
liu, yl 3
li, y 3
innocenzi, p 3
friedrich, k 3

Sources
polymer 19
journal of applied polymer science 11
progress in organic coatings 4
polymers & polymer composites 4
polymer international 4
polymer composites 4
macromolecules 3
macromolecular rapid communications 3
journal of polymer science part a-polymer chemistry 3
journal of materials science 3
iranian polymer journal 3
composites science and technology 3
composites part a-applied science and manufacturing 3
wear 2
polymer-plastics technology and engineering 2

Keywords
polymer science 64
nanocomposites 30
polymers 19
nanocomposites 17
epoxy 17
materials science, composites 15
polymer science 15

behavior 15
morphology 14
composites 13
mechanical-properties 12
epoxy resin 12
materials science, multidisciplinary 11
epoxy 10
epoxy resin 9

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2005 119
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Country

peoples r china 41
usa 19
italy 13
germany 11
taiwan 8
japan 7
france 7
south korea 6
iran 5
india 5
spain 4
canada 4
england 3
australia 3
switzerland 2

Institution

shanghai jiao tong univ 8
univ sci & technol china 6
iran polymer & petrochem inst 5
zhongshan univ 4
politecn turin 4
georgia inst technol 4
case western reserve univ 4
anhui univ 4
univ sassari 3
univ kaiserslautern 3
michigan state univ 3
chung yuan christian univ 3
chinese acad sci 3
azad univ 3

xiangtan univ 2

DataBase
science citation index 129

- # CLUSTER 43
  Clay materials and nanocomposites (including montmorillonites, organoclays, layered silica nanocomposites, and polypropylene- and epoxy-clay nanocomposites), emphasizing exfoliation degree and mechanism, preparation by melt intercalation, dispersion, and mechanical properties (429 Records)

(Countries: USA, followed by China, followed by South Korea, Taiwan, France, Japan. Institutions: Marquette University, CAS, Inha University. Other USA include University of Akron, Michigan State University, NIST.).

Cluster Syntax Features

Descriptive Terms
clai 63.4%, nanocomposit 8.3%, montmorillonit 2.3%, clay.nanocomposites 2.0%, organoclai 1.8%, exfoli 1.5%, intercal 1.4%, polym 0.6%, melt 0.4%, polypropylen 0.4%, silic 0.4%, dispers 0.4%, epoxi 0.3%, layer 0.2%, properti 0.2%

Discriminating Terms
clai 40.2%, nanocomposit 4.0%, film 1.7%, montmorillonit 1.4%, clay.nanocomposites 1.3%, organoclai 1.1%, exfoli 0.9%, intercal 0.7%, surfac 0.6%, nanoparticl 0.6%, magnet 0.5%, carbon 0.5%, nanotub 0.5%, deposit 0.5%, structur 0.4%

Single Word Terms
clai 427, nanocomposit 299, properti 223, rai 194, montmorillonit 175, layer 172, structur 166, intercal 165, diffract 163, polym 155, mechan 154, dispers 153, electron 145, exfoli 141, microscopi 138

Double Word Terms
clay.nanocomposites 162, ray.diffraction 157, electron.microscopy 125, transmission.electron 108, mechanical.properties 86, diffraction.xrd 54, clay.particles 52, clay.content 48, polymer.clay 46, montmorillonite.clay 45, clay.layers 45, thermal.stability 44, clay.nanocomposite 44, microscopy.tem 43, angle.ray 39

Triple Word Terms
transmission.electron.microscopy 100, ray.diffraction.xrd 54, electron.microscopy.tem 42, differential.scanning.calorimetry 34, scanning.electron.microscopy 30, polymer.clay.nanocomposites 29, wide.angle.ray 27, ray.diffraction.transmission 26, diffraction.transmission.electron 23, maleic.anhydride.grafted 21, xrd.transmission.electron 21, angle.ray.diffraction 20, clay.nanocomposites.melt 18, angle.ray.scattering 17, glass.transition.temperature 17

Term Cliques
44.73% clai nanocomposit clay.nanocomposites polym polypropylen silic dispers layer properti
43.56% clai nanocomposit clay.nanocomposites polym melt polypropylen silic dispers properti
46.32% clai nanocomposit clay.nanocomposites exfoli intercal polym silic dispers layer properti
45.27% clai nanocomposit clay.nanocomposites exfoli intercal polym melt silic dispers properti
43.28% clai nanocomposit clay.nanocomposites organoclai polypropylen silic dispers layer properti
42.11% clai nanocomposit clay.nanocomposites organoclai melt polypropylen silic dispers properti
41.60% clai nanocomposit clay.nanocomposites organoclai exfoli intercal silic dispers epoxi layer properti
40.64% clai nanocomposit clay.nanocomposites organoclai exfoli intercal melt silic dispers epoxi properti
46.83% clai nanocomposit montmorillonit clay.nanocomposites exfoli intercal polym silic layer properti
45.78% clai nanocomposit montmorillonit clay.nanocomposites exfoli intercal polym melt silic property

Sample Cluster Record Titles

Assessing organo-clay dispersion in polymer layered silicate nanocomposites: A SAXS approach

Polyimide/silica hybrid-clay nanocomposites

The effects of clay on the thermal degradation behavior of poly(styrene-co-acrylonitirile)

Fully exfoliated nanocomposite from polypyrrole graft copolymer/clay

Poly(propylene)/clay nanocomposites prepared by reactive compounding with an epoxy based masterbatch

Effect of organic modification on the compatibilization efficiency of clay in an immiscible polymer blend

Effects of clay and LNR on mechanical properties and morphology of NR/HDPE-aramid composites

Tensile fracture morphologies of nylon-6/montmorillonite nanocomposites

Flammability of styrenic polymer clay nanocomposites based on a methyl methacrylate oligomerically-modified clay

Cluster Metrics

Authors

wilkie, ca 20
yoon, js 10
jiang, dd 10
chen, gx 9
zhang, lq 7
wu, yp 6
lee, yb 6
jana, sc 6
zheng, xx 5
zhang, hf 5
yang, ms 5
nam, bu 5
jho, jy 5
jang, bn 5
hong, ch 5

Sources

polymer 57

journal of applied polymer science 38
macromolecules 22
journal of polymer science part b-polymer physics 20
polymer international 13
applied clay science 13
polymer degradation and stability 12
macromolecular rapid communications 10
polymer engineering and science 9
langmuir 9
journal of colloid and interface science 8
clay minerals 8
macromolecular symposia 7
composites science and technology 6
clays and clay minerals 6

Keywords
polymer science 211
nanocomposites 107
montmorillonite 99
clay 83
nanocomposites 81
layered silicate nanocomposites 79
mechanical-properties 63
behavior 50
morphology 48
nanocomposite 45
intercalation 45
clay 38
chemistry, physical 37
composites 37
polymer science 36

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2006 10

Country
usa 99
peoples r china 70
south korea 38
taiwan 30
france 30
japan 25
canada 21
australia 18

england 16
india 14
spain 13
italy 13
singapore 12
israel 9
germany 9

Institution
marquette univ 19
chinese acad sci 15
inha univ 11
univ akron 10
natl res council canada 10
chung yuan christian univ 9
shanghai jiao tong univ 8
seoul natl univ 8
michigan state univ 8
csic 8
beijing univ chem technol 8
cnr 7
univ sci & technol china 6
natl inst stand & technol 6
inst mat res & engn 6

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science citation index 429

- CLUSTER 21
  Montmorillonites (MMTs) (especially MMT nanocomposites), emphasizing intercalation, exfoliation, and thermal properties (133 Records)

(Countries: China dominant, South Korea, USA, Japan. Institutions: CAS, University S&T China, Shanghai Jiao Tong University, Korea Research institute of Chemical Technology.).

Cluster Syntax Features

Descriptive Terms
mmt 51.3%, montmorillonit 9.4%, nanocomposit 8.9%, intercal 7.0%, mmt.nanocomposites 1.3%, exfoli 1.2%, montmorillonite.mmt 1.1%, clai 0.7%, montmorillonite.nanocomposites 0.5%, silic 0.4%, polymer 0.3%, na.mmt 0.3%, composit 0.3%, thermal 0.3%, layer 0.3%

Discriminating Terms
mmt 31.6%, montmorillonit 5.5%, nanocomposit 4.0%, intercal 3.9%, film 1.6%, mmt.nanocomposites 0.8%, surfac 0.8%, montmorillonite.mmt 0.7%, exfoli 0.6%, nanoparticl 0.5%, magnet 0.5%, carbon 0.5%, nanotub 0.5%, structur 0.5%, deposit 0.4%

Single Word Terms
montmorillonit 109, mmt 102, nanocomposit 98, intercal 88, rai 70, diffract 65, layer 62, thermal 58, properti 52, electron 51, exfoli 49, structur 49, temperatur 46, clai 45, xrd 42

Double Word Terms
montmorillonite.mmt 65, ray.diffraction 63, mmt.nanocomposites 41, transmission.electron 39, montmorillonite.nanocomposites 38, electron.microscopy 33, thermal.stability 28, diffraction.xrd 27, na.mmt 16, mechanical.properties 16, glass.transition 16, mmt.nanocomposite 15, nanocomposites.situ 14, microscopy.tem 14, tensile.strength 14

Triple Word Terms
transmission.electron.microscopy 29, ray.diffraction.xrd 26, montmorillonite.mmt.nanocomposites 18, electron.microscopy.tem 13, diffraction.transmission.electron 12, ray.diffraction.transmission 12, xrd.transmission.electron 12, wide.angle.ray 11, diffraction.xrd.transmission 10, glass.transition.temperature 10, differential.scanning.calorimetry 10, transmission.electron.microscope 8, angle.ray.diffraction 8, nanocomposites.montmorillonite.mmt 7, scanning.electron.microscopy 7

Term Cliques
46.53% montmorillonit nanocomposit exfoli montmorillonite.mmt clai silic composit thermal layer
47.56% montmorillonit nanocomposit intercal exfoli clai na.mmt composit layer
51.21% montmorillonit nanocomposit intercal exfoli montmorillonite.mmt clai composit thermal layer
49.87% mmt montmorillonit nanocomposit exfoli montmorillonite.mmt clai silic composit thermal
46.00% mmt montmorillonit nanocomposit mmt.nanocomposites exfoli montmorillonite.mmt clai montmorillonite.nanocomposites silic polymer thermal
51.32% mmt montmorillonit nanocomposit intercal exfoli clai na.mmt composit
54.55% mmt montmorillonit nanocomposit intercal exfoli montmorillonite.mmt clai

composit thermal
48.79% mmt montmorillonit nanocomposit intercal mmt.nanocomposites exfoli clai polymer na.mmt
49.83% mmt montmorillonit nanocomposit intercal mmt.nanocomposites exfoli montmorillonite.mmt clai montmorillonite.nanocomposites polymer thermal

Sample Cluster Record Titles

Thermally stimulated current measurements on epoxidized natural rubber (ENR50) - organically modified montmorillonite composite

Photooxidation of polypropylene/montmorillonite nanocomposites. 2. Interactions with antioxidants

Synthesis and characterization of conductive polypyrrole/montmorillonite nanocomposite

Intercalation and exfoliation relationships in melt-processed poly(styrene-co-acrylonitrile)/montmorillonite nanocomposites

Effect of heat treatment on amino acid intercalated in montmorillonite

Polyacrylate/(chitosan modified montmorillonite) nanocomposite: Water absorption and photostability

ZnGA-MMT catalyzed the copolymerization of carbon dioxide with propylene oxide

Preparation and properties of compatibilized LDPE/organo-modified montmorillonite nanocomposites

Insertion of polypyrrole chains into montmorillonite galleries by a solvent-free mechanochemical route

Cluster Metrics

Authors
lee, jh 5
wang, q 4
karger-kocsis, j 4
he, ps 4
gatos, kg 4
chen, dz 4
zhang, sm 3
yoshimoto, s 3

yang, ms 3
xu, jt 3
xie, sb 3
ohashi, f 3
nam, jd 3
liu, hj 3
kameyama, t 3

Sources

polymer 16
journal of applied polymer science 14
journal of polymer science part b-polymer physics 7
european polymer journal 7
polymer-korea 6
macromolecular rapid communications 5
polymers & polymer composites 4
polymer degradation and stability 4
polimery 3
macromolecular materials and engineering 2
journal of materials science 2
journal of materials chemistry 2
journal of colloid and interface science 2
japanese journal of applied physics part 1-regular papers brief communications & review papers 2
composites science and technology 2

Keywords

polymer science 71
montmorillonite 45
mechanical-properties 30
nanocomposites 29
nanocomposites 25
layered silicate nanocomposites 22
nanocomposite 21
clay 20
montmorillonite 17
morphology 17
behavior 16
intercalation 15
clay nanocomposites 15
materials science, multidisciplinary 14
hybrid 13

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2004 13

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Country
peoples r china 52
south korea 19
usa 16
japan 11
taiwan 6
germany 5
france 5
poland 4
egypt 4
australia 4
singapore 3
ukraine 2
malaysia 2
india 2
hungary 2

Institution
chinese acad sci 8
univ sci & technol china 7
shanghai jiao tong univ 7
korea res inst chem technol 6
zhejiang univ 4
sichuan univ 4
sungkyunkwan univ 3
polish acad sci 3
chungnam natl univ 3
aichi ind technol inst 3
wuhan univ 2
univ ulsan 2
univ texas 2
univ sydney 2
univ sofia 2

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science citation index 133

- # CLUSTER 188
  Nanocomposites (including layered silicate and layered double hydroxide [LDH] nanocomposites), organoclays, and organic montmorillonites (OMMTs), emphasizing preparation, exfoliation, intercalation, and enhanced properties, especially thermal properties (445 Records)

(Countries: China, USA, followed by South Korea, Japan. Institutions: CAS dominant, University S&T China, NAS Ukraine, RAS. USA include SUNY Stony Brook.).

Cluster Syntax Features

Descriptive Terms
nanocomposit 59.2%, polym 1.8%, silic 1.3%, organoclai 1.3%, exfoli 1.3%, intercal 1.3%, ommt 1.1%, montmorillonit 0.9%, properti 0.7%, melt 0.7%, ldh 0.6%, silica 0.5%, matrix 0.5%, poli 0.5%, thermal 0.4%

Discriminating Terms
nanocomposit 41.8%, film 1.7%, organoclai 0.9%, exfoli 0.9%, ommt 0.9%, silic 0.8%, intercal 0.8%, surfac 0.7%, nanotub 0.6%, magnet 0.6%, carbon 0.6%, montmorillonit 0.5%, deposit 0.5%, quantum 0.5%, ldh 0.4%

Single Word Terms
nanocomposit 434, properti 228, polym 182, structur 157, mechan 136, layer 135, composit 133, matrix 131, electron 130, dispers 127, thermal 126, rai 126, materi 121, temperatur 119, intercal 114

Double Word Terms
ray.diffraction 104, electron.microscopy 89, transmission.electron 88, mechanical.properties 73, thermal.stability 55, layered.silicate 48, microscopy.tem 46, differential.scanning 42, diffraction.xrd 39, scanning.calorimetry 39, properties.nanocomposites 38, scanning.electron 37, silicate.nanocomposites 36, glass.transition 29, polymer.nanocomposites 29

Triple Word Terms
transmission.electron.microscopy 71, electron.microscopy.tem 46, ray.diffraction.xrd 39, differential.scanning.calorimetry 38, layered.silicate.nanocomposites 32, scanning.electron.microscopy 28, fourier.transform.infrared 26, scanning.calorimetry.dsc 26, glass.transition.temperature 19, angle.ray.diffraction 18, wide.angle.ray 17, ray.diffraction.transmission 15, xrd.transmission.electron 15, diffraction.xrd.transmission

14, diffraction.transmission.electron 14

Term Cliques
44.34% nanocomposit silica poli
29.27% nanocomposit silic organoclai exfoli intercal ommt montmorillonit properti melt matrix poli thermal
33.71% nanocomposit polym exfoli intercal ldh matrix poli thermal
32.19% nanocomposit polym silic organoclai exfoli intercal montmorillonit properti melt matrix poli thermal

Sample Cluster Record Titles

Polystyrene/LDHs hybrid nanocomposites prepared by emulsion polymerization

Dynamic mechanical analysis of polyvinylalcohol/silica nanocomposite

Isothermal crystallisation behaviour and kinetics of polyvinylalcohol/silica nanocomposite

Effect of organoclay content on physical characteristics of poly(oethoxyaniline) nanocomposites

Formation and characterization of highly interfacial hybrid nanocomposites

Electrical transport and dielectric relaxation in Fe3O4-polypyrrole hybrid nanocomposites

Effect of polymer-particle interaction in swelling dynamics of ultrathin nanocomposite films

Thermal stabilities of polystyrene/silica hybrid nanocomposites via microwave-assisted in situ polymerization

Factors affecting the dispersion of montmorillonite in LLDPE nanocomposite

Cluster Metrics

Authors
privalko, eg 7
choi, hj 7
privalko, vp 6
zhou, sx 5
zhang, zj 5
wu, lm 5
wang, q 5

li, y 5
li, l 5
hsiao, bs 5
zaikov, ge 4
wu, tm 4
shen, l 4
shen, j 4
rupp, jep 4

Sources

polymer 41
journal of applied polymer science 24
polymer degradation and stability 18
macromolecules 16
chemistry of materials 10
journal of polymer science part b-polymer physics 9
journal of materials chemistry 8
journal of colloid and interface science 8
acta polymerica sinica 8
synthetic metals 7
polymer international 7
macromolecular materials and engineering 7
journal of materials science 7
polymers for advanced technologies 6
polymers & polymer composites 6

Keywords

polymer science 182
nanocomposites 87
materials science, multidisciplinary 66
nanocomposites 61
nanocomposite 59
mechanical-properties 57
chemistry, physical 47
chemistry, multidisciplinary 45
morphology 42
montmorillonite 42
clay 38
layered silicate nanocomposites 36
materials science, multidisciplinary 36
behavior 36
polymer science 35

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peoples r china 118
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south korea 33
japan 32
france 24
india 21
australia 17
germany 16
taiwan 14
russia 14
canada 14
italy 12
ukraine 11
spain 9
singapore 9

Institution
chinese acad sci 21
univ sci & technol china 11
natl acad sci ukraine 10
russian acad sci 9
shanghai jiao tong univ 7
inha univ 7
fudan univ 7
beijing univ chem technol 7
tsing hua univ 6
tokyo inst technol 6
tianjin univ 5
suny stony brook 5
sichuan univ 5
presidency coll 5
natl chung hsing univ 5

DataBase
science citation index 445

- CLUSTER 241
  Phase formation, transitions, and behavior in powders, cubic solids, and crystals, as explored by x-ray powder diffraction (296 Records)

(Countries: China, followed by India, Japan, Germany. Institutions: RAS, CAS, University S&T China, Bhabha Atomic Research Center.).

Cluster Syntax Features

Descriptive Terms
phase 15.1%, powder 5.5%, temperatur 2.4%, solid 2.2%, diffract 2.1%, cubic 1.7%, rai 1.6%, pressur 1.4%, crystal 1.3%, powder.diffraction 1.3%, nanocrystallin 1.1%, transform 1.0%, ray.powder 1.0%, powder.ray 1.0%, thermal 0.9%

Discriminating Terms
phase 9.4%, powder 3.4%, film 2.7%, cubic 1.3%, solid 1.2%, surfac 1.1%, powder.diffraction 1.1%, ray.powder 0.9%, diffract 0.8%, powder.ray 0.8%, nanoparticl 0.8%, nanotub 0.8%, ray.powder.diffraction 0.8%, layer 0.7%, carbon 0.7%

Single Word Terms
phase 223, rai 208, powder 206, diffract 206, temperatur 191, structur 142, crystal 109, solid 104, high 94, thermal 92, xrd 89, electron 89, sampl 88, form 84, composit 83

Double Word Terms
ray.diffraction 141, powder.ray 71, powder.diffraction 69, ray.powder 64, high.temperature 52, electron.microscopy 46, diffraction.xrd 42, phase.transition 38, transmission.electron 38, solid.state 38, solid.solution 36, differential.thermal 32, differential.scanning 30, low.temperature 29, room.temperature 29

Triple Word Terms

powder.ray.diffraction 67, ray.powder.diffraction 57, transmission.electron.microscopy 31, ray.diffraction.xrd 28, differential.scanning.calorimetry 26, scanning.electron.microscopy 16, ray.diffraction.data 15, differential.thermal.dta 14, solid.state.reaction 14, powder.diffraction.xrd 14, fourier.transform.infrared 12, scanning.calorimetry.dsc 12, unit.cell.volume 10, unit.cell.parameters 10, transform.infrared.spectroscopy 9

Term Cliques

38.91% temperatur cubic rai pressur crystal powder.ray
40.20% powder diffract rai crystal powder.diffraction nanocrystallin transform ray.powder thermal
40.35% powder diffract cubic rai crystal powder.diffraction nanocrystallin ray.powder thermal
42.38% powder solid diffract cubic rai crystal powder.diffraction ray.powder thermal
49.24% powder temperatur solid diffract cubic rai crystal powder.ray
42.91% phase temperatur rai pressur crystal nanocrystallin transform
43.10% phase temperatur cubic rai pressur crystal nanocrystallin
50.75% phase powder temperatur diffract rai crystal nanocrystallin transform thermal
50.90% phase powder temperatur diffract cubic rai crystal nanocrystallin thermal
52.93% phase powder temperatur solid diffract cubic rai crystal thermal

Sample Cluster Record Titles

X-ray and neutron Rietveld quantitative phase analysis of industrial Portland cement clinkers

Antiferroelectric phase transition in Sr9In(PO4)(7)

Phase equilibria in the Ni-Zn-Ge ternary system at 570 K

Solid-state characterization of chitosans derived from lobster chitin

Phase formation stages of MgTa2O6 and Pb(Mg1/3Ta2/3)O-3

Powder X-ray diffraction data of a new calcium zirconium phosphate Ca7Zr(PO4)(6)

Temperature-dependent phase stability of nanocrystalline SiO2

Crystal structure and phase transition behavior of La1-xSrxGa1-yMgyO3-delta

Crystal structure, thermal expansion and electrical conductivity of dual-phase Gd0.8Sr0.2Co1-yFeyO3-delta (0 <= y <= 1.0)

Cluster Metrics

Authors

tyagi, ak 8
ma, jh 7
qian, yt 6
yokoyama, h 4
yang, zh 4
wang, j 4
maeda, y 4
chen, ly 4
achary, sn 4
zhang, y 3
yan, ch 3
yamashita, t 3
yamamoto, j 3
shi, ly 3
shi, l 3

Sources

journal of alloys and compounds 20
journal of the american ceramic society 14
journal of solid state chemistry 13
physical review b 8
materials letters 8
chemistry of materials 8
materials chemistry and physics 7
thermochimica acta 6
journal of rare earths 5
journal of physics-condensed matter 5
journal of physics and chemistry of solids 5
journal of physical chemistry b 5
journal of crystal growth 5
intermetallics 5
glass physics and chemistry 5

Keywords

chemistry, physical 54
materials science, multidisciplinary 48
materials science, multidisciplinary 43
materials science, ceramics 31
metallurgical engineering 25
metallurgy & 25
chemistry, physical 25
physics, condensed matter 24
x-ray diffraction 24
chemistry, inorganic & nuclear 23
system 23

physics, condensed matter 20
chemistry, multidisciplinary 18
phase 18
crystal-structure 18

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Country
peoples r china 63
india 42
japan 36
germany 30
russia 23
usa 20
france 20
england 15
brazil 11
italy 9
sweden 8
spain 8
australia 8
taiwan 7
south korea 5

Institution
russian acad sci 11
chinese acad sci 11
univ sci & technol china 9
bhabha atom res ctr 9
st petersburg state univ 7
european synchrotron radiat facil 6
univ sci & technol beijing 5
wenzhou univ 4
univ bayreuth 4
tohoku univ 4
shanghai univ 4
moscow mv lomonosov state univ 4
harbin inst technol 4
acad sinica 4
univ vienna 3

DataBase
science citation index 296

- # CLUSTER 220
  Structural studies, emphasizing crystal structure, x-ray powder diffraction, and structure refinement (278 Records)

(Countries: USA, Germany, Japan, Ukraine, France. Institutions: Volyn State University dominant, Polish Academy of Science, Moscow Lomonosov State University, University of Munster.).

Cluster Syntax Features

Descriptive Terms
structur 7.1%, crystal 6.9%, compound 3.9%, diffract 3.6%, refin 3.0%, crystal.structure 2.9%, space 2.8%, rai 2.2%, type 2.0%, powder 1.8%, atom 1.6%, ray.diffraction 1.6%, unit 1.3%, data 1.2%, site 1.2%

Discriminating Terms
crystal 2.7%, film 2.5%, refin 2.4%, structur 2.3%, compound 2.1%, crystal.structure 2.1%, space 1.7%, diffract 1.7%, surfac 1.1%, unit.cell 0.9%, nanoparticl 0.9%, diffraction.data 0.8%, particl 0.8%, type 0.8%, unit 0.8%

Single Word Terms
structur 262, rai 236, diffract 236, crystal 199, space 138, powder 128, atom 114,

compound 113, type 110, data 107, singl 98, refin 89, temperatur 88, unit 87, phase 84

Double Word Terms
ray.diffraction 179, crystal.structure 97, single.crystal 79, unit.cell 61, crystal.ray 57, diffraction.data 56, powder.diffraction 51, ray.powder 48, crystal.structures 48, powder.ray 42, structure.type 32, room.temperature 28, cell.parameters 26, type.structure 22, solid.state 22

Triple Word Terms
single.crystal.ray 57, crystal.ray.diffraction 54, ray.powder.diffraction 41, ray.diffraction.data 41, powder.ray.diffraction 39, unit.cell.parameters 18, powder.diffraction.data 12, structure.type.space 11, ho.er.tm 11, dy.ho.er 11, transmission.electron.microscopy 10, crystal.structures.compounds 9, ray.diffraction.patterns 9, single.crystal.diffraction 9, powder.single.crystal 9

Term Cliques
55.76% structur crystal diffract refin crystal.structure space rai atom ray.diffraction unit site
57.03% structur crystal diffract refin crystal.structure space rai atom ray.diffraction unit data
58.37% structur crystal diffract refin crystal.structure space rai powder atom ray.diffraction data
55.64% structur crystal diffract refin crystal.structure space rai type powder atom ray.diffraction site
53.60% structur crystal compound diffract refin crystal.structure space rai atom unit site
53.66% structur crystal compound diffract refin crystal.structure space rai type powder atom site

Sample Cluster Record Titles

Crystal structures of the compounds R3CuSe6 (R = Gd, Tb and Dy) and TbCu0.34Te2

Crystal structures of the RCuPbSe3 (R = Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu) compounds

Structure refinement of CsNO3(II) by coupling of N-14 MAS NMR experiments with WIEN2k DFT calculations

Zr5Ir2In4 - A superstructure of the Lu5Ni2In4 type

P-T phase diagram and single crystal structural refinement. of NaMn7O12

Crystal structure of Zr2Al3C4

Structure and magnetic properties of (Nd,Y)(3)(Fe,Co,Ti)(29) compounds

An anomalous x-ray diffraction study of the hydration structures of Cs+ and I- in concentrated solutions

Structure-property relations of regiosymmetrical 3,4-dioxy-functionalized polythiophenes

Cluster Metrics

Authors

olekseyuk, id 24
gulay, ld 19
pottgen, r 7
parasyuk, ov 7
piskach, lv 6
shemet, vy 5
pietraszko, a 5
pekhnyo, vi 5
mitchell, rh 5
liferovich, rp 5
hoffmann, rd 5
stepien-damm, j 4
reguera, e 4
zaremba, vi 3
vogt, t 3

Sources

journal of alloys and compounds 44
journal of solid state chemistry 21
zeitschrift fur anorganische und allgemeine chemie 14
american mineralogist 11
solid state sciences 9
journal of physical chemistry b 9
physical review b 8
chemistry of materials 8
powder diffraction 7
journal of the american chemical society 6
acta crystallographica section b-structural science 5
zeitschrift fur kristallographie 4
recent advances in the science and technology of zeolites and related materials, pts a - c 4
inorganic materials 4
inorganic chemistry 4

Keywords

chemistry, physical 72
chemistry, inorganic & nuclear 58
materials science, multidisciplinary 57
crystal structure 50
metallurgical engineering 46
metallurgy & 46
chemistry, physical 34
crystal-structure 27
x-ray diffraction 24
crystallography 22
x-ray 21
chemistry, multidisciplinary 19
crystal-structure 19
materials science, multidisciplinary 18
diffraction 16

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2005 236
2004 41
2006 1

Country

usa 43
germany 42
japan 36
ukraine 34
france 32
england 23
peoples r china 19
russia 17
poland 15
canada 12
india 9
australia 8
south korea 7
italy 7
austria 7

Institution

volyn state univ 25
polish acad sci 12
moscow mv lomonosov state univ 10
univ munster 7
russian acad sci 6

chinese acad sci 6
tohoku univ 5
rutherford appleton lab 5
natl inst mat sci 5
natl acad sci ukraine 5
max planck inst festkorperforsch 5
lakehead univ 5
indian inst technol 5
european synchrotron radiat facil 5
cnrs 5

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science citation index 278

- CLUSTER 240
  Crystal structure, examined by x-ray diffraction and single crystal methods (388 Records)

(Countries: Japan, USA, followed by China, Germany. Institutions: RAS, CAS, Osaka University, Tokyo Institute of Technology.).

Cluster Syntax Features

Descriptive Terms
crystal 41.3%, structur 2.2%, crystal.structure 2.1%, chain 2.1%, molecul 2.0%,

single.crystal 1.6%, singl 1.6%, single.crystals 1.0%, molecular 0.9%, liquid 0.9%, diffract 0.8%, rai 0.8%, form 0.8%, polymorph 0.7%, phase 0.7%

Discriminating Terms

crystal 30.1%, film 2.5%, crystal.structure 1.6%, single.crystal 1.1%, chain 1.1%, nanoparticl 0.9%, single.crystals 0.8%, particl 0.8%, nanotub 0.8%, molecul 0.7%, surfac 0.7%, carbon 0.7%, deposit 0.7%, polymorph 0.6%, magnet 0.6%

Single Word Terms

crystal 354, structur 260, rai 197, diffract 174, singl 146, form 135, two 135, molecul 125, molecular 117, on 105, phase 90, chain 88, bond 82, temperatur 78, format 74

Double Word Terms

ray.diffraction 155, crystal.structure 102, single.crystal 99, single.crystals 49, crystal.ray 41, crystal.structures 38, crystal.growth 31, self.assembly 28, liquid.crystalline 26, differential.scanning 25, two.dimensional 24, scanning.calorimetry 24, atomic.force 24, solid.state 24, liquid.crystal 22

Triple Word Terms

single.crystal.ray 41, crystal.ray.diffraction 33, differential.scanning.calorimetry 23, atomic.force.microscopy 21, powder.ray.diffraction 15, angle.ray.diffraction 14, wide.angle.ray 14, ray.diffraction.data 13, force.microscopy.afm 10, small.angle.ray 10, transmission.electron.microscopy 9, angle.ray.scattering 9, van.der.waals 9, ray.diffraction.crystals 9, microscopy.differential.scanning 8

Term Cliques

34.91% structur chain molecul molecular diffract rai form polymorph phase
36.08% structur chain molecul molecular liquid diffract rai phase
42.53% crystal structur molecul molecular diffract rai form polymorph phase
44.49% crystal structur crystal.structure single.crystal singl single.crystals diffract rai
41.13% crystal structur crystal.structure molecul single.crystal molecular diffract rai form polymorph
44.05% crystal structur crystal.structure molecul single.crystal singl molecular diffract rai form

Sample Cluster Record Titles

Characterization and analyses on complex melting, polymorphism, and crystal phases in melt-crystallized poly(hexamethylene terephthalate)

A new liquid crystal compound based on an ionic imidazolium salt

[Studies on the growth and characterization of a NLO active sodium substituted lithium p-nitrophenolate single crystal]

[Crystal structure of octaethyloxyphthalocyaninato copper, the overlap affect on the ring skeleton distortion]

[Crystal structure of 1,2-[4-butoxybenzoyloxy-4 '-pentyl]diphenylethane]

[Preparation of new ferroelectric glycine phosphite single crystals]

[Sequence distribution and crystal structure of poly (ethylene/trimethylene terephthalate) copolyesters]

[Improvement in UV optical properties of CsLiB6O10 by reducing water molecules in the crystal]

[Growth and optical characterization of Cu- and Mg-substituted L-arginine di phosphate single crystals]

Cluster Metrics

Authors

yokoyama, h 6
yamamoto, j 5
iwata, t 5
doi, y 5
sasaki, t 4
nishiyama, i 4
gale, jd 4
cheng, szd 4
wang, x 3
schindler, m 3
rohl, al 3
putnis, a 3
parsons, s 3
mori, y 3
kobatake, s 3

Sources

journal of crystal growth 19
journal of the american chemical society 18
chemistry of materials 15
molecular crystals and liquid crystals 12
journal of physical chemistry b 12

crystal growth & design 11
macromolecules 10
angewandte chemie-international edition 10
polymer 7
acta crystallographica section d-biological crystallography 7
liquid crystals 6
journal of materials chemistry 6
chemistry-a european journal 6
biomacromolecules 6
zeitschrift fur anorganische und allgemeine chemie 5

Keywords

chemistry, multidisciplinary 74
crystallography 73
chemistry, physical 60
materials science, multidisciplinary 36
growth 32
polymer science 29
materials science, multidisciplinary 23
chemistry, inorganic & nuclear 21
atomic-force microscopy 21
morphology 21
crystallization 20
chemistry, organic 17
spectroscopy 17
crystal structure 17
x-ray 16

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2005 342
2004 45
2006 1

Country

japan 78
usa 72
peoples r china 49
germany 44
france 31
india 27
russia 24
england 22
canada 14
netherlands 13
south korea 12
poland 10

italy 9
switzerland 8
australia 8

Institution
russian acad sci 19
chinese acad sci 12
osaka univ 10
tokyo inst technol 8
curtin univ technol 7
univ halle wittenberg 5
univ cambridge 5
kyushu univ 5
cnrs 5
chiba univ 5
xiamen univ 4
univ tokyo 4
univ strasbourg 1 4
univ paris 06 4
univ munster 4

DataBase
science citation index 388

- # CLUSTER 127
  Structure, synthesis, and characterization of compounds (especially diterpenoids, cyclodextrin, and peptides), with emphasis on isolation from other materials, x-ray diffraction studies, crystal structure, and preferred conformations (102 Records)

(Countries: China, Japan, USA, Germany. Institutions: CAS, RAS, University of Padua.).

Cluster Syntax Features

Descriptive Terms
beta 48.9%, alpha 9.1%, alpha.beta 2.7%, ent 1.8%, diterpenoid 0.9%, cyclodextrin 0.9%, new 0.8%, peptid 0.8%, structur 0.8%, compound 0.6%, isol 0.6%, diffract 0.5%, conform 0.5%, acid 0.5%, crystal 0.5%

Discriminating Terms
beta 30.1%, alpha 4.9%, film 1.8%, alpha.beta 1.7%, ent 1.2%, surfac 0.8%, nanoparticl 0.7%, diterpenoid 0.6%, particl 0.6%, carbon 0.6%, magnet 0.6%, layer 0.5%, cyclodextrin 0.5%, nanotub 0.5%, deposit 0.5%

Single Word Terms
beta 91, structur 77, rai 62, diffract 56, alpha 54, crystal 41, two 33, on 29, new 27, compound 26, molecul 23, form 23, singl 22, nmr 21, synthesi 21

Double Word Terms
ray.diffraction 42, alpha.beta 31, single.crystal 19, crystal.ray 17, crystal.structure 14, beta.alpha 9, beta.cyclodextrin 8, solid.state 7, alpha.alpha 7, beta.gamma 7, side.chain 7, crystal.structures 6, structure.single 6, beta.beta 6, electron.microscopy 6

Triple Word Terms
single.crystal.ray 17, crystal.ray.diffraction 12, structure.single.crystal 6, alpha.beta.gamma 6, scanning.electron.microscopy 5, powder.ray.diffraction 5, structures.elucidated.spectroscopic 4, beta.alpha.beta 4, beta.cyclodextrin.beta 4, alpha.alpha.beta 3, nmr.ray.diffraction 3, alpha.beta.unsaturated 3, tricalcium.phosphate.beta 3, beta.tricalcium.phosphate 3, ray.diffraction.structure 3

Term Cliques
17.97% cyclodextrin compound isol
39.41% ent structur diffract acid crystal
31.62% ent diterpenoid new structur compound isol diffract crystal
30.72% alpha.beta ent diterpenoid structur compound crystal
42.48% alpha diterpenoid structur compound diffract crystal
38.40% alpha alpha.beta diterpenoid structur compound crystal
51.96% beta new structur compound diffract crystal
39.87% beta cyclodextrin acid
41.83% beta cyclodextrin compound
50.70% beta alpha structur compound diffract conform crystal
45.34% beta alpha peptid structur diffract conform acid crystal
47.20% beta alpha alpha.beta structur compound conform crystal

Sample Cluster Record Titles

Structural analysis of cyclodextrins: A comparative study of classical and quantummechanical methods

X-ray diffraction study of the Cu2Se-In2Se3-Cr2Se3 system near CuInCr2Se5

Immunosuppressive ent-kaurene diterpenoids from Isodon serra

Preferred conformations of peptides containing tert-leucine, a sterically demanding, lipophilic alpha-amino acid with a quaternary side-chain C-beta atom

Cytotoxic diterpenoids from the roots of Euphorbia ebracteolata

Highly stereoselective synthesis of (E)- and (Z)-alpha-fluoro-alpha,beta-unsaturated esters and (E)- and (Z)-alpha-fluoro-alpha,beta-unsaturated amides from 1-bromo-1-fluoroalkenes via palladium-catalyzed carbonylation reactions

Design of peptides with alpha,beta-dehydro residues: Synthesis, crystal structure and molecular conformation of a peptide N-Boc-Phe-triangle Phe-Ile-OCH3

Solid-state inclusion compounds of small amphiphilic molecules (CnEm) in beta-cyclodextrin: a study at defined relative humidities

Isolation, characterization and crystal structure of cytotoxic ent-kaurane diterpenoids from Isodon weisiensis C. Y. Wu

Cluster Metrics

Authors

kaptein, b 4
broxterman, qb 4
toniolo, c 3
formaggio, f 3
crisma, m 3
zhang, zj 2
zhang, ss 2
yang, dj 2
wang, h 2
teixeira-dias, jjc 2
sun, k 2
singh, tp 2
rafalska-lasocha, a 2

pramanik, a 2
moretto, a 2

Sources
planta medica 4
organic letters 4
zeitschrift fur naturforschung section b-a journal of chemical sciences 3
tetrahedron 3
organic & biomolecular chemistry 3
journal of peptide research 3
journal of organic chemistry 3
helvetica chimica acta 3
carbohydrate research 3
powder diffraction 2
macromolecules 2
journal of materials science 2
chinese chemical letters 2
chemistry-a european journal 2
bulletin of the chemical society of japan 2

Keywords
chemistry, multidisciplinary 23
chemistry, organic 15
materials science, multidisciplinary 8
chemistry, organic 8
chemistry, inorganic & nuclear 7
x-ray diffraction 7
polymer science 6
biochemistry & molecular biology 6
derivatives 6
chemistry, physical 5
chemistry, medicinal 5
pharmacology & pharmacy 5
peptides 5
crystal 5
acid 5

Publication Year
2005 92
2004 10

Country
peoples r china 18
japan 13
usa 12
germany 10

netherlands 7
spain 6
poland 6
france 6
italy 5
india 5
sweden 4
russia 4
south korea 3
mexico 3
england 3

Institution

chinese acad sci 7
russian acad sci 4
univ padua 3
univ utrecht 2
univ sydney 2
univ sci & technol china 2
univ sains malaysia 2
univ nacl autonoma mexico 2
univ lyon 1 2
univ karachi 2
univ calcutta 2
univ aveiro 2
qingdao univ sci & technol 2
polish acad sci 2
nw normal univ 2

DataBase

science citation index 102

- # CLUSTER 203
  Structural characterization and synthesis of compounds, emphasizing crystallography (especially single crystal x-ray diffraction) and NMR spectroscopy (280 Records)

(Countries: China dominant, USA, Germany. Institutions: RAS, CAS, Qingdao University S&T, Nankai University. USA includes University of Texas.).

Cluster Syntax Features

Descriptive Terms
compound 20.7%, crystal 5.7%, single.crystal.ray 3.6%, crystal.ray 3.6%, single.crystal 3.0%, structur 2.8%, nmr 2.7%, crystal.ray.diffraction 2.5%, diffract 2.0%, rai 1.9%, ring 1.8%, ray.diffraction 1.5%, synthesi 1.3%, crystal.structure 1.2%, singl 1.1%

Discriminating Terms
compound 13.0%, single.crystal.ray 2.5%, crystal.ray 2.4%, film 2.1%, single.crystal 1.8%, crystal 1.7%, crystal.ray.diffraction 1.7%, nmr 1.5%, surfac 1.0%, ring 1.0%, particl 0.7%, nanoparticl 0.7%, triazol 0.7%, crystal.structure 0.6%, phenyl 0.6%

Single Word Terms
structur 253, rai 248, diffract 237, compound 225, crystal 217, singl 166, synthesi 138, nmr 109, synthes 102, reaction 89, new 87, two 80, element 72, bond 69, beta 68

Double Word Terms
ray.diffraction 194, single.crystal 159, crystal.ray 140, crystal.structure 78, crystal.structures 37, synthesis.crystal 35, nmr.spectroscopy 34, solid.state 29, system.space 26, elemental.nmr 26, synthesis.structure 25, structure.single 25, title.compound 24, molecular.structure 22, structures.single 20

Triple Word Terms
single.crystal.ray 139, crystal.ray.diffraction 119, synthesis.crystal.structure 28, structure.single.crystal 25, structures.single.crystal 20, ray.diffraction.compound 18, monoclinic.system.space 13, ray.diffraction.crystal 11, structure.title.compound 10, structure.ray.diffraction 10, crystal.molecular.structure 10, crystal.structure.ray 9, nmr.single.crystal 9, spectroscopy.mass.spectrometry 8, compound.ray.diffraction 8

Term Cliques
60.13% compound crystal single.crystal structur nmr rai ring ray.diffraction synthesi crystal.structure singl
65.71% compound crystal single.crystal structur nmr diffract rai ray.diffraction synthesi crystal.structure singl
59.67% compound crystal single.crystal.ray crystal.ray single.crystal structur nmr

crystal.ray.diffraction rai ring ray.diffraction synthesi singl
64.40% compound crystal single.crystal.ray crystal.ray single.crystal structur nmr
crystal.ray.diffraction diffract rai ray.diffraction synthesi singl

Sample Cluster Record Titles

Synthesis and characterization of new (N -> B) phenyl substituted[N-benzyliminodiacetate-O,O',N]boranes

Synthesis and structure of spirooxazines of the thieno[3,2-b]pyrroline series

Facile syntheses of new pyrazolo [1,5-a] pyrimidines derivatives via reactions of enaminones with aminopyrazole

Synthesis, crystal structure and biological activities of 2-4-fluorophenyl)-2-oxo-1-(1H-1,2,4-triazol-1-yl) ethyl morpholine-4-carbodithioate

Synthesis and crystal structure of bis{(mu-chloro)-chloro-[N-benzoyl-N '-(2-hydroxyethyl)thiourea] mercury(II)}

Synthesis, crystal structure, and solid-state NMR spectroscopy of a salt-inclusion stannosilicate: [Na3F][SnSi3O9]

Synthesis of N-benzoyl-N '-arylselenoureas under phase transfer catalysis conditions and suprarnolecular crystal structure

Studies on synthesis, structure and biological activities of novel triazole compounds containing thioamide

Crystal and molecular structure of 2,3,5,6-bis(ortho-1,10-decylidene)dihydropyrazine

Cluster Metrics

Authors
xu, lz 7
yin, hd 5
li, wh 5
hou, br 5
chernega, an 5
wen, lr 4
wang, xl 4
qin, yq 4
liu, w 4
li, m 4

li, k 4
antipin, my 4
zhu, cy 3
zhang, ym 3
zhang, ss 3

Sources
journal of organometallic chemistry 12
chinese journal of organic chemistry 12
zeitschrift fur anorganische und allgemeine chemie 10
russian journal of general chemistry 10
chemical research in chinese universities 10
chemical journal of chinese universities-chinese 10
journal of natural products 8
acta crystallographica section e-structure reports online 8
zeitschrift fur naturforschung section b-a journal of chemical sciences 7
journal of molecular structure 7
inorganica chimica acta 7
inorganic chemistry 7
chinese journal of inorganic chemistry 7
chinese journal of chemistry 7
russian chemical bulletin 6

Keywords
chemistry, multidisciplinary 84
chemistry, inorganic & nuclear 78
crystal structure 51
chemistry, organic 33
chemistry, organic 33
complexes 28
crystal-structure 24
derivatives 23
derivatives 20
chemistry, physical 19
chemistry, applied 18
crystal 18
chemistry 18
crystallography 16
crystal-structure 13

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2005 228
2004 52

Country
peoples r china 93

usa 39
germany 38
russia 19
england 12
italy 10
spain 9
japan 9
ukraine 8
poland 8
india 8
france 8
canada 8
taiwan 6
south korea 6

Institution

russian acad sci 16
chinese acad sci 16
qingdao univ sci & technol 13
nankai univ 9
natl acad sci ukraine 7
ocean univ china 6
jilin univ 6
univ munich 5
univ durham 5
ne normal univ 5
zhejiang univ technol 4
univ wurzburg 4
univ texas 4
moscow mv lomonosov state univ 4
liaocheng univ 4

DataBase

science citation index 280

- # CLUSTER 108

  Crystal structure at the resolution of a few angstroms using single crystal x-ray diffraction (574 Records)

(Countries: China, followed by USA, followed by Russia, Germany, France. Institutions: CAS, RAS, Moscow Lomonosov State University, Jilin University, Nanjing University. USA includes University of North Texas.).

Cluster Syntax Features

Descriptive Terms

angstrom 47.1%, crystal 5.5%, beta 2.0%, space 2.0%, crystal.structure 1.9%, angstrom.beta 1.7%, structur 1.7%, compound 1.4%, h2o 1.1%, monoclin 1.0%, center 1.0%, single.crystal.ray 0.9%, crystal.ray.diffraction 0.9%, crystal.ray 0.9%, diffract 0.9%

Discriminating Terms

angstrom 32.1%, film 2.0%, crystal 1.6%, angstrom.beta 1.2%, crystal.structure 1.1%, surfac 0.9%, space 0.9%, beta 0.9%, nanoparticl 0.7%, particl 0.7%, monoclin 0.6%, carbon 0.6%, nanotub 0.6%, crystal.ray.diffraction 0.6%, single.crystal.ray 0.6%

Single Word Terms

angstrom 573, structur 525, rai 503, crystal 495, diffract 484, space 406, beta 332, singl 316, compound 256, two 247, monoclin 221, synthesi 200, synthes 196, bond 195, data 189

Double Word Terms

ray.diffraction 453, single.crystal 283, crystal.ray 261, crystal.structure 259, angstrom.beta 229, monoclinic.space 122, angstrom.alpha 115, synthesis.crystal 94, unit.cell 90, diffraction.data 80, crystal.structures 79, cell.parameters 77, structure.single 77, crystallizes.monoclinic 65, system.space 63

Triple Word Terms

single.crystal.ray 260, crystal.ray.diffraction 253, synthesis.crystal.structure 84, structure.single.crystal 74, ray.diffraction.data 65, powder.ray.diffraction 57, ray.diffraction.crystal 49, angstrom.alpha.beta 46, unit.cell.parameters 44, crystallizes.monoclinic.space 42, alpha.beta.gamma 40, center.dot.h2o 40, crystal.structure.single 37, monoclinic.system.space 30, structures.single.crystal 29

Term Cliques
57.17% angstrom crystal beta space angstrom.beta structur compound h2o monoclin center single.crystal.ray crystal.ray.diffraction crystal.ray diffract
58.72% angstrom crystal beta space crystal.structure angstrom.beta structur compound monoclin center single.crystal.ray crystal.ray.diffraction crystal.ray diffract

Sample Cluster Record Titles

Crystal structure of human arginase I at 1.29-angstrom resolution and exploration of inhibition in the immune response

Crystal structure of poly(dithiotriethylene adipate)

Expression, purification and crystal structure of a truncated acylpeptide hydrolase from Aeropyrum pernix K1

Crystal structures of pentakis(dimethyl sulfoxide)dioxoneptunium(VI) silicotungstate, [NpO2(DMSO)(5)](2)SiW12O40, and aquatetrakis(dimethyl sulfoxide)dioxouranium(VI) silicomolybdate hydrate, UO2(DMSO)(4)(H2O)(2)SiMo12O40 center dot H2O

Synthesis and crystal structure of bis[tetrachloroiron(III)] 4,7,13,16,21,24-hexaoxa-1,10-diazoniabicyclo[8.8.8]hexacosane

Synthesis, crystal structure and properties of a organoammonium heteropoly complex, (C6H18N2)(3)[P2Mo5O23] center dot 4H(2)O

Synthesis and crystal structure of one-dimensional cis-syn-cis-dicyclohexyl-18-crown-6 complexes: [Na(DC18C6-A)](2)[M(mnt)(2)] (M = Pd, Pt)

A novel metal-organic coordination complex crystal: tri-allylthiourea zinc chloride (ATZC)

The crystal structure of 1-(4-chlorophenyl)-3-(4-methylbenzoyl)thiourea

Cluster Metrics

Authors

yang, gy 13
zheng, st 10
chekhlov, an 8
zhang, j 7
wang, eb 7
zhang, y 6
richmond, mg 6
yakubovich, ov 5
xu, rr 5
xu, l 5
xu, dj 5
tu, sj 5
sergienko, vs 5
nowogrocki, g 5
li, gh 5

Sources

chinese journal of structural chemistry 56
journal of solid state chemistry 52
inorganic chemistry 39
journal of chemical crystallography 32
zeitschrift fur anorganische und allgemeine chemie 23
solid state sciences 20
journal of molecular structure 20
journal of alloys and compounds 19
crystallography reports 18
journal of structural chemistry 16
chemistry of materials 16
russian journal of inorganic chemistry 12
russian journal of coordination chemistry 11
journal of coordination chemistry 11
synthesis and reactivity in inorganic metal-organic and nano-metal chemistry 9

Keywords

chemistry, inorganic & nuclear 265
crystal structure 116
chemistry, physical 95
crystallography 86
chemistry, physical 70
crystallography 63
crystal-structure 59
materials science, multidisciplinary 48
crystal-structure 47
chemistry 46
spectroscopy 42

crystal structure 39
complexes 38
x-ray diffraction 33
crystal 32

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2004 100
2006 2

Country
peoples r china 162
usa 101
russia 76
germany 49
france 44
india 27
japan 25
canada 23
italy 22
south korea 18
england 18
austria 18
poland 14
spain 12
taiwan 9

Institution
chinese acad sci 49
russian acad sci 47
moscow mv lomonosov state univ 23
jilin univ 15
nanjing univ 14
univ vienna 10
nankai univ 10
ne normal univ 9
xuzhou normal univ 8
zhejiang univ 7
univ tokyo 7
suzhou univ 7
univ n texas 6
st petersburg state univ 6
polish acad sci 6

DataBase
science citation index 574

- # CLUSTER 148
  Crystal and bond structure of coordination polymers, complexes, hydrates, and other compounds, emphasizing studies on hydrogen bonds and single crystal x-ray diffraction (306 Records)

(Countries: China very dominant, Germany, USA, France. Institutions: CAS, Jilin University, Nankai University, Nanjing University.).

Cluster Syntax Features

Descriptive Terms

center 14.2%, dot 9.6%, h2o 5.6%, crystal 5.3%, coordin 2.4%, bond 2.0%, compound 2.0%, crystal.structure 1.8%, structur 1.6%, hydrogen 1.6%, complex 1.4%, single.crystal.ray 1.1%, crystal.ray 1.1%, single.crystal 1.0%, dimension 1.0%

Discriminating Terms

center 9.3%, dot 4.7%, h2o 3.8%, film 2.2%, crystal 1.6%, coordin 1.4%, crystal.structure 1.1%, surfac 1.0%, compound 0.8%, nanoparticl 0.8%, bond 0.7%, particl 0.7%, single.crystal.ray 0.7%, crystal.ray 0.7%, carbon 0.7%

Single Word Terms

structur 271, crystal 255, rai 243, diffract 216, center 197, dot 182, singl 167, synthes 154, bond 150, compound 149, two 148, synthesi 148, space 147, hydrogen 133, form 128

Double Word Terms

ray.diffraction 194, single.crystal 158, crystal.structure 135, crystal.ray 129, synthesis.crystal 83, hydrogen.bonds 79, one.dimensional 55, three.dimensional 54, system.space 49, diffraction.crystal 43, coordination.polymer 42, monoclinic.space 39, water.molecules 39, oxygen.atoms 34, crystal.structures 32

Triple Word Terms
single.crystal.ray 129, crystal.ray.diffraction 118, synthesis.crystal.structure 77, ray.diffraction.crystal 35, h2o.center.dot 27, center.dot.h2o 26, monoclinic.system.space 25, center.dot.hydrogen 21, structure.single.crystal 21, ray.single.crystal 20, crystal.structure.ray 19, diffraction.crystal.belongs 19, single.crystal.diffraction 16, structure.ray.diffraction 15, one.dimensional.chain 15

Term Cliques
51.99% crystal bond crystal.structure structur hydrogen complex single.crystal.ray crystal.ray single.crystal dimension
53.10% crystal bond compound crystal.structure structur hydrogen single.crystal.ray crystal.ray single.crystal dimension
51.57% crystal coordin bond crystal.structure structur complex single.crystal.ray crystal.ray single.crystal dimension
52.68% crystal coordin bond compound crystal.structure structur single.crystal.ray crystal.ray single.crystal dimension
50.42% h2o crystal coordin crystal.structure structur complex single.crystal.ray crystal.ray single.crystal dimension
51.54% h2o crystal coordin compound crystal.structure structur single.crystal.ray crystal.ray single.crystal dimension
55.08% center dot crystal bond crystal.structure structur hydrogen complex single.crystal.ray crystal.ray single.crystal
56.09% center dot crystal bond compound crystal.structure structur hydrogen single.crystal.ray crystal.ray single.crystal
55.10% center dot h2o crystal crystal.structure structur complex single.crystal.ray crystal.ray single.crystal
56.21% center dot h2o crystal compound crystal.structure structur single.crystal.ray crystal.ray single.crystal

Sample Cluster Record Titles

A new one-dimensional coordination polymer [Co(CCl3COO)(2)(CH3OH)(2)(mu-4,4 '-bipy)](n): Synthesis and structural aspects

Iron(II) and nickel(II)-thiocyanato complexes of 1-alkyl-2-(arylazo)imidazole: single crystal X-ray structure of [Fe(MeaaiEt)(2)(NCS)(2)] (MeaaiEt=1-ethyl-2(p-tolylazo)imidazole) and [Ni(MeaaiMe)(NCS)(2)(H2O)(2)] center dot 2DMF (MeaaiMe=1-methyl-2(p-tolylazo)imidazole)

Synthesis of a metal-dicarboxylate hybrid with three dimensional Na-O-Cu connectivity: structure, magnetic property and controlled solid state thermolysis leading to CuO nanorod

[Study on synthesis, structure and properties of the N,N '-dibenzyl-benzimidazolium tetrachlorocuprate(II) complex]

[Synthesis and crystal structure of a novel two-dimensional network copper(II) coordination polymer {Cu(mu(2)-C10H8N2O3)(mu(2)-C6H12N4)(1/2)}(n)]

[Coordination network: synthesis, characterization, crystal structure and packing of thallium m-nitrobenzenesulfonate, Tl(m-NO2C6H4SO3)]

[Synthesis and crystal structure of polymeric aqua (2,2 '-bipyridine)(mu-isonicotinato)copper(II) nitrate dihydrate]

[Investigations of the structure of H2O clusters adsorbed on TiO2 surfaces by near-infrared absorption spectroscopy]

[Crystal and electronic structure of novel organic-inorganic hybrid coordination polymer {[C12H28N2][(Pb3I8) (DMF)(2)]center dot 2DMF}(n)]

Cluster Metrics

Authors
gao, s 13
zhao, h 11
huo, lh 11
xu, l 10
wang, eb 9
zhao, jg 8
li, yz 8
li, gh 8
yu, jh 7
zhang, y 6
xu, rr 5
wang, j 5
taulelle, f 5
lu, wg 5
lu, ld 5

Sources
chinese journal of inorganic chemistry 64
journal of molecular structure 16
inorganic chemistry 14
acta chimica sinica 12
chinese journal of structural chemistry 11
acta crystallographica section e-structure reports online 9

zeitschrift fur anorganische und allgemeine chemie 8
chemical journal of chinese universities-chinese 8
acta crystallographica section c-crystal structure communications 8
chinese journal of chemistry 7
journal of coordination chemistry 6
crystengcomm 6
crystal growth & design 6
comptes rendus chimie 6
journal of the american chemical society 5

Keywords
chemistry, inorganic & nuclear 141
crystal structure 101
chemistry, multidisciplinary 70
complexes 46
crystallography 33
chemistry, physical 33
crystal-structure 27
crystal 23
hydrothermal synthesis 22
synthesis 21
crystal-structure 19
chemistry 19
hydrothermal synthesis 18
design 18
crystallography 18

Publication Year
2005 279
2004 27

Country
peoples r china 174
germany 27
usa 20
france 18
russia 14
japan 14
india 13
canada 10
poland 9
england 8
italy 7
spain 6
south korea 5
taiwan 4

switzerland 4

Institution

chinese acad sci 26
jilin univ 17
nankai univ 12
nanjing univ 11
heilongjiang univ 10
russian acad sci 9
ne normal univ 9
nanjing univ sci & technol 6
guangxi normal univ 6
adam mickiewicz univ poznan 6
zhejiang univ 5
univ versailles 5
suzhou univ 5
shaoguan univ 5
nw univ xian 5

DataBase

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- # CLUSTER 125
  Metal complexes and coordination polymers, especially copper (Cu), cadmium (Cd), and pyridyl compounds, with emphasis on synthesis and crystal structure (205 Records)

(Countries: China very dominant, USA, Germany, Spain. Institutions: CAS dominant, Nanjing University, University of Barcelona, Nankai University.).

Cluster Syntax Features

Descriptive Terms
cu 15.6%, complex 9.1%, coordin 5.8%, ligand 5.6%, copper 4.2%, center 3.9%, h2o 2.8%, bridg 2.4%, dot 2.2%, clo4 1.7%, coordination.polymers 1.1%, bi 1.1%, cd 1.1%, pyridyl 1.0%, structur 0.8%

Discriminating Terms
cu 9.2%, complex 4.3%, coordin 3.7%, ligand 3.3%, copper 2.3%, film 2.1%, center 2.0%, h2o 1.7%, bridg 1.5%, clo4 1.2%, surfac 1.0%, coordination.polymers 0.8%, nanoparticl 0.7%, particl 0.7%, pyridyl 0.7%

Single Word Terms
complex 168, structur 165, ligand 149, rai 144, cu 123, coordin 122, crystal 122, two 118, diffract 114, copper 88, center 87, bridg 85, form 83, reaction 82, synthes 78

Double Word Terms

ray.diffraction 104, single.crystal 64, crystal.ray 58, coordination.polymers 41, crystal.structure 36, one.dimensional 34, two.dimensional 31, crystal.structures 30, self.assembly 30, coordination.polymer 23, synthesis.crystal 23, copper.complexes 22, magnetic.susceptibility 22, verlag.gmbh 22, vch.verlag 22

Triple Word Terms

single.crystal.ray 58, crystal.ray.diffraction 49, vch.verlag.gmbh 22, gmbh.co.kgaa 19, verlag.gmbh.co 19, co.kgaa.69451 18, kgaa.69451.weinheim 18, center.dot.h2o 18, synthesis.crystal.structure 13, structures.single.crystal 13, h2o.center.dot 12, center.dot.cu 10, distorted.square.pyramidal 10, no3.center.dot 10, magnetic.susceptibility.measurements 10

Term Cliques

40.91% coordin ligand h2o clo4 coordination.polymers bi pyridyl structur
40.73% coordin ligand h2o clo4 coordination.polymers bi cd structur
44.09% coordin ligand center h2o coordination.polymers bi pyridyl structur
45.00% coordin ligand center h2o dot coordination.polymers pyridyl structur
43.63% coordin ligand center h2o bridg coordination.polymers bi cd structur
44.44% coordin ligand center h2o bridg dot coordination.polymers cd structur
57.80% complex ligand copper bridg bi structur
59.02% complex ligand copper bridg dot structur
48.66% complex coordin ligand h2o clo4 bi pyridyl structur
48.48% complex coordin ligand h2o clo4 bi cd structur
51.83% complex coordin ligand center h2o bi pyridyl structur
52.74% complex coordin ligand center h2o dot pyridyl structur
50.51% complex coordin ligand center h2o bridg bi cd structur
51.33% complex coordin ligand center h2o bridg dot cd structur
62.44% cu complex ligand clo4 structur
63.25% cu complex ligand copper bridg structur

Sample Cluster Record Titles

Synthesis, crystal structures and spectroscopic characterization of two neutral heterobimetallic clusters MS4Cu4(pz(Me2))(6)X-2 (where M = Mo (1) or W (2), X = Cl (1) or disordered Cl/Br (2), and pz(Me2)=3,5-dimethylpyrazole)

Novel copper(II)-dien-imidazole/imidazolate-bridged copper(II) complexes - Crystal structure of [Cu(dien)(Him)](ClO4)(2) and of [(dien)Cu(mu-im)Cu(dien)](ClO4)(3), a homobinuclear model for the copper(II) site of the CuZn-superoxide dismutase

Copper coordination compounds of chelating imidazole-azo-aryl ligand. The molecular structures of bis[1-ethyl-2-(p-tolylazo)imidazole]-bis-(azido)copper(II) and bis[1-methyl-2-(phenylazo)imidazole]-bis(thiocyanato)copper(II)

[Luminescent Zn and Cd coordination polymers]

[Copper(II) and nickel(II) complexes of N,N-bis(2-hydroxyethyl)octamethyl-1,4,8,11-tetraazacyclotetradecane]

[Synthesis and crystal structure of bridge binuclear Schiff base Cu(II) complex]

[Self-assembly of copper(II) complexes with a dibasic tridentate ligand and monodentate N-heterocycles: structural, magnetic and EPR studies]

[Syntheses, structures and characteristic of three copper(II) coordination polymers with flexible ligand 1,4-bis(1,2,4-triazol-1-ylmethyl)benzene]

[Synthesis, structure, and fluorescence of two cadmium(II)-citrate coordination polymers with different coordination architectures]

Cluster Metrics

Authors
lloret, f 7
li, yz 5
kim, c 5
julve, m 5
zhang, y 4
zhang, j 4
yuan, dq 4
yao, yg 4
lu, cz 4
li, bl 4
kim, y 4
hong, sj 4
hong, mc 4
han, l 4
fenske, d 4

Sources
european journal of inorganic chemistry 23
inorganic chemistry 20
inorganica chimica acta 17
journal of molecular structure 13
synthesis and reactivity in inorganic metal-organic and nano-metal chemistry 12
dalton transactions 9
chemical communications 9

inorganic chemistry communications 8
polyhedron 7
new journal of chemistry 7
crystal growth & design 7
zeitschrift fur anorganische und allgemeine chemie 6
journal of coordination chemistry 4
crystengcomm 4
transition metal chemistry 3

Keywords
chemistry, inorganic & nuclear 112
chemistry, multidisciplinary 44
complexes 43
crystal-structure 32
ligands 27
crystal structure 23
complexes 22
chemistry 20
crystal-structures 19
network 18
magnetic-properties 18
magnetic-properties 16
chemistry, physical 16
crystallography 15
networks 15

Publication Year
2005 182
2004 23

Country
peoples r china 76
usa 21
germany 19
spain 18
japan 16
india 16
england 15
italy 13
south korea 8
poland 7
taiwan 6
canada 6
turkey 5
russia 5
greece 5

Institution
chinese acad sci 20
nanjing univ 9
univ barcelona 8
nankai univ 8
univ valencia 7
suzhou univ 5
ewha womans univ 5
univ nottingham 4
univ karlsruhe 4
russian acad sci 4
jilin univ 4
univ wroclaw 3
univ sci & technol china 3
univ parma 3
univ ioannina 3

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science citation index 205

- CLUSTER 136
  Metal complexes and coordination polymers, focusing on structure and reactivity, especially of nickel (Ni) complexes, chelates, and pyridines (237 Records)

(Countries: USA, China, Germany. Institutions: RAS, Nankai University, CAS. USA includes University of South Carolina.).

Cluster Syntax Features

Descriptive Terms
ligand 53.3%, complex 9.2%, coordin 3.5%, bi 1.1%, metal 0.9%, bridg 0.8%, compound 0.8%, atom 0.6%, structur 0.5%, chelat 0.5%, two 0.5%, crystal 0.4%, ni 0.4%, reaction 0.3%, pyridin 0.3%

Discriminating Terms
ligand 36.2%, complex 4.3%, coordin 2.1%, film 2.0%, surfac 0.9%, particl 0.7%, carbon 0.6%, nanoparticl 0.6%, nanotub 0.6%, layer 0.6%, temperatur 0.5%, bi 0.5%, phase 0.5%, deposit 0.5%, magnet 0.4%

Single Word Terms
ligand 237, complex 176, structur 155, rai 116, coordin 116, two 105, metal 102, diffract 100, crystal 98, synthesi 83, atom 80, synthes 74, reaction 73, compound 68, form 65

Double Word Terms
ray.diffraction 91, single.crystal 49, crystal.ray 42, crystal.structure 33, solid.state 31, self.assembly 26, metal.complexes 22, crystal.structures 21, nmr.spectroscopy 18, oxygen.atoms 16, distorted.octahedral 15, room.temperature 14, metal.ligand 13, transition.metal 13, vch.verlag 13

Triple Word Terms
single.crystal.ray 42, crystal.ray.diffraction 37, vch.verlag.gmbh 13, co.kgaa.69451 11, kgaa.69451.weinheim 11, verlag.gmbh.co 11, gmbh.co.kgaa 11, synthesis.crystal.structure 9, structures.ray.diffraction 9, schiff.base.ligand 7, density.functional.theory 7, ray.diffraction.complex 6, ligand.charge.transfer 6, metal.ligand.charge 6, complexes.single.crystal 5

Term Cliques
40.88% ligand coordin bi compound atom structur chelat pyridin
40.89% ligand coordin bi bridg compound atom structur two crystal reaction pyridin
44.82% ligand complex coordin metal atom structur chelat ni pyridin
45.03% ligand complex coordin metal bridg atom structur two crystal ni pyridin
46.18% ligand complex coordin bi metal atom structur chelat pyridin
44.87% ligand complex coordin bi metal bridg atom structur two crystal reaction pyridin

Sample Cluster Record Titles

Synthesis of mono-coordinate iron(II)-phen complex via a solid state ligand exchange process from iron(II) oxalate dihydrate at room temperature under mechanical stressing

Coordination studies of 5,6-diphenyl-3-(2-pyridyl)-1,2,4-triazine towards Zn2+ cation. Synthesis and characterization by X-ray diffraction and spectroscopic methods

Mixed-ligand complexes of Ni(i-Bu2PS2)(2) with 4-aminopyridine. Structure of [Ni(4-NH2Py)(i-Bu2PS2)(2)]

Trinuclear nickel complexes with triplesalen ligands: Simultaneous occurrence of mixed valence and valence tautomerism in the oxidized species

Anion template effect and the polymerization degree - Diversity through flexibility

[Abiotic metallofoldamers as electrochemically responsive molecules]

[Synthesis, crystal structure and magnetic properties of dinuclear nickel(II) complex]

[Aqueous electrochemistry of binuclear copper complex with Robson-type ligand: dissolved versus surface-immobilized reactant]

[Synthesis and coordination chemistry of fluorinated xanthate ligands]

Cluster Metrics

Authors
lehn, jm 5
bu, xh 5
adams, rd 4
zhang, rh 3
zhang, j 3
yin, hd 3
ruzicka, a 3
li, jr 3
lang, es 3
jambor, r 3
holecek, j 3
dostal, l 3
cisarova, i 3
zhu, wx 2
zheng, xj 2

Sources
inorganic chemistry 22
journal of the american chemical society 13
inorganica chimica acta 13
european journal of inorganic chemistry 13
zeitschrift fur anorganische und allgemeine chemie 12
journal of organometallic chemistry 12
synthesis and reactivity in inorganic metal-organic and nano-metal chemistry 11
polyhedron 7
chemistry-a european journal 7
organometallics 6
chemical communications 4
angewandte chemie-international edition 4
russian journal of inorganic chemistry 3
russian journal of coordination chemistry 3

langmuir 3

Keywords
chemistry, inorganic & nuclear 110
chemistry, multidisciplinary 57
complexes 43
complexes 28
chemistry, organic 23
crystal-structure 20
chemistry 20
chemistry, physical 19
crystal-structures 16
crystal structure 16
copper(ii) 16
coordination 14
ligands 13
derivatives 12
crystal 12

Publication Year
2005 214
2004 21
2006 2

Country
usa 50
peoples r china 41
germany 31
spain 19
france 16
russia 14
japan 13
india 11
south korea 10
italy 9
england 9
canada 9
switzerland 6
czech republic 6
turkey 5

Institution
russian acad sci 8
nankai univ 8
chinese acad sci 8
univ s carolina 5

univ pardubice 4
nanjing univ 4
liaocheng univ 4
beijing normal univ 4
univ wurzburg 3
univ strasbourg 1 3
univ milan 3
univ jyvaskyla 3
univ fed santa maria 3
univ durham 3
univ british columbia 3

DataBase
science citation index 237

- # CLUSTER 207
  Metal complexes and coordination polymers, emphasizing structure, reactivity, NMR spectroscopy, and synthesis, especially of platinum (Pt) and chlorine (Cl) complexes (647 Records)

(Countries: China dominant, USA, Germany, Japan, Russia. Institutions: RAS, CAS, followed by Nanjing University, CNR.).

Cluster Syntax Features

Descriptive Terms
complex 57.5%, ligand 2.8%, iii 1.7%, structur 0.8%, cl 0.7%, coordin 0.6%, crystal 0.6%, reaction 0.6%, metal 0.6%, beta 0.6%, nmr 0.5%, compound 0.5%, bi 0.5%,

synthesi 0.4%, pt 0.4%

Discriminating Terms
complex 40.0%, film 2.1%, ligand 1.6%, iii 1.0%, surfac 0.9%, particl 0.7%, nanoparticl 0.7%, carbon 0.6%, nanotub 0.6%, layer 0.6%, deposit 0.5%, temperatur 0.5%, size 0.4%, si 0.4%, cl 0.4%

Single Word Terms
complex 640, structur 416, rai 321, ligand 275, diffract 262, crystal 229, synthesi 226, two 206, reaction 198, metal 186, synthes 181, form 164, atom 146, properti 145, nmr 143

Double Word Terms
ray.diffraction 225, single.crystal 94, crystal.ray 84, crystal.structure 67, solid.state 64, crystal.structures 55, nmr.spectroscopy 41, metal.complexes 37, room.temperature 34, molecular.structures 34, iii.complexes 33, square.planar 32, metal.ions 30, structure.complex 29, structures.complexes 29

Triple Word Terms
single.crystal.ray 83, crystal.ray.diffraction 65, vch.verlag.gmbh 20, structures.ray.diffraction 19, differential.scanning.calorimetry 18, gmbh.co.kgaa 18, verlag.gmbh.co 18, complexes.ray.diffraction 17, co.kgaa.69451 17, kgaa.69451.weinheim 17, powder.ray.diffraction 15, ray.diffraction.complexes 15, complexes.single.crystal 15, ray.crystal.structure 14, atomic.force.microscopy 13

Term Cliques
40.44% complex ligand structur coordin crystal reaction beta compound synthesi
35.03% complex ligand structur cl crystal reaction nmr compound bi synthesi pt
36.22% complex ligand structur cl crystal reaction metal nmr compound synthesi pt
36.36% complex ligand structur cl coordin crystal reaction nmr compound bi synthesi
37.56% complex ligand structur cl coordin crystal reaction metal nmr compound synthesi
35.36% complex ligand iii structur cl coordin nmr compound bi synthesi
36.68% complex ligand iii structur cl coordin metal nmr compound synthesi

Sample Cluster Record Titles

Spectroscopic evidence for Pt-Pt interaction in a Langmuir-Blodgett film of an amphiphilic platinum(II) complex

Synthesis, characterization, and cytotoxic activity of copper(II) and platinum(II) complexes of 2-benzoylpyrrole and X-ray structure of bis[2-benzoylpyrrolato(N,O)]copper(II)

[Bimetallic cluster complexes: synthesis, structures and applications to catalysis]

[Fluorescent self-assembled monolayers of bis(salicylaldiminato)zinc(II) Schiff-base complexes]

[Synthesis, characterisation, electrochemistry and luminescence studies of 9-anthrylgold(I) complexes]

[Metal complexes for molecular electronics and photonics]

[Synthesis of nanometer amino acid heteropoly charge-transfer complex (HPhe)(3)PMo12O40 center dot 2H(2)O by one step solid state reaction at room temperature]

[Synthesis of phosphorescent platinum complexes with 3-aryl pyridazine as prominent emitting materials in organic light-emitting device]

[Self-assembled nanowires of lipid-packaged halogen-bridged platinum complexes formed by one-pot oxidation of Pt(en)(2) complexes by Au(III) ions]

Cluster Metrics

Authors
yam, vww 9
zhu, ny 6
perez, j 6
zhang, y 5
yu, kb 5
white, ah 5
wang, y 5
skelton, bw 5
pillinger, m 5
nam, w 5
li, yz 5
li, l 5
kim, km 5
goncalves, is 5
antipin, my 5

Sources
synthesis and reactivity in inorganic metal-organic and nano-metal chemistry 48
organometallics 27
journal of organometallic chemistry 23
inorganica chimica acta 23
inorganic chemistry 21

dalton transactions 21
european journal of inorganic chemistry 20
russian chemical bulletin 16
chinese journal of inorganic chemistry 15
journal of the american chemical society 14
chemistry-a european journal 14
polyhedron 13
zeitschrift fur anorganische und allgemeine chemie 10
journal of physical chemistry b 10
inorganic chemistry communications 9

Keywords
chemistry, inorganic & nuclear 223
chemistry, multidisciplinary 131
ligands 74
chemistry, physical 62
chemistry, organic 57
complexes 51
crystal-structure 48
crystal structure 47
complexes 45
chemistry 43
crystal-structure 36
derivatives 34
polymer science 27
metal-complexes 27
luminescence 26

Publication Year
2005 571
2004 70
2006 6

Country
peoples r china 151
usa 75
germany 64
japan 55
russia 50
india 44
spain 34
italy 27
france 26
south korea 25
england 23
taiwan 19

australia 17
canada 15
switzerland 12

Institution
russian acad sci 41
chinese acad sci 39
nanjing univ 11
cnr 10
univ tokyo 9
univ hong kong 9
natl sun yat sen univ 9
nankai univ 9
moscow mv lomonosov state univ 9
zhejiang univ 7
univ sci & technol china 7
univ murcia 7
univ aveiro 7
osaka univ 7
ewha womans univ 7

DataBase
science citation index 647

- ## CLUSTER 23
  Structure, reactions, and synthesis of metal complexes, especially arene complexes and those containing chlorine (Cl), the hemilabile ligand, amines, and zirconium (Zr) (126 Records)

(Countries: Spain, USA, China. Institutions: RAS, University of Zaragoza, University Alcala de Henares. USA Include University of North Texas, University of Houston.).

Cluster Syntax Features

Descriptive Terms
eta 58.1%, complex 6.6%, eta.eta 2.7%, cl 1.3%, pph2 1.1%, ch2 1.0%, eta.c5h5 1.0%, ligand 1.0%, reaction 0.9%, c5h5 0.9%, nme2 0.8%, zr 0.7%, sime3 0.6%, thf 0.6%, ru 0.5%

Discriminating Terms
eta 33.9%, complex 2.3%, film 1.7%, eta.eta 1.6%, surfac 0.8%, pph2 0.6%, cl 0.6%, nanoparticl 0.6%, eta.c5h5 0.6%, particl 0.6%, c5h5 0.5%, layer 0.5%, ch2 0.5%, magnet 0.5%, nanotub 0.5%

Single Word Terms
structur 115, complex 110, rai 109, eta 107, diffract 99, reaction 91, ligand 71, compound 62, crystal 56, synthesi 51, yield 51, afford 49, molecular 48, nmr 44, cl 41

Double Word Terms
ray.diffraction 59, eta.eta 37, single.crystal 30, molecular.structures 29, crystal.ray 29, eta.c5h5 23, nmr.spectroscopy 22, complexes.eta 20, solid.state 17, fe.eta 16, molecular.structure 16, vch.verlag 14, verlag.gmbh 14, crystal.structure 14, structures.complexes 12

Triple Word Terms
single.crystal.ray 29, vch.verlag.gmbh 14, crystal.ray.diffraction 14, verlag.gmbh.co 10, kgaa.69451.weinheim 9, co.kgaa.69451 9, gmbh.co.kgaa 9, structure.ray.diffraction 8, eta.eta.eta 8, solid.state.structure 7, molecular.structures.ray 7, eta.c5h5.fe 6, eta.c5h4.fe 6, c5h5.fe.eta 6, fe.eta.eta 6

Term Cliques
38.49% pph2 ligand reaction ru
38.69% pph2 ligand reaction zr
15.48% pph2 eta.c5h5 c5h5 ru
15.67% pph2 eta.c5h5 c5h5 zr
29.76% pph2 ch2 reaction ru
29.96% pph2 ch2 reaction zr
41.38% complex cl ligand reaction zr sime3 thf
40.70% complex cl ligand reaction nme2 zr sime3
28.23% complex cl eta.c5h5 c5h5 zr sime3 thf
40.61% complex cl ch2 reaction zr thf
45.37% complex eta.eta ligand reaction sime3 thf
44.58% complex eta.eta ligand reaction nme2 sime3

57.80% eta complex cl ligand reaction ru
58.20% eta complex cl ligand reaction thf
42.46% eta complex cl eta.c5h5 c5h5 ru
42.86% eta complex cl eta.c5h5 c5h5 thf
51.98% eta complex cl ch2 reaction ru
52.38% eta complex cl ch2 reaction thf
57.28% eta complex eta.eta ligand reaction ru
57.67% eta complex eta.eta ligand reaction thf
51.46% eta complex eta.eta ch2 reaction ru
51.85% eta complex eta.eta ch2 reaction thf

Sample Cluster Record Titles

Unexpected hydride addition to azobenzene mediated by metallic samarium: Synthesis and molecular structure of (ArO)(THF)(2)Sm(eta(2)-PhNHNPh)(2) (Ar = C6H2-t-Bu-2-2,6-Me-4)

Allyl(acetylacetonato)palladium (II) complexes: versatile precursors for the synthesis of dimeric allylpalladium (II) complexes

The synthesis and characterisation of bis(phosphane)-linked (eta(6)-p-cymene)ruthenium(II)-borane compounds

(eta(5)-pentamethylcyclopentadienyl)iridium(III) complexes with eta(2)-N,O and eta(2)-P,S ligands

Reaction of aryl azides with tris(trimethylsilyl)silyllithium: Synthesis of tmeda or thf adducts of [Li{N(Ar)Si(SiMe3)(3)}] and 1,4-trimethylsilyl migration from oxygen to nitrogen

Synthesis of elastomeric polypropylene in bulk using C-1-symmetric ansa-metallocenes. New aspects of the synthesis of 1-(fluoren-9-yl)-2-(2-methyl-5,6-dihydrocyclopenta[f]-1H-inden-1-yl)etha ne and complexes of zirconium and hafnium with this ligand

Aryl-imido niobium complexes with chloro-silyl and aryl-eta-amidosilyl cyclopentadienyl ligands: X-ray structure of the constrained-geometry compound [Nb(eta(5)-C5H4SiMe2-eta(1)-NAr)(NAr)Cl] (Ar=2,6-Me2C6H3)

Synthesis, structural characterization, and reactivity of 13-vertex lanthanacarboranes bearing eta(7)-arachno-carboranyl ligands

Activation of 1,3,5-trimethyl-1,3,5-triazacyclohexane by OS3(CO)(12) to form amidino [(MeN)(2)CH] cluster complexes

Cluster Metrics

Authors

zanotti, v 5
zacchini, s 5
petrovskii, pv 5
marchetti, f 5
kollipara, mr 5
govindaswamy, p 5
busetto, l 5
royo, p 4
mosquera, meg 4
kudinov, ar 4
krut'ko, dp 4
churakov, av 4
veksler, en 3
teixeira-dias, jjc 3
starikova, za 3

Sources

organometallics 36
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inorganica chimica acta 3
inorganic chemistry communications 2
chinese journal of chemistry 2
chemistry-a european journal 2
synthetic communications 1
synthesis and reactivity in inorganic metal-organic and nano-metal chemistry 1
new journal of chemistry 1

Keywords

chemistry, inorganic & nuclear 102
chemistry, organic 63
reactivity 26
ligands 22
chemistry 22
chemistry, multidisciplinary 17
crystal-structure 17
molecular-structure 15
derivatives 15

complexes 14
crystal-structure 12
ligand 11
crystal 11
ligands 10
molecular-structure 9

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2004 16

Country

spain 23
usa 20
peoples r china 17
russia 12
italy 11
germany 11
france 9
england 8
india 7
japan 6
canada 5
switzerland 4
portugal 4
poland 3
south korea 2

Institution

russian acad sci 10
univ zaragoza 7
univ alcala de henares 7
univ bologna 6
chinese acad sci 5
ne hill univ 4
moscow mv lomonosov state univ 4
univ porto 3
univ oviedo 3
univ n texas 3
univ houston 3
univ castilla la mancha 3
univ bourgogne 3
univ aveiro 3
nankai univ 3

DataBase
science citation index 126

- # CLUSTER 45
  Ruthenium (Ru) complexes (especially those containing bipyridine, triphenylphosphine [PPh3], and chlorine [Cl]), including investigations of structure, reactivity, and synthesis, as well as x-ray diffraction studies (112 Records)

(Countries: USA dominant, Japan, Switzerland, Italy, Germany. Institutions: National Taiwan University, CNR. USA include University of Miami, University of South Carolina.).

Cluster Syntax Features

Descriptive Terms
ru 44.4%, complex 8.5%, bpy 6.9%, ruthenium 5.0%, os 1.9%, ligand 1.9%, pph3 1.9%, cl 1.2%, tpy 1.0%, ru.bpy 0.9%, bipyridin 0.8%, ruthenium.complexes 0.7%, rucl 0.7%, bridg 0.7%, compound 0.6%

Discriminating Terms
ru 27.1%, bpy 4.3%, complex 3.4%, ruthenium 3.0%, film 1.6%, os 1.2%, pph3 1.1%, ligand 0.8%, surfac 0.8%, tpy 0.7%, particl 0.6%, cl 0.6%, ru.bpy 0.6%, nanoparticl 0.6%, layer 0.5%

Single Word Terms
ru 99, complex 93, structur 73, ruthenium 68, ligand 61, rai 55, reaction 54, diffract 50, crystal 43, electron 39, compound 38, synthesi 37, metal 37, two 35, new 34

Double Word Terms
ray.diffraction 43, crystal.ray 28, single.crystal 28, ruthenium.complexes 27, complexes.ru 19, ru.ru 17, ru.bpy 17, bpy.bipyridine 16, complex.ru 16, ruthenium.complex 12, cyclic.voltammetry 12, molecular.structures 10, compounds.ru 10, ru.iii 10, room.temperature 9

Triple Word Terms
single.crystal.ray 28, crystal.ray.diffraction 24, structures.single.crystal 6, ru.bpy.bpy 5, ligand.charge.transfer 5, metal.ligand.charge 5, ru.ru.bond 5, structure.ray.diffraction 5, co.kgaa.69451 5, vch.verlag.gmbh 5, gmbh.co.kgaa 5, verlag.gmbh.co 5, kgaa.69451.weinheim 5, ru.ru.bonds 4, dye.sensitized.solar 4

Term Cliques
31.61% complex pph3 ruthenium.complexes rucl bridg
32.14% complex os tpy bridg
32.14% complex os cl tpy
36.46% complex ruthenium pph3 cl ruthenium.complexes rucl
51.34% ru complex cl tpy
48.04% ru complex pph3 ruthenium.complexes bridg
52.08% ru complex ligand bipyridin bridg compound
50.45% ru complex ligand bipyridin ruthenium.complexes bridg
52.08% ru complex ligand cl bipyridin compound
50.15% ru complex ruthenium pph3 cl ruthenium.complexes
50.26% ru complex ruthenium ligand ru.bpy bipyridin ruthenium.complexes
51.91% ru complex ruthenium ligand cl bipyridin ruthenium.complexes
46.43% ru complex bpy tpy bridg
50.89% ru complex bpy ligand bipyridin bridg
50.64% ru complex bpy ruthenium ligand ru.bpy bipyridin

Sample Cluster Record Titles

Synthesis and characterization of a ruthenocene carboxylate containing ruthenium(II) complex

Electron delocalization in mixed-valence butadienediyl-bridged diruthenium complexes

Synthesis, structures, magnetism and electrochemical properties of triruthenium-acetylide complexes

Electronic and molecular surface structure of Ru(tcterpy)(NCS)(3) and Ru(dcbpy)(2)(NCS)(2) adsorbed from solution onto nanostructured TiO2: A photoelectron spectroscopy study

Synthesis, characterization and fabrication of solar cells making use of [Ru(dcbpy)(tptz)X]X (where X = Cl-, SCN-, CN-) complexes

New high nuclearity platinum-ruthenium carbonyl cluster complexes containing a phenylacetylene ligand: Structures and properties

Selective ligand modification on the periphery of diruthenium compounds: Toward new metal-alkynyl scaffolds

Iminophosphorane-based nucleophilic ruthenium(II) carbene complexes: Unusual C-C coupling and C-H activation promoted by the addition of alkynes to the Ru=C bond

Homoleptic, sigma-bonded octahedral superelectrophilic metal carbonyl cations of [iron(II), ruthenium(II), and osmium(II). Part 2: Syntheses and characterizations of [M(CO)(6)][BF4](2) (M = Fe, Ru, Os)]

Cluster Metrics

Authors

urbanos, fa 3
torres, mr 3
spek, al 3
ren, t 3
priego, jl 3
nazeeruddin, mk 3
lee, gh 3
jimenez-aparicio, r 3
gratzel, m 3
gonzalez-prieto, r 3
de cola, l 3
barral, mc 3
zhu, l 2
yeh, cy 2
williams, id 2

Sources

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inorganica chimica acta 13
inorganic chemistry 13
chemistry-a european journal 7
journal of organometallic chemistry 6
journal of the american chemical society 5
european journal of inorganic chemistry 5
polyhedron 4
journal of molecular catalysis a-chemical 4
journal of physical chemistry b 3
chemistry letters 3
new journal of chemistry 2
journal of solid state electrochemistry 2
journal of cluster science 2
dalton transactions 2

Keywords

chemistry, inorganic & nuclear 64
ruthenium 27
chemistry, multidisciplinary 22
chemistry, organic 20
chemistry, physical 15

ligands 15
crystal-structure 14
complexes 12
complexes 12
chemistry 10
molecular-structure 9
molecular wires 8
transition-metal-complexes 7
crystal 7
transfer 6

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2005 101
2004 11

Country
usa 23
japan 12
switzerland 11
italy 11
germany 11
spain 9
peoples r china 9
france 8
netherlands 6
india 6
taiwan 5
australia 5
sweden 3
england 3
canada 3

Institution
natl taiwan univ 4
cnr 4
univ utrecht 3
univ sao paulo 3
univ miami 3
univ ferrara 3
univ amsterdam 3
swiss fed inst technol 3
uppsala univ 2
univ western australia 2
univ valencia 2
univ ulm 2
univ turin 2

univ s carolina 2
univ rennes 1 2

DataBase
science citation index 112

CATEGORY 15 - 509B2a ***(2 leaf clusters)***

DNA (775 REC)

THRUST

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- DNA studies, emphasizing self-assembly of DNA molecules, DNA-directed assembly of nanostructures (especially nanoparticles), evaluation of protein-DNA binding, and gene delivery (554 Records) Cluster 54
- Detection of DNA, emphasizing hybridization detection, use of microarrays, interaction of DNA with gold nanoparticles, DNA biosensors, and DNA immobilization (221 Records) Cluster 92

- # CLUSTER 54
  DNA studies, emphasizing self-assembly of DNA molecules, DNA-directed assembly of nanostructures (especially nanoparticles), evaluation of protein-DNA binding, and gene delivery (554 Records)

(Countries: USA dominant, Japan, China, Germany. Institutions: CAS dominant, RAS, University of Tokyo. USA include Purdue University, University of Wisconsin, University of Illinois, UCB, Duke University.).

Cluster Syntax Features

Descriptive Terms
dna 81.3%, strand 1.1%, molecul 0.7%, dna.molecules 0.7%, complex 0.5%, assembl 0.4%, bind 0.4%, sequenc 0.3%, protein 0.3%, gene 0.3%, nanoparticl 0.2%, plasmid 0.2%, stranded.dna 0.2%, base 0.2%, singl 0.2%

Discriminating Terms
dna 51.4%, film 1.6%, strand 0.7%, carbon 0.6%, surfac 0.5%, temperatur 0.5%, nanotub 0.5%, magnet 0.5%, layer 0.5%, crystal 0.4%, dna.molecules 0.4%, electron 0.4%, particl 0.4%, deposit 0.4%, oxid 0.4%

Single Word Terms
dna 554, structur 190, molecul 188, surfac 157, complex 155, singl 151, form 150, microscopi 147, strand 147, assembl 144, two 136, forc 135, interact 132, molecular 128, bind 113

Double Word Terms
atomic.force 96, dna.molecules 93, force.microscopy 88, stranded.dna 74, double.stranded 60, plasmid.dna 49, dna.dna 48, microscopy.afm 46, dna.binding 44, self.assembly 43, single.stranded 40, dna.molecule 37, electron.microscopy 36, single.molecule 33, gene.delivery 32

Triple Word Terms
atomic.force.microscopy 82, force.microscopy.afm 46, double.stranded.dna 45, single.stranded.dna 32, surface.plasmon.resonance 24, transmission.electron.microscopy 20, atomic.force.microscope 13, poly.ethylene.glycol 12, single.dna.molecules 12, polymerase.chain.reaction 11, resonance.energy.transfer 11, ray.photoelectron.spectroscopy 11, stranded.dna.molecules 11, calf.thymus.dna 10, deoxyribonucleic.acid.dna 9

Term Cliques
34.01% dna complex gene nanoparticl plasmid
32.07% dna complex bind protein gene plasmid
32.64% dna complex bind sequenc protein base

42.19% dna complex assembl nanoparticl
33.57% dna complex assembl sequenc protein base
30.48% dna strand assembl sequenc protein stranded.dna base
29.88% dna strand molecul bind sequenc protein stranded.dna base singl
29.88% dna strand molecul dna.molecules bind sequenc stranded.dna base singl

Sample Cluster Record Titles

Controlling self-assembly by linking protein folding, DNA binding, and the redox chemistry of heme

A novel method to synthesize versatile multiple-branched DNA (MB-DNA) by reversible photochemical ligation

Assembly of plasmid DNA into liposomes after condensation by cationic lipid in anionic detergent solution

Dielectrophoresis of nanoscale double-stranded DNA and humidity effects on its electrical conductivity

Construction of polycation-based non-viral DNA nanoparticles and polyanion multilayers via layer-by-layer self-assembly

Development of a DNA sensor based on alkanethiol self-assembled monolayer-modified electrodes

Guanine is indispensable for immunoglobulin switch region RNA-DNA hybrid formation

In vitro non-viral gene delivery with nanofibrous scaffolds

DNA-programmed assembly of nanostructures

Cluster Metrics

Authors

wang, l 8
dekker, c 8
yan, h 7
mao, cd 7
seeman, nc 6
roberts, cj 6
turberfield, aj 5

simmel, fc 5
seela, f 5
reif, jh 5
liu, y 5
li, z 5
yin, p 4
yevdokimov, ym 4
wilson, wd 4

Sources

langmuir 25
nano letters 22
journal of the american chemical society 18
proceedings of the national academy of sciences of the united states of america 16
nucleic acids research 15
angewandte chemie-international edition 15
physical review letters 12
biophysical journal 11
biomacromolecules 10
bioconjugate chemistry 10
analytical chemistry 10
physical review e 8
journal of molecular biology 8
biochemistry 8
small 7

Keywords

chemistry, multidisciplinary 103
biochemistry & molecular biology 88
dna 77
dna 49
complexes 45
chemistry, physical 44
molecules 43
materials science, multidisciplinary 38
protein 36
cells 34
biophysics 33
biochemistry & molecular biology 33
binding 32
nanoparticles 30
chemistry, analytical 28

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Country

usa 185
japan 87
peoples r china 68
germany 56
france 37
england 34
south korea 21
italy 17
canada 17
netherlands 16
russia 14
israel 14
taiwan 12
india 11
spain 8

Institution

chinese acad sci 22
russian acad sci 12
univ tokyo 11
purdue univ 10
kyoto univ 10
univ munich 9
natl inst adv ind sci & technol 9
univ wisconsin 8
univ oxford 8
univ nottingham 8
univ illinois 8
univ calif berkeley 8
osaka univ 8
duke univ 8
delft univ technol 8

DataBase

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- # CLUSTER 92
  Detection of DNA, emphasizing hybridization detection, use of microarrays, interaction of DNA with gold nanoparticles, DNA biosensors, and DNA immobilization (221 Records)

(Countries: USA dominant, China, followed by Germany, Japan. Institutions: SE University, University of New South Wales, Northwestern University, Max Planck Institute of Polymer Research, Institute for Mterials Research and Engineering. Other USA include University of Rochester, UCI, UCB, USN, University of Maryland, University of Illinois).

Cluster Syntax Features

Descriptive Terms
dna 38.7%, oligonucleotid 5.2%, hybrid 5.1%, detect 3.9%, gold 2.6%, strand 2.1%, target 1.9%, probe 1.9%, nucleic 1.6%, label 1.3%, microarrai 1.2%, immobil 1.1%, sequenc 1.1%, target.dna 1.0%, nanoparticl 1.0%

Discriminating Terms
dna 23.8%, oligonucleotid 3.5%, hybrid 2.7%, detect 1.8%, film 1.7%, strand 1.3%, nucleic 1.1%, target 1.0%, gold 0.9%, probe 0.8%, microarrai 0.8%, label 0.8%, target.dna 0.7%, structur 0.7%, carbon 0.6%

Single Word Terms
dna 206, hybrid 122, detect 121, surfac 111, probe 100, oligonucleotid 93, gold 90, target 84, singl 82, strand 77, complementari 70, sensit 68, label 66, sequenc 66, nanoparticl 65

Double Word Terms
target.dna 41, dna.hybridization 41, single.stranded 31, stranded.dna 30, nucleic.acid 30, gold.nanoparticles 29, surface.plasmon 26, detection.dna 24, self.assembled 24, plasmon.resonance 24, gold.nanoparticle 23, complementary.dna 22, nucleic.acids 21, single.base 20, label.free 18

Triple Word Terms
surface.plasmon.resonance 24, single.stranded.dna 22, plasmon.resonance.spr 13, double.stranded.dna 11, detection.dna.hybridization 10, peptide.nucleic.acid 10, ray.photoelectron.spectroscopy 10, single.base.mismatch 9, atomic.force.microscopy 9, self.assembled.monolayers 8, resonance.energy.transfer 7, quartz.crystal.microbalance 7, stranded.dna.ssdna 7, polymerase.chain.reaction 6, complementary.target.dna 6

Term Cliques
42.61% dna target probe nucleic label sequenc
40.90% dna hybrid detect target probe label microarrai immobil sequenc target.dna
41.40% dna hybrid detect strand target probe label microarrai immobil target.dna
43.48% dna hybrid detect gold target probe label sequenc target.dna nanoparticl
43.48% dna hybrid detect gold target probe label immobil sequenc target.dna
43.98% dna hybrid detect gold strand target probe label immobil target.dna
45.84% dna oligonucleotid hybrid detect gold target probe label sequenc nanoparticl
45.84% dna oligonucleotid hybrid detect gold target probe label immobil sequence

Sample Cluster Record Titles

A biosensor monitoring DNA hybridization based on polyaniline intercalated graphite oxide nanocomposite

Hybridization of oligonucleotide-modified silver and gold nanoparticles in aqueous dispersions and on gold films

Detection of DNA and protein molecules using an FET-type biosensor with gold as a gate metal

Electrochemical detection of DNA sequences using nano-magnetic particles

Effects of gold nanoparticle and electrode surface properties on electrocatalytic silver deposition for electrochemical DNA hybridization detection

Two-potential electrochemical probe for study of DNA immobilization

Detection limits for nanoscale biosensors

New materials for electrochemical sensing V: Nanoparticles for DNA labeling

Cyclopentane-modified PNA improves the sensitivity of nanoparticle-based scanometric DNA detection

Cluster Metrics

Authors

mirkin, ca 5
lu, zh 5
knoll, w 5
gooding, jj 5
wark, aw 4
seela, f 4
lee, hj 4
corn, rm 4
wong, els 3
wang, yj 3
tsai, cy 3
spadavecchia, j 3
rella, r 3
redmond, g 3
merkoci, a 3

Sources

analytical chemistry 16
langmuir 13
journal of the american chemical society 13
biosensors & bioelectronics 10
journal of nanoscience and nanotechnology 9
nucleic acids research 8
sensors and actuators b-chemical 7
nano letters 7
chemical communications 6
talanta 5
analytical and bioanalytical chemistry 5
journal of physical chemistry b 4
bioelectrochemistry 4
applied physics letters 4
analyst 4

Keywords

chemistry, multidisciplinary 53
chemistry, analytical 52
hybridization 39
dna 35
chemistry, physical 27
biochemistry & molecular biology 25
materials science, multidisciplinary 24
probes 22
oligonucleotides 21

microarrays 21
hybridization 20
nanoparticles 20
surfaces 19
gold 19
self-assembled monolayers 15

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Country

usa 73
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germany 26
japan 17
south korea 11
england 10
italy 8
france 7
canada 7
australia 7
singapore 6
portugal 6
spain 5
israel 5
taiwan 4

Institution

se univ 7
univ new s wales 5
northwestern univ 5
max planck inst polymer res 5
inst mat res & engn 5
univ rochester 4
univ osnabruck 4
univ calif irvine 4
univ calif berkeley 4
chinese acad sci 4
wuhan univ 3
usn 3
univ maryland 3
univ illinois 3
univ florence 3

DataBase
science citation index 221

CATEGORY 16 - 509B2b (24 leaf clusters)

Proteins and Cellular Components (5070 REC)

THRUST

()

- Protein studies, focusing on surface interactions (especially protein adsorption and adhesion), unfolding and refolding, and related atomic force microscopy studies, especially of bovine serum albumin (BSA), poly(ethylene glycol) (PEG), and fibrinogen (212 Records) Cluster 177
- Protein studies, focusing on structure and function, namely binding domain features, alteration of protein binding, protein-protein interactions, fluorescent proteins, and proteomics (594 Records) Cluster 174
- Analysis and adjustment of immunoassays, including fluoroimmunoassays and immunoglobulin (especially IgG) studies (221 Records) Cluster 165
- Biosensors and immunosensors based on surface plasmon resonance (SPR) (140 Records) Cluster 91
- Analysis of protein binding, including effects of inhibitors, investigation of binding sites/domains, and surface plasmon resonance analysis to determine binding properties (337 Records) Cluster 182
- Receptor/ligand interactions, emphasizing receptor structural characteristics, recognition, regulation, and ligand activity, including affinity of agonists and antagonists (88 Records) Cluster 51
- Peptides, emphasizing binding properties, peptide-membrane interactions, structure, mass spectrometry of peptides, antimicrobial peptides, and identification of peptides by means of chromatography (166 Records) Cluster 57

- Fibrils (especially amyloid and collagen fibrils), focusing on formation by aggregation, role of amyloids in neural conditions (especially Alzheimer's disease), and structure (102 Records) Cluster 11
- Viruses and RNA, focusing on structure determination, capsid properties, and sequencing (129 Records) Cluster 110
- Gene expression and gene delivery for therapeutic benefit, focusing on nanoparticles as non-viral vectors for gene delivery, analysis of gene expression data, and DNA transfection systems (157 Records) Cluster 130
- Treatment and risk prediction of cancer and cardiovascular disease (CVD), focusing on evaluation of lymphatic system (especially sentinel lymph nodes [SLNs]), especially for patients with breast cancer (88 Records) Cluster 64
- Studies of tumors and the brain, with emphasis on liposomal and nanoparticle-based delivery (especially of drugs), nanostructure-aided magnetic resonance imaging of cells, and crossing of the blood-brain barrier (208 Records) Cluster 201
- Cellular function and processes, focusing on endothelial and epithelial cells, cellular response to gene expression, induction and inhibition of apoptosis, and studies on cancer and tumor cells (339 Records) Cluster 191
- Investigation of cell surface and plasma membrane (especially of bacteria), focusing on cell adhesion, labeling for detetion, imaging techniques, and intercellular transfer (608 Records) Cluster 195
- Connective and anatomical support tissue (especially bone and its main component, collagen), focusing on studies on osteoblasts, cell proliferation, and orthopedic implants (226 Records) Cluster 135
- Biomaterials, bioactive substances, and biodegradable composites (especially chitosan, poly(lactide-co-glycolide) [PLGA], alginate, and poly(lactic acid)), focusing on microspheres and encapsulation, tissue engineering scaffolds, and hydrogels (119 Records) Cluster 134
- Preparation and investigation of membranes, emphasizing proton conductivity, permeability studies, filtration applications, preparation by grafting, sulfonated membranes, and methanol fuel cell applications (253 Records) Cluster 82
- Lipid (especially phospholipid) bilayers, focusing on properties of vesicles, channel interactions, membrane binding, and dipalmitoyl phosphatidylcholine (DPPC) and cholesterol structures (231 Records) Cluster 142

- Drug delivery systems, focusing on drug release, especially of nanoparticles and from nanocapsules (219 Records) Cluster 97
- Drug delivery systems, emphasizing targeting of cancer cells, oral delivery, and lipid and nanoparticle-based carriers (169 Records) Cluster 93
- Ethical, health, and social issues of nanotechnology (especially biological applications), weighing the risks and benefits to the public (142 Records) Cluster 81
- Network and self-organization processes, with emphasiss on self-organizing neural networks, self-organized maps (SOMs), and learning systems (132 Records) Cluster 99
- Microtubule motor proteins (kinesin and dynein), with models and analysis of movement mechanism (106 Records) Cluster 22
- Microfilament proteins (myosin and actin), emphasizing dynamics of muscle contraction and function of myosin heads (84 Records) Cluster 4

- # CLUSTER 177
  Protein studies, focusing on surface interactions (especially protein adsorption and adhesion), unfolding and refolding, and related atomic force microscopy studies, especially of bovine serum albumin (BSA), poly(ethylene glycol) (PEG), and fibrinogen (212 Records)

(Countries: USA dominant, Germany, Japan, Switzerland, England, China. Institutions: Tokyo Institute of Technology, ETH, McMaster University, CAS. USA include University of Illinois, University of Washington, University of Texas, UCLA, UCB).

Cluster Syntax Features

Descriptive Terms
protein 35.8%, forc 4.5%, adsorpt 4.2%, unfold 3.1%, protein.adsorption 2.2%, surfac 1.9%, bsa 1.9%, serum 1.8%, albumin 1.7%, peg 1.1%, serum.albumin 1.0%, fibrinogen 0.8%, atomic.force 0.8%, adsorb 0.8%, adhes 0.7%

Discriminating Terms
protein 24.7%, unfold 2.5%, adsorpt 2.2%, forc 2.1%, protein.adsorption 1.7%, film 1.7%, bsa 1.4%, serum 1.4%, albumin 1.3%, serum.albumin 0.8%, peg 0.7%, carbon 0.7%, nanotub 0.6%, fibrinogen 0.6%, magnet 0.6%

Single Word Terms
protein 206, surfac 125, forc 97, adsorpt 92, microscopi 91, atom 86, interact 77, structur 75, serum 62, adsorb 61, albumin 59, molecul 57, model 57, measur 56, two 56

Double Word Terms
atomic.force 80, force.microscopy 66, protein.adsorption 60, serum.albumin 48, bovine.serum 38, microscopy.afm 28, albumin.bsa 26, poly.ethylene 25, ethylene.glycol 25, single.molecule 23, force.microscope 21, ionic.strength 17, human.serum 17, contact.angle 16, electron.microscopy 14

Triple Word Terms
atomic.force.microscopy 64, bovine.serum.albumin 36, force.microscopy.afm 28,

serum.albumin.bsa 25, poly.ethylene.glycol 22, atomic.force.microscope 21, human.serum.albumin 15, serum.albumin.hsa 12, ethylene.glycol.peg 12, scanning.electron.microscopy 11, force.microscope.afm 9, ray.photoelectron.spectroscopy 8, differential.scanning.calorimetry 8, confocal.laser.scanning 7, mode.atomic.force 7

Term Cliques
38.49% protein bsa serum albumin serum.albumin
39.74% protein adsorpt surfac serum albumin serum.albumin fibrinogen adsorb
40.43% protein adsorpt protein.adsorption surfac peg adsorb adhes
37.05% protein adsorpt protein.adsorption surfac serum albumin peg fibrinogen adsorb
51.23% protein forc surfac atomic.force adhes
45.66% protein forc surfac peg adhes
49.29% protein forc unfold atomic.force

Sample Cluster Record Titles

Ultrathin coatings from isocyanate-terminated star PEG prepolymers: Layer formation and characterization

Adhesion mode atomic force microscopy study of dual component protein films

Quantification of the kinetics and thermodynamics of protein adsorption using atomic force microscopy

Comparison of coatings from reactive star shaped PEG-stat-PPG prepolymers and grafted linear PEG for biological and medical applications

Nanostructured antifouling poly(ethylene glycol) films for silicon-based microsystems

Investigation of interactions between dendrimer-coated magnetite nanoparticles and bovine serum albumin

Application of probe microscopy to protein unfolding: Adsorption and ensemble analyses

Adsorption and interaction of fibronectin and human serum albumin at the liquid-liquid interface

Adsorption of fibrinogen and lysozyme on silicon grafted with poly(2-methacryloyloxyethyl phosphorylcholine) via surface-initiated atom transfer radical polymerization

Cluster Metrics

Authors
textor, m 6
ikai, a 5
brash, jl 4
voros, j 3
spencer, nd 3
sheardown, h 3
muller, rh 3
muller, dj 3
moeller, m 3
groll, j 3
goppert, tm 3
ameringer, t 3
yang, jh 2
yamamoto, h 2
xu, lc 2

Sources
langmuir 26
biomaterials 11
biophysical journal 10
biomacromolecules 8
journal of physical chemistry b 6
colloids and surfaces b-biointerfaces 6
journal of molecular biology 5
analytical chemistry 5
ultramicroscopy 4
journal of the american chemical society 4
journal of colloid and interface science 4
journal of biological chemistry 4
proceedings of the national academy of sciences of the united states of america 3
macromolecular bioscience 3
journal of controlled release 3

Keywords
chemistry, physical 46
adsorption 30
self-assembled monolayers 29
biochemistry & molecular biology 25
atomic-force microscopy 20
protein 20
chemistry, multidisciplinary 19
surfaces 17
spectroscopy 17

protein adsorption 17
engineering, biomedical 16
materials science, biomaterials 16
spectroscopy 14
biophysics 14
biochemistry & molecular biology 14

Publication Year

2005 188
2004 20
2006 4

Country

usa 75
germany 31
japan 22
switzerland 17
england 17
peoples r china 16
italy 12
france 10
canada 10
taiwan 6
sweden 5
spain 4
south korea 3
slovakia 3
new zealand 3

Institution

tokyo inst technol 6
eth 6
mcmaster univ 5
chinese acad sci 5
univ leeds 4
univ illinois 4
univ cambridge 4
max planck inst colloids & interfaces 4
free univ berlin 4
univ washington 3
univ tokyo 3
univ texas 3
univ s australia 3
univ calif los angeles 3
univ calif berkeley 3

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- # CLUSTER 174
  Protein studies, focusing on structure and function, namely binding domain features, alteration of protein binding, protein-protein interactions, fluorescent proteins, and proteomics (594 Records)

(Countries: USA very dominant, Germany, Japan, followed by England, Italy, China, France, South Korea. Institutions: University of Texas, CAS, Osaka University, University of Illinois. Other USA include UCSD, UCLA, Harvard University, Vanderbilt University, UCB).

Cluster Syntax Features

Descriptive Terms
protein 72.7%, bind 0.9%, interact 0.6%, membran 0.4%, peptid 0.3%, function 0.3%, domain 0.3%, cell 0.3%, structur 0.3%, fluoresc 0.3%, complex 0.3%, activ 0.3%, detect 0.2%, proteom 0.2%, surfac 0.2%

Discriminating Terms
protein 50.2%, film 1.9%, carbon 0.6%, temperatur 0.6%, nanotub 0.6%, magnet 0.5%, particl 0.5%, deposit 0.5%, oxid 0.4%, layer 0.4%, si 0.4%, quantum 0.4%, nanoparticl 0.4%, electron 0.4%, surfac 0.4%

Single Word Terms
protein 593, structur 262, surfac 203, function 187, interact 172, bind 162, two 160, form 142, high 141, activ 138, molecular 136, cell 134, complex 121, model 114, solut 105

Double Word Terms
electron.microscopy 55, plasmon.resonance 50, surface.plasmon 50, mass.spectrometry 38, protein.protein 34, three.dimensional 34, self.assembly 32, amino.acid 32, escherichia.coli 32, ray.diffraction 31, atomic.force 31, transmission.electron 30, force.microscopy 29, protein.interactions 26, two.dimensional 25

Triple Word Terms
surface.plasmon.resonance 50, atomic.force.microscopy 28, transmission.electron.microscopy 27, scanning.electron.microscopy 14, protein.protein.interactions 13, green.fluorescent.protein 13, plasmon.resonance.spr 12, differential.scanning.calorimetry 12, matrix.laser.desorption 9, tandem.mass.spectrometry 9, nuclear.magnetic.resonance 8, amino.acid.sequence 8, laser.desorption.ionization 8, force.microscopy.afm 8, heat.shock.protein 7

Term Cliques
36.03% protein function cell complex proteom
30.77% protein peptid complex detect proteom
33.33% protein bind peptid fluoresc detect
35.05% protein bind membran cell fluoresc
33.52% protein bind interact function domain cell complex activ surfac
32.70% protein bind interact peptid complex activ detect surfac
32.43% protein bind interact peptid domain complex activ surfac
33.64% protein bind interact membran function domain cell structur complex surface

Sample Cluster Record Titles

Advanced nanoscale separations and mass spectrometry for sensitive high-throughput proteomics

Structure and stability of a model three-helix-bundle protein on tailored surfaces

Increased resistance of DNA lipoplexes to protein binding in vitro by surface-modification with a multivalent hydrophilic polymer

Biophysical characterization of human XRCC1 and its binding to damaged and undamaged DNA

The use of hydrophobins to functionalize surfaces

Nano-mechanics of protein-based biostructures by atomic force microscopy

Adsorbed layers formed from mixtures of proteins

[Peptide lipid interactions: insights and perspectives]

[Role of protein kinase C-epsilon (PKC epsilon) in isoflurane-induced cardioprotection]

Cluster Metrics

Authors
kulomaa, ms 6
zhang, y 4
wenzel, w 4
wang, j 4
verma, a 4
nordlund, hr 4
nicolini, c 4
hytonen, vp 4
hu, nf 4
douglas, t 4
young, m 3
semenova, mg 3
schug, a 3
scheibel, t 3
sachs, c 3

Sources
journal of the american chemical society 17
journal of biological chemistry 17
proceedings of the national academy of sciences of the united states of america 16
langmuir 15
biochemistry 15
analytical chemistry 15
biochemical and biophysical research communications 13
ieee transactions on nanobioscience 9
biomacromolecules 9
journal of molecular biology 8
biochemical journal 8
proteomics 7
journal of physical chemistry b 7
biophysical journal 7
chemical communications 6

Keywords
biochemistry & molecular biology 135
chemistry, multidisciplinary 58
chemistry, analytical 48

biophysics 44
chemistry, physical 41
protein 41
biochemistry & molecular biology 37
binding 37
biochemical research methods 35
proteins 31
materials science, multidisciplinary 27
spectroscopy 25
multidisciplinary sciences 24
expression 22
adsorption 21

Publication Year

2005 526
2004 56
2006 12

Country

usa 224
germany 76
japan 64
england 47
italy 38
peoples r china 37
france 34
south korea 25
canada 17
sweden 15
netherlands 15
switzerland 11
finland 11
denmark 10
spain 9

Institution

univ texas 15
chinese acad sci 13
osaka univ 11
univ illinois 10
univ calif san diego 8
linkoping univ 8
univ calif los angeles 7
tech univ munich 7
harvard univ 7
vanderbilt univ 6

univ jyvaskyla 6
univ genoa 6
univ calif berkeley 6
univ alberta 6
tsing hua univ 6

DataBase
science citation index 594

- # CLUSTER 165
  Analysis and adjustment of immunoassays, including fluoroimmunoassays and immunoglobulin (especially IgG) studies (221 Records)

(Countries: USA dominant, China, Japan. Institutions: Tsing Hua University, University of Twente, University of Turku. USA include Northwestern University, US Navy.).

Cluster Syntax Features

Descriptive Terms
antibodi 29.4%, assai 10.3%, detect 5.7%, antigen 4.1%, label 2.3%, fluoresc 1.5%, immobil 1.4%, immunoassai 1.4%, enzym 1.3%, human 1.2%, protein 1.1%, igg 1.0%, bind 0.9%, anti 0.9%, affin 0.9%

Discriminating Terms
antibodi 20.4%, assai 7.0%, detect 2.9%, antigen 2.8%, film 1.9%, label 1.4%, immunoassai 1.0%, immobil 0.7%, enzym 0.7%, igg 0.7%, human 0.6%, carbon 0.6%, fluoresc 0.6%, temperatur 0.6%, structur 0.6%

Single Word Terms
detect 139, antibodi 131, assai 111, surfac 89, protein 83, sensit 79, high 76, bind 73, concentr 70, antigen 70, limit 62, label 59, anti 59, human 57, immobil 57

Double Word Terms
surface.plasmon 37, plasmon.resonance 36, detection.limit 29, monoclonal.antibody 22, enzyme.linked 22, linked.immunosorbent 20, monoclonal.antibodies 19, immunosorbent.assay 18, mass.spectrometry 18, antibody.antigen 16, liquid.chromatography 14, high.sensitivity 14, force.microscopy 14, electron.microscopy 12, assay.elisa 12

Triple Word Terms
surface.plasmon.resonance 36, enzyme.linked.immunosorbent 20, linked.immunosorbent.assay 18, atomic.force.microscopy 12, immunosorbent.assay.elisa 11, plasmon.resonance.spr 9, ionization.mass.spectrometry 8, quartz.crystal.microbalance 8, resonance.energy.transfer 6, crystal.microbalance.qcm 6, human.serum.albumin 6, force.microscopy.afm 6, transmission.electron.microscopy 6, monoclonal.antibodies.mabs 6, high.liquid.chromatography 5

Term Cliques
33.23% assai detect antigen label fluoresc immunoassai affin
33.30% antibodi detect antigen immobil human protein igg bind anti affin
31.42% antibodi detect antigen immobil immunoassai human igg anti affin
32.93% antibodi detect antigen label immobil igg bind anti affin
31.52% antibodi detect antigen label immobil immunoassai igg anti affin
39.82% antibodi assai detect immobil enzym protein affin
37.36% antibodi assai detect immobil immunoassai enzym affin
37.15% antibodi assai detect antigen immobil human protein bind anti affin
35.70% antibodi assai detect antigen immobil immunoassai human anti affin
37.20% antibodi assai detect antigen label immobil bind anti affin
35.80% antibodi assai detect antigen label immobil immunoassai anti affin

Sample Cluster Record Titles

Assessing protease activity pattern by means of multiple substrate ESI-MS assays

Magnetic force-based multiplexed immunoassay using superparamagnetic nanoparticles in microfluidic channel

Development of a microplate-based, electrophoretic fluorescent protein kinase a assay: Comparison with filter-binding and fluorescence polarization assay formats

Enzyme inhibitor screening using a homogeneous proximity-based immunoassay for estradiol

Establishment and characterization of 7 new monoclonal antibodies to tissue inhibitor of metalloproteinases-1

Ligand displacement immunoassay

Piezoelectric immunoassay for complement C4 based on a Nafion-modified interface for antibody immobilization

Fimbriae of enterotoxigenic Escherichia coli function as a mucosal carrier for a coupled heterologous antigen

Real-time QCM-D immunoassay through oriented antibody immobilization using cross-linked hydrogel biointerfaces

Cluster Metrics

Authors

lovgren, t 7
karst, u 7
soukka, t 6
liesener, a 5
harma, h 4
zhang, xr 3
yu, rq 3
valanne, a 3
shen, gl 3
park, jw 3
o'sullivan, ck 3
liu, jm 3
li, ld 3
li, js 3
zhao, r 2

Sources

analytical chemistry 16
biosensors & bioelectronics 10
langmuir 8
journal of immunological methods 7

analytica chimica acta 7
analytical biochemistry 5
analyst 5
sensors and actuators b-chemical 4
rapid communications in mass spectrometry 4
lab on a chip 4
proceedings of the national academy of sciences of the united states of america 3
on the convergence of bio-information-, environmental-, energy-, space- and nano-technologies, pts 1 and 2 3
journal of the american chemical society 3
journal of molecular biology 3
clinical chemistry 3

Keywords
chemistry, analytical 60
protein 21
chemistry, multidisciplinary 20
biochemistry & molecular biology 19
immunoassay 17
biochemical research methods 17
binding 15
biophysics 14
biochemical research methods 14
biotechnology & applied microbiology 13
biotechnology & applied microbiology 12
spectroscopy 12
proteins 12
biosensor 12
assay 12

Publication Year
2005 195
2004 23
2006 3

Country
usa 72
peoples r china 29
japan 21
germany 14
england 13
france 12
finland 11
netherlands 10
spain 9
south korea 9

canada 9
italy 6
switzerland 5
belgium 5
sweden 4

Institution
tsing hua univ 8
univ twente 7
univ turku 7
zhangzhou normal coll 3
univ rovira & virgili 3
univ paris 06 3
peking univ 3
northwestern univ 3
nci 3
hunan univ 3
eli lilly & co 3
chinese acad sci 3
vrije univ brussels 2
usn 2
univ zurich 2

DataBase
science citation index 221

- # CLUSTER 91
  Biosensors and immunosensors based on surface plasmon resonance (SPR) (140 Records)

(Countries: USA, followed by Japan, China, Germany. Institutions: Kyushu University, Arizona State University, Northwestern University, CAS. Other USA include Purdue University, USDA ARS).

Cluster Syntax Features

Descriptive Terms
spr 12.7%, biosensor 8.9%, plasmon 7.1%, surface.plasmon.resonance 7.0%, plasmon.resonance 6.9%, surface.plasmon 6.7%, antibodi 3.8%, reson 3.8%, detect 3.3%, sensor 2.4%, plasmon.resonance.spr 2.0%, resonance.spr 2.0%, chip 1.9%, surfac 1.6%, protein 1.5%

Discriminating Terms
spr 8.2%, biosensor 5.6%, surface.plasmon.resonance 4.4%, plasmon.resonance 4.3%, plasmon 4.1%, surface.plasmon 4.1%, antibodi 2.3%, reson 1.7%, film 1.6%, detect 1.4%, plasmon.resonance.spr 1.3%, resonance.spr 1.3%, chip 1.1%, sensor 1.1%, structur 0.7%

Single Word Terms
surfac 121, reson 117, plasmon 114, detect 87, spr 84, biosensor 62, sensor 61, antibodi 57, bind 54, protein 50, measur 47, interact 45, concentr 42, chip 41, immobil 41

Double Word Terms
plasmon.resonance 114, surface.plasmon 113, resonance.spr 80, spr.sensor 19, real.time 19, sensor.chip 19, detection.limit 16, spr.biosensor 16, sensor.surface 11, resonance.biosensor 10, gold.surface 10, serum.albumin 10, bovine.serum 9, label.free 9, spr.detection 8

Triple Word Terms
surface.plasmon.resonance 113, plasmon.resonance.spr 80, plasmon.resonance.biosensor 10, resonance.spr.biosensor 10, bovine.serum.albumin 9, resonance.spr.sensor 8, serum.albumin.bsa 7, quartz.crystal.microbalance 6, resonance.spr.immunosensor 6, plasmon.resonance.imaging 6, plasmon.resonance.sensor 6, atomic.force.microscopy 5, chip.surface.plasmon 5, spr.sensor.chip 5, plasmon.resonance.spectroscopy 5

Term Cliques
42.62% biosensor antibodi detect sensor chip protein
62.86% spr plasmon surface.plasmon.resonance plasmon.resonance surface.plasmon antibodi reson detect sensor plasmon.resonance.spr resonance.spr chip surfac protein

Sample Cluster Record Titles

Surface plasmon resonance - Applications in understanding receptor-ligand interaction

Towards advanced chemical and biological nanosensors - An overview

Detection of picomolar levels of interleukin-8 in human saliva by SPR

[Localized surface plasmon resonance based optical biosensor using surface modified nanoparticle layer for label-free monitoring of antigen-antibody reaction]

[Gold nanoparticle-enhanced surface plasmon resonance measurement with a highly sensitive quantification for human tissue inhibitor of metalloproteinases-2]

[Aptamer-based biosensors for the detection of HIV-1 Tat protein]

[A surface plasmon resonance-based assay for small molecule inhibitors of human cyclophilin A]

[Characterization of conformational epitope of alginate-derived polymannuronates by surface plasmon resonance]

[Fluorescence detection of enzymatic activity within a liposome based nano-biosensor]

Cluster Metrics

Authors
booksh, ks 6
miura, n 5
masson, jf 5
matsumoto, k 4
li, y 4
gobi, kv 4
van duyne, rp 3
toko, k 3
sakai, t 3
oh, bk 3
o'kennedy, r 3
lee, wh 3
lee, w 3
kim, yc 3
imato, t 3

Sources
sensors and actuators b-chemical 12
analytical chemistry 12
biosensors & bioelectronics 10
talanta 6
analytical biochemistry 6
analytica chimica acta 4
langmuir 3
journal of immunological methods 3
food and agricultural immunology 3

chinese journal of analytical chemistry 3
transactions of the asae 2
proteomics 2
physics letters a 2
methods 2
lab on a chip 2

Keywords

chemistry, analytical 50
surface plasmon resonance 27
biosensor 23
surface-plasmon resonance 16
surface plasmon resonance 15
biochemistry & molecular biology 15
instruments & instrumentation 13
immunoassay 13
electrochemistry 12
binding 12
biosensor 11
biotechnology & applied microbiology 11
self-assembled monolayers 10
biophysics 10
biochemical research methods 10

Publication Year

2005 126
2004 11
2003 3

Country

usa 31
japan 22
peoples r china 17
germany 14
south korea 11
sweden 10
france 9
netherlands 6
england 5
canada 4
taiwan 3
north ireland 3
italy 3
ireland 3
ukraine 2

Institution

kyushu univ 8
arizona state univ 7
northwestern univ 4
chinese acad sci 4
univ regensburg 3
sogang univ 3
purdue univ 3
linkoping univ 3
inra 3
dublin city univ 3
biacore ab 3
zhejiang univ 2
xiangtan univ 2
xenosense ltd 2
usda ars 2

DataBase

science citation index 140

- CLUSTER 182
  Analysis of protein binding, including effects of inhibitors, investigation of binding sites/domains, and surface plasmon resonance analysis to determine binding properties (337 Records)

(Countries: USA very dominant, Japan, Germany, England, followed by France, Sweden. Institutions: NCI, University of Oxford, CNRS, Scripps Research Institute, Lund University, CAS. Other USA include University of Pittsburgh, University of Pennsylvania, University of Illinois, NIAID, University of Washington).

Cluster Syntax Features

Descriptive Terms
bind 39.6%, protein 3.1%, affin 3.0%, inhibitor 2.0%, interact 1.8%, site 1.8%, domain 1.5%, activ 1.5%, surface.plasmon.resonance 1.3%, plasmon.resonance 1.3%, surface.plasmon 1.2%, plasmon 1.1%, mutant 1.1%, residu 1.0%, alpha 0.8%

Discriminating Terms
bind 25.8%, film 2.0%, affin 1.9%, inhibitor 1.3%, protein 1.2%, surface.plasmon.resonance 0.8%, site 0.8%, plasmon.resonance 0.7%, mutant 0.7%, surface.plasmon 0.7%, particl 0.6%, temperatur 0.6%, magnet 0.6%, carbon 0.6%, domain 0.6%

Single Word Terms
bind 305, surfac 214, protein 186, reson 176, interact 176, plasmon 171, activ 153, affin 143, site 128, structur 128, two 105, complex 94, cell 92, domain 91, function 90

Double Word Terms
surface.plasmon 169, plasmon.resonance 169, high.affinity 41, resonance.spr 39, binding.site 38, binding.sites 36, binding.affinity 34, wild.type 29, binding.protein 28, amino.acid 24, active.site 23, escherichia.coli 23, binding.domain 22, amino.acids 21, binding.proteins 20

Triple Word Terms
surface.plasmon.resonance 168, plasmon.resonance.spr 38, atomic.force.microscopy 12, site.directed.mutagenesis 11, human.immunodeficiency.virus 11, plasmon.resonance.binding 10, high.affinity.binding 9, amino.acid.residues 9, molecular.dynamics.simulations 7, plasmon.resonance.experiments 7, binding.surface.plasmon 7, immunodeficiency.virus.type 7, transmission.electron.microscopy 6, immobilized.sensor.chip 6, three.dimensional.structure 6

Term Cliques
44.24% bind inhibitor interact site activ surface.plasmon.resonance plasmon.resonance surface.plasmon plasmon mutant residu
43.47% bind protein affin interact site domain activ surface.plasmon.resonance plasmon.resonance surface.plasmon plasmon mutant residu alpha

Sample Cluster Record Titles

Molecular recognition characteristics in the insulin-like growth factor (IGF)-insulin-like growth factor binding protein-3/5 (IGFBP-3/5) heparin axis

Label-free detection of small-molecule-protein interactions by using nanowire nanosensors

Vimentin-dependent spatial translocation of an activated MAP kinase in injured nerve

Specific interaction between Smad1 and CHIP: a surface plasmon resonance study

Interaction of insulin-like growth factor II (IGF-II) with multiple plasma proteins - High affinity binding of plasminogen to IGF-II and IGF-binding protein-3

The antineoplastic lectin of the common edible mushroom (Agaricus bisporus) has two binding sites, each specific for a different configuration at a single epimeric hydroxyl

Preparation of a gradient biotinylated polyethylene surface to bind streptavidin-FITC

Direct evidence for Sphingomonas sp A1 periplasmic proteins as macromolecule-binding proteins associated with the ABC transporter: Molecular insights into alginate transport in the periplasm

9-hydroxyazafluorenes and their use in thrombin inhibitors

Cluster Metrics

Authors
shen, x 3
lopez, ja 3
liskamp, rmj 3

lea, sm 3
jiang, hl 3
fisher, rj 3
zipfel, pf 2
yoon, yj 2
xue, wf 2
xu, l 2
wyatt, r 2
worthy, km 2
wilson, wd 2
usui, t 2
tang, m 2

Sources

journal of biological chemistry 36
biochemistry 22
biochemical and biophysical research communications 13
journal of molecular biology 9
journal of the american chemical society 8
journal of medicinal chemistry 8
chembiochem 7
biochemical journal 7
analytical biochemistry 7
journal of immunology 5
analytical chemistry 5
proceedings of the national academy of sciences of the united states of america 4
molecular microbiology 4
journal of virology 4
journal of bacteriology 4

Keywords

biochemistry & molecular biology 144
binding 40
crystal-structure 36
protein 30
biophysics 25
chemistry, medicinal 23
chemistry, multidisciplinary 22
surface plasmon resonance 22
surface-plasmon resonance 21
biochemistry & molecular biology 19
chemistry, analytical 18
recognition 17
identification 17
expression 17
proteins 15

Publication Year
2005 315
2004 21
2006 1

Country
usa 145
japan 35
germany 32
england 29
france 21
sweden 20
south korea 12
switzerland 11
peoples r china 11
italy 10
australia 10
denmark 9
canada 9
india 8
taiwan 6

Institution
nci 10
univ oxford 8
cnrs 8
scripps res inst 7
lund univ 7
chinese acad sci 7
univ utrecht 5
univ pittsburgh 5
univ penn 5
univ illinois 5
seoul natl univ 5
niaid 5
natl inst adv ind sci & technol 5
kyoto univ 5
univ washington 4

DataBase
science citation index 337

- # CLUSTER 51
  Receptor/ligand interactions, emphasizing receptor structural characteristics, recognition, regulation, and ligand activity, including affinity of agonists and antagonists (88 Records)

(Countries: USA very dominant, England, Germany, Japan. Institutions: University Aarhus, University of Cambridge, University of Pennsylvania, University of Massachusetts, Merck Research Labs, CAS. Other USA include Purdue University).

Cluster Syntax Features

Descriptive Terms
receptor 61.6%, bind 6.1%, ligand 1.6%, affin 1.2%, interact 0.7%, activ 0.7%, regul 0.6%, protein 0.6%, recognit 0.6%, antagonist 0.6%, alpha 0.5%, peptid 0.4%, agonist 0.4%, domain 0.3%, ligand.binding 0.3%

Discriminating Terms
receptor 37.9%, bind 2.9%, film 1.8%, affin 0.6%, ligand 0.6%, carbon 0.6%, temperatur 0.6%, layer 0.5%, nanotub 0.5%, magnet 0.5%, particl 0.5%, electron 0.5%, crystal 0.5%, oxid 0.4%, deposit 0.4%

Single Word Terms
receptor 84, bind 61, surfac 46, activ 41, interact 39, protein 35, function 34, affin 34, structur 34, cell 33, ligand 32, two 26, reson 26, complex 25, plasmon 24

Double Word Terms
surface.plasmon 24, plasmon.resonance 24, receptor.binding 13, ligand.binding 12, high.affinity 11, binding.affinities 9, force.microscopy 9, atomic.force 8, cell.surface 7, binding.site 7, ligand.receptor 7, binding.affinity 7, receptor.ligand 6, amino.acid 6,

structure.activity 6

Triple Word Terms
surface.plasmon.resonance 24, atomic.force.microscopy 8, plasmon.resonance.spr 6, force.microscopy.afm 4, density.lipoprotein.receptor 4, low.density.lipoprotein 4, protein.coupled.receptors 4, plasmon.resonance.binding 3, binding.surface.plasmon 3, plasmon.resonance.biacore 2, hek.293.cells 2, cryo.electron.microscopy 2, tumor.necrosis.factor 2, chemical.cross.linking 2, peroxisome.proliferator.activated 2

Term Cliques
35.80% receptor ligand activ antagonist agonist ligand.binding
37.01% receptor ligand activ protein alpha agonist ligand.binding
38.31% receptor ligand activ regul protein alpha agonist
43.18% receptor bind interact recognit antagonist domain
39.65% receptor bind ligand activ protein alpha peptid domain ligand.binding
40.66% receptor bind ligand activ regul protein alpha peptid domain
39.55% receptor bind ligand affin interact activ antagonist peptid domain ligand.binding
42.16% receptor bind ligand affin interact activ protein peptid domain ligand.binding

Sample Cluster Record Titles

Platelet-leukocyte aggregation induced by PAR agonists: regulation by nitric oxide and matrix metalloproteinases

Insulinand its receptor: structure, function and evolution

Low density lipoprotein receptor-related protein mediates endocytic clearance of Pro-MMP-2 center dot TIMP-2 complex through a thrombospondin-independent mechanism

A novel pesticide-induced conformational state of the oestrogen receptor ligand-binding domain, detected by conformation-specific peptide binding

Surface recognition of biomacromolecules using nanoparticle receptors

Parvovirus B19 does not bind to membrane-associated globoside in vitro

Role of A beta and the alpha 7 nicotinic acetylcholine receptor in regulating synaptic plasticity in Alzheimer's disease

Novel heterocyclic trans olefin analogues of N-{4-[4-(2,3-dichlorophenyl)piperazin-1-yl]butyl}arylcarboxamides as selective probes with high affinity for the dopamine D3 receptor

Two different T cell receptors use different thermodynamic strategies to recognize the same peptide/MHC ligand

Cluster Metrics

Authors
rotello, vm 3
yue, ld 2
ye, f 2
yamaguchi, t 2
vernier, jm 2
verma, a 2
shen, x 2
shen, jh 2
schaffhauser, h 2
rowe, ba 2
lee, hw 2
kim, jk 2
jiang, hl 2
james, jk 2
imasaka, t 2

Sources
journal of biological chemistry 6
bioorganic & medicinal chemistry letters 6
proceedings of the national academy of sciences of the united states of america 4
journal of the american chemical society 3
protein science 2
nature chemical biology 2
journal of molecular biology 2
journal of medicinal chemistry 2
febs letters 2
febs journal 2
chemical communications 2
biochemistry 2
biochemical and biophysical research communications 2
virology 1
trac-trends in analytical chemistry 1

Keywords
biochemistry & molecular biology 29
binding 16
chemistry, medicinal 10
protein 9
chemistry, multidisciplinary 7
chemistry, organic 7

biophysics 7
surface plasmon resonance 6
cell biology 6
recognition 5
reveals 5
recognition 5
ligands 5
complex 5
receptors 4

Publication Year

2005 79
2004 6
2006 2
2003 1

Country

usa 38
england 10
germany 8
japan 7
switzerland 5
south korea 5
france 5
denmark 5
peoples r china 4
australia 4
sweden 3
netherlands 3
canada 3
belgium 3
wales 2

Institution

univ cambridge 4
univ penn 3
univ massachusetts 3
univ aarhus 3
merck res labs 3
chinese acad sci 3
aarhus univ 3
univ melbourne 2
univ marburg 2
univ catholique louvain 2
purdue univ 2
natl taiwan univ 2

monash univ 2
lund univ 2
hungarian acad sci 2

DataBase
science citation index 88

- # CLUSTER 57
  Peptides, emphasizing binding properties, peptide-membrane interactions, structure, mass spectrometry of peptides, antimicrobial peptides, and identification of peptides by means of chromatography (166 Records)

(Countries: USA very dominant, Japan, followed by Germany, Canada, Australia, China. Institutions: MIT, Weizmann Institute of Science, Harvard University. Other USA include University of Wisconsin, University of Minnesota, Scripps Research institute, Rice University, Northwestern University, Vanderbilt University, University of Texas).

Cluster Syntax Features

Descriptive Terms
peptid 73.8%, bind 0.9%, membran 0.9%, amino 0.8%, sequenc 0.7%, mass 0.6%, acid 0.6%, protein 0.5%, residu 0.5%, lipid 0.5%, antimicrobi 0.5%, amino.acids 0.4%, chromatographi 0.3%, alpha 0.3%, interact 0.3%

Discriminating Terms
peptid 46.2%, film 1.7%, carbon 0.6%, layer 0.6%, surfac 0.5%, temperatur 0.5%, particl 0.5%, magnet 0.5%, nanotub 0.5%, crystal 0.5%, electron 0.4%, deposit 0.4%,

nanoparticl 0.4%, quantum 0.4%, oxid 0.4%

Single Word Terms
peptid 160, structur 65, acid 55, protein 54, sequenc 54, interact 51, surfac 49, amino 47, bind 46, activ 46, membran 44, two 42, residu 42, function 41, form 38

Double Word Terms
mass.spectrometry 25, amino.acid 23, surface.plasmon 22, amino.acids 21, plasmon.resonance 20, liquid.chromatography 18, atomic.force 18, force.microscopy 17, electron.microscopy 12, circular.dichroism 12, peptide.lipid 11, tandem.mass 10, antimicrobial.peptides 10, transmission.electron 10, reversed.phase 10

Triple Word Terms
surface.plasmon.resonance 20, atomic.force.microscopy 16, transmission.electron.microscopy 8, plasmon.resonance.spr 8, tandem.mass.spectrometry 8, amino.acid.sequence 8, time.flight.mass 6, amino.acid.residues 6, laser.desorption.ionization 5, liquid.chromatography.mass 5, force.microscopy.afm 5, high.liquid.chromatography 5, matrix.laser.desorption 5, chromatography.mass.spectrometry 5, ionization.mass.spectrometry 4

Term Cliques
30.42% peptid acid lipid antimicrobi amino.acids alpha
33.03% peptid acid residu lipid amino.acids alpha
35.06% peptid sequenc mass amino.acids chromatographi
39.04% peptid sequenc mass protein chromatographi
32.93% peptid amino acid antimicrobi amino.acids alpha
35.11% peptid amino sequenc acid residu amino.acids alpha
32.44% peptid membran acid lipid antimicrobi alpha interact
34.68% peptid membran acid residu lipid alpha interact
34.60% peptid membran amino acid antimicrobi alpha interact
36.30% peptid membran amino sequenc acid residu alpha interact
32.13% peptid bind acid lipid antimicrobi amino.acids
34.74% peptid bind acid residu lipid amino.acids
34.64% peptid bind amino acid antimicrobi amino.acids
36.57% peptid bind amino sequenc acid residu amino.acids
36.06% peptid bind membran protein residu lipid interact
33.91% peptid bind membran acid lipid antimicrobi interact
36.14% peptid bind membran acid residu lipid interact
36.06% peptid bind membran amino acid antimicrobi interact
37.50% peptid bind membran amino sequenc protein residu interact
37.58% peptid bind membran amino sequenc acid residu interact

Sample Cluster Record Titles

High-sensitivity ion mobility spectrometry/mass spectrometry using electrodynamic ion funnel interfaces

Adsorption of amyloid beta (1-40) peptide at phospholipid monolayers

Intermolecular packing and alignment in an ordered beta-hairpin antimicrobial peptide aggregate from 2D solid-state NMR

Discovering neuropeptides in Caenorhabditis elegans by two dimensional liquid chromatography and mass spectrometry

MaP peptides: Programming the self-assembly of peptide-based mesoscopic matrices

Protamine as an efficient membrane-translocating peptide

Characterization of adducts formed between human serum albumin and the butadiene metabolite epoxybutanediol

Phase behavior and nanoscale structure of phospholipid membranes incorporated with acylated C-14-peptides

Engineering stable peptide toxins by means of backbone cyclization: Stabilization of the alpha-conotoxin MII

Cluster Metrics

Authors

shai, y 4
mardilovich, a 3
kokkoli, e 3
banerjee, a 3
aguilar, mi 3
zhang, j 2
yang, dc 2
weissleder, r 2
wang, xb 2
verma, s 2
thibault, p 2
stupp, si 2
smith, rd 2
singh, n 2
reynolds, f 2

Sources

analytical chemistry 10
journal of the american chemical society 9
langmuir 6
journal of biological chemistry 6
biophysical journal 6
biochemistry 6
chembiochem 5
biochemical and biophysical research communications 5
proceedings of the national academy of sciences of the united states of america 4
chemical communications 4
biomacromolecules 4
bioconjugate chemistry 4
rapid communications in mass spectrometry 3
journal of mass spectrometry 3
journal of controlled release 3

Keywords
biochemistry & molecular biology 37
chemistry, multidisciplinary 25
chemistry, analytical 21
proteins 15
protein 15
biophysics 15
biochemistry & molecular biology 14
chemistry, organic 12
chemistry, physical 11
chemistry, medicinal 11
spectroscopy 11
peptide 9
biochemical research methods 8
chemistry, organic 8
peptides 7

Publication Year
2005 153
2004 8
2006 4
2003 1

Country
usa 67
japan 18
germany 12
canada 11
australia 10
peoples r china 9

france 8
netherlands 7
england 7
israel 6
india 6
denmark 5
south korea 4
italy 4
switzerland 3

Institution
mit 5
weizmann inst sci 4
harvard univ 4
univ wisconsin 3
univ utrecht 3
univ queensland 3
univ minnesota 3
scripps res inst 3
rice univ 3
northwestern univ 3
monash univ 3
westmead hosp 2
vanderbilt univ 2
univ texas 2
univ so denmark 2

DataBase
science citation index 166

- # CLUSTER 11
  Fibrils (especially amyloid and collagen fibrils), focusing on formation by aggregation, role of amyloids in neural conditions (especially Alzheimer's disease), and structure (102 Records)

(Countries: USA very dominant, England, Japan. Institutions: University of Cambridge, Osaka University, NIDDKD, Japan S&T Agency. Other USA include JHU, Baylor College of Medicine, Arizona State University, UCLA).

Cluster Syntax Features

Descriptive Terms

fibril 32.0%, amyloid 27.1%, beta 4.2%, aggreg 3.1%, amyloid.fibrils 2.6%, protein 2.2%, diseas 1.9%, peptid 1.4%, alzheim 1.3%, collagen 0.8%, protofibril 0.8%, prion 0.7%, sheet 0.5%, fibril.formation 0.5%, beta.sheet 0.5%

Discriminating Terms
fibril 19.2%, amyloid 16.4%, beta 1.8%, film 1.7%, amyloid.fibrils 1.6%, aggreg 1.4%, diseas 1.1%, alzheim 0.8%, surfac 0.8%, protein 0.6%, peptid 0.6%, nanoparticl 0.6%, carbon 0.6%, particl 0.5%, magnet 0.5%

Single Word Terms
fibril 80, amyloid 75, protein 72, structur 69, microscopi 60, form 59, beta 57, format 56, diseas 54, aggreg 51, forc 43, atom 42, assembl 39, alzheim 37, peptid 36

Double Word Terms
amyloid.fibrils 41, atomic.force 40, force.microscopy 40, alzheimer.disease 30, electron.microscopy 26, fibril.formation 25, beta.sheet 23, amyloid.beta 20, transmission.electron 16, self.assembly 15, amyloid.formation 15, circular.dichroism 13, wild.type 12, beta.amyloid 12, amyloid.fibril 12

Triple Word Terms
atomic.force.microscopy 39, transmission.electron.microscopy 15, beta.sheet.structure 8, amyloid.fibril.formation 8, form.amyloid.fibrils 6, force.microscopy.afm 5, amyloid.beta.protein 5, self.assembly.amyloid 4, wild.type.beta 4, formation.amyloid.fibrils 4, cross.beta.structure 4, paired.helical.filaments 4, scanning.transmission.electron 4, amyloid.beta.peptide 4, microscopy.atomic.force 4

Term Cliques
40.31% amyloid beta aggreg diseas peptid alzheim protofibril prion sheet
43.25% amyloid beta aggreg amyloid.fibrils diseas peptid alzheim prion sheet
47.82% amyloid beta aggreg amyloid.fibrils protein diseas peptid alzheim prion
45.10% fibril collagen
41.50% fibril amyloid aggreg diseas peptid protofibril prion sheet fibril.formation
44.44% fibril amyloid aggreg amyloid.fibrils diseas peptid prion sheet fibril.formation
49.02% fibril amyloid aggreg amyloid.fibrils protein diseas peptid prion fibril.formation
42.75% fibril amyloid beta aggreg diseas peptid protofibril prion sheet beta.sheet
45.39% fibril amyloid beta aggreg amyloid.fibrils diseas peptid prion sheet beta.sheet
52.51% fibril amyloid beta aggreg amyloid.fibrils protein diseas peptid prion

Sample Cluster Record Titles

Probing the origins, diagnosis and treatment of amyloid diseases using antibodies

Heterotrimeric type I collagen C-telopeptide conformation as docked to its helix receptor

Exploring the early steps of aggregation of amyloid-forming peptide KFFE

Construction of a protein array on amyloid-like fibrils using co-assembly of designed peptides

Amyloidogenic domains, prions and structural inheritance: rudiments of early life or recent acquisition?

Atomic force microscopy study of human amylin (20-29) fibrils

Stereospecific amyloid-like fibril formation by a peptide fragment of beta(2)-microglobulin

Rapid assembly of amyloid-beta peptide at a liquid/liquid interface produces unstable beta-sheet fibers

Structure and function of amyloid in Alzheimer's disease

Cluster Metrics

Authors
naiki, h 5
goto, y 5
kawai, t 4
yeh, ml 3
yau, wm 3
yamaguchi, k 3
wickner, rb 3
tycko, r 3
rosenberry, tl 3
reed, dk 3
park, cb 3
nichols, mr 3
moss, ma 3
luo, zp 3
hoh, jh 3

Sources
biochemistry 14
journal of molecular biology 8
journal of biological chemistry 8
microscopy research and technique 5
biophysical journal 5
journal of structural biology 4

science 2
protein science 2
protein and peptide letters 2
neurobiology of disease 2
langmuir 2
journal of the american chemical society 2
febs journal 2
biochemical and biophysical research communications 2
amyloid-journal of protein folding disorders 2

Keywords
biochemistry & molecular biology 55
in-vitro 29
protein 26
alzheimers-disease 20
atomic-force microscopy 17
fibril formation 14
biophysics 13
aggregation 13
model 12
peptide 11
atomic-force microscopy 11
alpha-synuclein 11
disease 10
amyloid fibrils 10
alzheimer's disease 9

Publication Year
2005 93
2004 8
2006 1

Country
usa 45
england 13
japan 12
italy 6
sweden 5
netherlands 4
germany 4
denmark 4
taiwan 3
peoples r china 3
hungary 3
france 3
canada 3

belgium 3
switzerland 2

Institution
univ cambridge 7
osaka univ 6
niddkd 5
japan sci & technol agcy 5
fukui univ 4
mayo clin 3
johns hopkins univ 3
baylor coll med 3
arizona state univ 3
univ wageningen & res ctr 2
univ szeged 2
univ pecs 2
univ nottingham 2
univ florence 2
univ calif los angeles 2

DataBase
science citation index 102

- CLUSTER 110
  Viruses and RNA, focusing on structure determination, capsid properties, and sequencing (129 Records)

(Countries: USA very dominant, Japan, Germany, France, China, England. Institutions: UCI, Scripps Research Institute, UCD, National

Institute Infectious Diseases, CAS. Other USA include Vanderbilt University, University of Texas, UCSD, Texas A&M.).

Cluster Syntax Features

Descriptive Terms

viru 18.7%, rna 15.9%, protein 8.9%, capsid 7.7%, sequenc 3.8%, viral 3.0%, genom 3.0%, vlp 1.8%, infect 1.6%, particl 1.0%, mosaic.virus 0.9%, mosaic 0.9%, gene 0.9%, trna 0.8%, virus 0.8%

Discriminating Terms

viru 11.8%, rna 10.1%, capsid 4.9%, protein 4.1%, sequenc 2.1%, viral 1.9%, genom 1.9%, film 1.8%, vlp 1.1%, infect 1.0%, surfac 0.6%, mosaic.virus 0.6%, carbon 0.6%, nanoparticl 0.6%, mosaic 0.6%

Single Word Terms

protein 97, viru 77, structur 71, particl 62, sequenc 52, rna 48, two 46, viral 38, assembl 38, genom 37, capsid 37, form 35, infect 35, cell 33, surfac 33

Double Word Terms

virus.particles 25, electron.microscopy 18, mosaic.virus 17, amino.acid 16, coat.protein 15, atomic.force 13, particles.diameter 12, viral.particles 12, force.microscopy 12, capsid.protein 11, particles.vlps 11, hepatitis.virus 8, three.dimensional 8, capsid.assembly 8, virus.particle 8

Triple Word Terms

atomic.force.microscopy 12, virus.particles.vlps 9, tobacco.mosaic.virus 7, rna.dependent.rna 5, mosaic.virus.tmv 5, dependent.rna.polymerase 5, open.reading.frame 5, amino.acid.residues 4, green.fluorescent.protein 4, double.stranded.rna 4, amino.acid.sequence 4, amino.acid.sequences 4, force.microscopy.afm 3, single.stranded.rna 3, enzyme.linked.immunosorbent 3

Term Cliques

31.32% protein vlp infect gene virus
34.42% protein genom infect gene virus
34.42% protein sequenc genom mosaic.virus mosaic
26.55% rna sequenc gene trna
42.64% rna protein viral genom
40.78% rna protein sequenc genom gene
37.50% viru protein viral genom infect particl mosaic.virus virus
37.02% viru protein viral genom infect particl mosaic.virus mosaic
38.65% viru protein capsid vlp infect particl virus
40.97% viru protein capsid viral infect particl virus

Sample Cluster Record Titles

Improved metal cluster deposition on a genetically engineered tobacco mosaic virus template

Caladium virus x, a new potexvirus from Caladium bicolor (Araceae)

Structure of birnavirus-like particles determined by combined electron cryomicroscopy and X-ray crystallography

A C-terminal truncated hepatitis C virus core protein variant assembles in vitro into virus-like particles in the absence of structured nucleic acids

"Natively unfolded" VPg is essential for Sesbania mosaic virus serine protease activity

jViz.Rna - A Java tool for RNA secondary structure visualization

P-RnaPredict - A parallel evolutionary algorithm for RNA folding: Effects of pseudorandom number quality

Wrapping things up about virus RNA replication

In vitro assembly of mosaic hepatitis B virus capsid-like particles (CLPs): Rescue into CLPs of assembly-deficient core protein fusions and FRET-suited CLP's

Cluster Metrics

Authors

mcpherson, a 4
takeda, n 3
kuznetsov, yg 3
zhang, j 2
xing, l 2
wiese, kc 2
white, d 2
vuento, m 2
vogel, m 2
tsukahara, t 2
toivola, j 2
oker-blom, c 2
nassal, m 2
miyamura, t 2
li, tc 2

Sources
journal of virology 13
virology 6
proceedings of the national academy of sciences of the united states of america 5
nucleic acids research 5
journal of molecular biology 4
virus research 3
journal of nanoscience and nanotechnology 3
journal of general virology 3
journal of computational and theoretical nanoscience 3
ieee transactions on nanobioscience 3
biochemical and biophysical research communications 3
archives of virology 3
on the convergence of bio-information-, environmental-, energy-, space- and nano-technologies, pts 1 and 2 2
molecular plant pathology 2
journal of virological methods 2

Keywords
virology 27
biochemistry & molecular biology 27
protein 14
dna 11
biophysics 10
chemistry, multidisciplinary 8
multidisciplinary sciences 7
cell biology 7
sequence 7
rna 7
identification 7
expression 7
binding 7
plant sciences 6
biochemical research methods 6

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2005 113
2004 16

Country
usa 51
japan 13
germany 11
france 10
peoples r china 8
england 7

italy 5
russia 4
netherlands 4
india 4
finland 4
canada 4
taiwan 3
switzerland 3
south korea 3

Institution

univ calif irvine 4
scripps res inst 4
univ calif davis 3
natl inst infect dis 3
chinese acad sci 3
vanderbilt univ 2
univ tokyo 2
univ texas 2
univ leeds 2
univ jyvaskyla 2
univ hosp freiburg 2
univ helsinki 2
univ calif san diego 2
texas a&m univ 2
simon fraser univ 2

DataBase

science citation index 129

- # CLUSTER 130

  Gene expression and gene delivery for therapeutic benefit, focusing on nanoparticles as non-viral vectors for gene delivery, analysis of gene expression data, and DNA transfection systems (157 Records)

(Countries: USA very dominant, South Korea, Japan, China, Germany, France. Institutions: National University of Singapore, Dankook University, Institute of Bioengineering and Nanotechnology. USA include University of Utah, University of Texas, University of Tennessee.).

Cluster Syntax Features

Descriptive Terms

gene 44.1%, express 5.3%, deliveri 3.1%, transfect 1.6%, cell 1.6%, dna 1.5%, vector 1.5%, gene.delivery 1.4%, gene.expression 1.2%, plasmid 1.2%, therapi 0.8%, isol 0.7%, transcript 0.7%, viral 0.6%, gene.therapy 0.5%

Discriminating Terms

gene 27.5%, express 3.0%, film 1.8%, deliveri 1.7%, transfect 1.0%, gene.delivery 0.9%, vector 0.8%, gene.expression 0.7%, plasmid 0.7%, surfac 0.7%, temperatur 0.6%, layer 0.5%, carbon 0.5%, structur 0.5%, nanotub 0.5%

Single Word Terms

gene 134, express 84, cell 76, system 57, deliveri 56, dna 53, high 41, effici 40, model 39, human 37, level 36, therapi 36, particl 34, activ 33, complex 33

Double Word Terms

gene.delivery 40, gene.expression 34, gene.therapy 25, plasmid.dna 20, gene.transfer 16, electron.microscopy 15, delivery.system 15, transfection.efficiency 14, non.viral 13, viral.gene 10, transgene.expression 10, reporter.gene 10, transmission.electron 9, cancer.cells 7, drug.delivery 7

Triple Word Terms

non.viral.gene 9, transmission.electron.microscopy 9, viral.gene.delivery 7, polymerase.chain.reaction 6, green.fluorescent.protein 6, targeted.gene.delivery 6, gene.delivery.system 6, nucleic.acid.delivery 5, gene.expression.patterns 4, chain.reaction.pcr 4, field.gel.electrophoresis 4, spectrum.beta.lactamase 4, scanning.electron.microscopy 4, electron.microscopy.tem 4, dynamic.light.scattering 4

Term Cliques

38.00% gene isol transcript
44.46% gene express cell gene.expression transcript
32.96% gene express deliveri transfect cell dna vector gene.delivery plasmid therapi viral gene.therapy
33.44% gene express deliveri transfect cell dna vector gene.delivery gene.expression plasmid therapi gene.therapy

Sample Cluster Record Titles

Gene expression clustering using self-organizing maps: analysis of the macrophage response to particulate biomaterials

Multifunctional nanoparticles possessing a "magnetic motor effect" for drug or gene delivery

Quantification of the expression of multidrug resistance-related genes in human tumour cell lines grown with free doxorubicin or doxorubicin encapsulated in polyisohexylcyanoacrylate nanospheres

Macro-branched cell-penetrating peptide design for gene delivery

WIGED: Web-based data integration system for analysis of gene expression in disease

Polymers for DNA delivery

Trimethylated chitosans as non-viral gene delivery vectors: Cytotoxicity and transfection efficiency

A bio-recognition device developed onto nano-crystals of carbonate apatite for cell-targeted gene delivery

Nanoparticulate system for efficient gene transfer into refractory cell targets

Cluster Metrics

Authors
wang, s 5
wang, cy 3
schatzlein, ag 3
li, y 3

lee, sw 3
yee, wc 2
wang, x 2
uchimura, s 2
uchegbu, if 2
tetley, l 2
shindo, t 2
roth, ja 2
ramesh, r 2
oishi, y 2
nishimura, g 2

Sources
journal of controlled release 8
bioconjugate chemistry 5
on the convergence of bio-information-, environmental-, energy-, space- and nano-technologies, pts 1 and 2 4
journal of nanoscience and nanotechnology 4
journal of gene medicine 4
journal of clinical microbiology 4
molecular therapy 3
journal of computational and theoretical nanoscience 3
proceedings of the national academy of sciences of the united states of america 2
journal of the american chemical society 2
journal of microbiology 2
journal of drug targeting 2
journal of drug delivery science and technology 2
journal of biological chemistry 2
ieee transactions on nanobioscience 2

Keywords
chemistry, multidisciplinary 26
in-vivo 22
microbiology 21
cells 19
biochemistry & molecular biology 16
expression 16
therapy 14
pharmacology & pharmacy 14
genetics & heredity 14
dna 13
delivery 13
nanoparticles 12
identification 12
medicine, research & experimental 11
in-vitro 11

Publication Year
2005 136
2004 20
2006 1

Country
usa 51
south korea 19
japan 16
peoples r china 12
germany 11
france 11
singapore 9
italy 7
canada 7
spain 5
england 5
india 4
scotland 3
poland 3
norway 3

Institution
natl univ singapore 6
dankook univ 5
inst bioengn & nanotechnol 4
univ utah 3
univ tokyo 3
univ strathclyde 3
univ munich 3
univ glasgow 3
osaka univ 3
yamaguchi univ 2
univ zagreb 2
univ wales coll cardiff 2
univ texas 2
univ tennessee 2
univ oslo 2

DataBase
science citation index 157

- # CLUSTER 64

  Treatment and risk prediction of cancer and cardiovascular disease (CVD), focusing on evaluation of lymphatic system (especially sentinel lymph nodes [SLNs]), especially for patients with breast cancer (88 Records)

(Countries: USA very dominant, England, Netherlands. Institutions: Massachusetts General Hospital, Harvard University, University of Utah, University of Barcelona, Hospital Clinia Barcelona. Other USA include University of Texas, MIT, Brigham and Women's Hospital, Boston University, Beth Israel Decaoness Medical Center).

Cluster Syntax Features

Descriptive Terms

patient 18.0%, node 14.0%, sentinel 6.1%, lymph 5.9%, risk 4.2%, lymph.node 2.6%, cancer 2.6%, diseas 2.2%, cvd 1.6%, sln 1.5%, cardiovascular 1.5%, metastas 1.0%, sentinel.lymph 1.0%, arteri 0.9%, women 0.9%

Discriminating Terms

patient 10.2%, node 7.9%, sentinel 3.5%, lymph 3.4%, risk 2.4%, film 1.7%, lymph.node 1.5%, cancer 1.4%, diseas 1.2%, cardiovascular 0.8%, sln 0.8%, surfac 0.8%, cvd 0.7%, structur 0.6%, sentinel.lymph 0.6%

Single Word Terms

patient 55, diseas 38, cancer 37, node 35, risk 31, lymph 30, on 26, sentinel 26, factor 25, clinic 25, cardiovascular 25, two 24, treatment 24, high 23, sensit 22

Double Word Terms

lymph.node 27, sentinel.lymph 20, cardiovascular.disease 18, disease.cvd 17, lymph.nodes 16, sentinel.node 14, tc.99m 14, risk.factors 14, breast.cancer 13, sentinel.nodes 11, cancer.patients 11, blue.dye 10, node.biopsy 10, magnetic.resonance 9, node.sln 9

Triple Word Terms

sentinel.lymph.node 18, cardiovascular.disease.cvd 16, lymph.node.sln 9, sentinel.lymph.nodes 7, sentinel.node.biopsy 7, magnetic.resonance.imaging 7, lymph.node.metastases 7, injection.tc.99m 6, squamous.cell.carcinoma 6, breast.cancer.patients 6, cvd.risk.factors 5, tc.99m.nanocolloid 5, tc.99m.labelled 5, lymph.node.biopsy 5, low.density.lipoprotein 4

Term Cliques

24.43% risk cvd cardiovascular arteri
28.64% risk diseas cvd cardiovascular women
26.64% node sentinel lymph lymph.node cancer sln metastas sentinel.lymph women
52.84% patient diseas
32.20% patient node sentinel lymph lymph.node cancer sln metastas sentinel.lymph

Sample Cluster Record Titles

Metabolic syndrome, a cardiovascular disease risk factor: Role of adipocytokines and impact of diet and physical activity

Oxidative stress and vascular disease

Sentinel node biopsy to evaluate the metastatic dissemination of oesophageal adenocarcinoma

Evaluation of sentinel nodes in the assessment of cervical metastases from head and neck squamous cell carcinomas - Presented at the 17th World Congress of the International Federation of Oto-Rhino-Laryngological Societies (IFOS) in Cairo, Egypt, 28 September 3 October, 2002

Sentinel node biopsy can replace four-node-sampling in staging early breast cancer

Endothelial dysfunction links erectile dysfunction to heart disease

Sensitive, noninvasive detection of lymph node metastases

[Radioguided sentinel lymph node detection in vulvar cancer]

[Sentinel lymph node mapping of the pleural space]

Cluster Metrics

Authors
weissleder, r 4
nieweg, oe 4
olmos, rav 3
kroon, bk 3
horenblas, s 3
harisinghani, mg 3
zanon, g 2
vidal-sicart, s 2
velasco, m 2
van tinteren, h 2
tabatabaei, s 2
sibbering, m 2
seljeflot, i 2
santamaria, g 2
sandvik, l 2

Sources
european journal of nuclear medicine and molecular imaging 7
arteriosclerosis thrombosis and vascular biology 3
urology 2
tumori 2
on the convergence of bio-information-, environmental-, energy-, space- and nano-technologies, pts 1 and 2 2
journal of urology 2
journal of clinical oncology 2
gynecologic oncology 2
american journal of cardiology 2
trees-structure and function 1
toxicology and applied pharmacology 1
thrombosis and haemostasis 1
skin pharmacology and physiology 1
scandinavian journal of clinical & laboratory investigation 1
quality of life research 1

Keywords
lymphoscintigraphy 12
radiology, nuclear medicine & medical imaging 11
oncology 10

carcinoma 9
biopsy 8
urology & nephrology 7
cardiac & cardiovascular systems 7
lymphadenectomy 7
atherosclerosis 7
squamous-cell carcinoma 6
dissection 6
coronary-heart-disease 6
cancer 6
coronary-heart-disease 5
cardiovascular disease 5

Publication Year
2005 79
2004 9

Country
usa 30
england 12
netherlands 7
japan 5
italy 5
spain 4
germany 4
canada 4
sweden 3
south korea 3
france 3
denmark 3
austria 3
turkey 2
taiwan 2

Institution
massachusetts gen hosp 5
harvard univ 4
univ utah 3
univ barcelona 3
hosp clin barcelona 3
univ vienna 2
univ texas 2
univ amsterdam 2
ullevaal univ hosp 2
royal marsden hosp 2
netherlands canc inst 2

mit 2
brigham & womens hosp 2
boston univ 2
beth israel deaconess med ctr 2

DataBase
science citation index 88

- CLUSTER 201
  Studies of tumors and the brain, with emphasis on liposomal and nanoparticle-based delivery (especially of drugs), nanostructure-aided magnetic resonance imaging of cells, and crossing of the blood-brain barrier (208 Records)

(Countries: USA very dominant, China, Japan, Germany, South Korea, France. Institutions: Washington University, CAS, University of Paris, University of Michigan, EWHA Women's University. Other USA include University of Pennsylvania, Ohio State University, Massachusetts General Hospital, University of Utah, University of Missouri, University of Kentucky, Rice University).

Cluster Syntax Features

Descriptive Terms

liposom 10.7%, tumor 9.2%, brain 8.8%, target 3.0%, blood 2.6%, rat 2.2%, mice 2.2%, cell 2.1%, vivo 1.8%, tissu 1.7%, imag 1.5%, therapi 1.5%, nanoparticl 1.2%, conjug 1.2%, deliveri 1.0%

Discriminating Terms
liposom 7.3%, tumor 6.2%, brain 6.0%, film 2.0%, blood 1.7%, target 1.6%, mice 1.5%, rat 1.4%, vivo 1.1%, tissu 1.0%, therapi 0.9%, structur 0.6%, conjug 0.6%, carbon 0.6%, temperatur 0.6%

Single Word Terms
cell 106, nanoparticl 72, target 71, tumor 67, vivo 63, activ 62, tissu 62, system 60, drug 59, surfac 59, blood 56, vitro 54, imag 54, mice 54, deliveri 52

Double Word Terms
blood.brain 19, magnetic.resonance 19, brain.barrier 19, drug.delivery 18, electron.microscopy 17, resonance.imaging 17, vitro.vivo 14, iron.oxide 13, contrast.agents 12, polyethylene.glycol 12, endothelial.cells 11, barrier.bbb 10, tumor.growth 10, glycol.peg 10, scanning.electron 10

Triple Word Terms
blood.brain.barrier 19, magnetic.resonance.imaging 17, brain.barrier.bbb 10, poly.ethylene.glycol 8, resonance.imaging.mri 8, central.nervous.system 8, scanning.electron.microscopy 8, transmission.electron.microscopy 7, surface.plasmon.resonance 6, cross.blood.brain 5, polyethylene.glycol.peg 5, ethylene.glycol.peg 5, iron.oxide.nanoparticles 5, sprague.dawley.rats 4, alpha.beta.integrin 4

Term Cliques
30.65% target blood cell tissu therapi nanoparticl conjug deliveri
30.77% target blood cell tissu imag therapi nanoparticl conjug
24.88% brain rat vivo deliveri
24.04% brain blood rat deliveri
30.77% brain target cell vivo tissu nanoparticl conjug deliveri
30.89% brain target cell vivo tissu imag nanoparticl conjug
30.35% brain target blood cell tissu nanoparticl conjug deliveri
30.47% brain target blood cell tissu imag nanoparticl conjug
31.43% tumor target cell tissu imag therapi nanoparticl conjug
32.09% tumor target cell vivo tissu imag nanoparticl conjug
30.72% tumor target mice cell tissu therapi nanoparticl conjug deliveri
31.30% tumor target mice cell vivo tissu nanoparticl conjug deliveri
30.02% liposom tumor target cell tissu therapi nanoparticl conjug deliveri

Sample Cluster Record Titles

[Drug delivery across the blood-brain barrier]

[Peptide-derivatized biodegradable nanoparticles able to cross the blood-brain barrier]

[Development and brain delivery of chitosan-PEG nanoparticles functionalized with the monoclonal antibody OX26]

[Relaxivity of liposomal paramagnetic MRI contrast agents]

[MR molecular imaging and fluorescence microscopy for identification of activated tumor endothelium using a bimodal lipidic nanoparticle]

[Nanosphere-mediated delivery of vitamin E increases its efficacy against oxidative stress resulting from exposure to amyloid beta]

[Accelerated blood clearance of PEGylated liposomes following preceding liposome injection: Effects of lipid dose and PEG surface-density and chain length of the first-dose liposomes]

[In vivo antitumor activity of folate receptor-targeted liposomal daunorubicin in a murine leukemia model]

[Intravenous hydrophobic drug delivery: A porous particle formulation of paclitaxel (AI-850)]

Cluster Metrics

Authors
couvreur, p 7
wickline, sa 5
andrieux, k 5
lanza, gm 4
vandelli, ma 3
tosi, g 3
sohn, ys 3
robertson, jd 3
mumper, rj 3
kobayashi, t 3
honda, h 3
gil, s 3
garcia-garcia, e 3
forni, f 3
desai, n 3

Sources

journal of controlled release 12
international journal of pharmaceutics 6
pharmaceutical research 5
nano letters 5
on the convergence of bio-information-, environmental-, energy-, space- and nano-technologies, pts 1 and 2 4
magnetic resonance in medicine 4
lasers in surgery and medicine 4
journal of magnetism and magnetic materials 4
bioconjugate chemistry 4
photochemistry and photobiology 3
european journal of pharmaceutics and biopharmaceutics 3
current pharmaceutical biotechnology 3
anticancer research 3
analytical chemistry 3
review of scientific instruments 2

Keywords

chemistry, multidisciplinary 34
nanoparticles 28
pharmacology & pharmacy 24
cells 24
radiology, nuclear medicine & medical imaging 21
liposomes 18
cancer 18
in-vivo 17
pharmacology & pharmacy 16
oncology 16
biochemistry & molecular biology 16
nanoparticles 15
delivery 13
therapy 12
rat 12

Publication Year

2005 188
2004 19
2006 1

Country

usa 96
peoples r china 18
japan 17
germany 17
south korea 15

france 13
england 8
netherlands 6
italy 6
taiwan 5
spain 4
brazil 4
austria 4
australia 4
switzerland 3

Institution
washington univ 6
chinese acad sci 6
univ paris 11 5
univ michigan 5
ewha womans univ 5
univ penn 4
ohio state univ 4
massachusetts gen hosp 4
korea adv inst sci & technol 4
yonsei univ 3
univ utah 3
univ tokushima 3
univ missouri 3
univ kentucky 3
rice univ 3

DataBase
science citation index 208

- CLUSTER 191
  Cellular function and processes, focusing on endothelial and epithelial

cells, cellular response to gene expression, induction and inhibition of apoptosis, and studies on cancer and tumor cells (339 Records)

(Countries: USA dominant, Germany, South Korea, Japan, China. Institutions: Harvard University, Wonkwang University, Kyung Hee University, JHU. Other USA include University of Florida, University of Pennsylvania, University of Michigan, University of Missouri, UCLA.).

Cluster Syntax Features

Descriptive Terms
cell 41.3%, human 3.4%, express 3.2%, endotheli 2.6%, apoptosi 1.5%, activ 1.3%, cancer 1.0%, receptor 0.9%, epitheli 0.9%, inhibit 0.9%, endothelial.cells 0.8%, protein 0.8%, gene 0.6%, cultur 0.6%, tumor 0.6%

Discriminating Terms
cell 23.5%, human 2.0%, film 2.0%, express 1.9%, endotheli 1.7%, apoptosi 1.0%, carbon 0.6%, epitheli 0.6%, temperatur 0.6%, cancer 0.6%, structur 0.6%, crystal 0.6%, nanotub 0.5%, endothelial.cells 0.5%, receptor 0.5%

Single Word Terms
cell 337, human 152, activ 149, express 133, microscopi 112, protein 111, induc 107, surfac 102, function 94, electron 90, line 90, mechan 87, inhibit 85, cultur 77, role 74

Double Word Terms
electron.microscopy 79, cell.line 56, transmission.electron 52, endothelial.cells 48, cancer.cells 35, epithelial.cells 34, cell.surface 31, cell.lines 29, scanning.electron 29, cell.proliferation 23, atomic.force 22, force.microscopy 21, growth.factor 21, endothelial.cell 21, cell.death 21

Triple Word Terms
transmission.electron.microscopy 45, scanning.electron.microscopy 27, atomic.force.microscopy 20, surface.plasmon.resonance 20, polymerase.chain.reaction 15, electron.microscopy.tem 12, human.umbilical.vein 12, umbilical.vein.endothelial 11, tumor.necrosis.factor 11, vein.endothelial.cells 10, green.fluorescent.protein 9, electron.microscopy.sem 9, necrosis.factor.alpha 9, reactive.oxygen.species 8, epidermal.growth.factor 8

Term Cliques
38.20% cell apoptosi activ inhibit protein tumor
39.65% cell apoptosi activ cancer cultur
35.84% cell apoptosi activ cancer inhibit tumor
39.76% cell human cancer epitheli cultur
43.41% cell human activ inhibit protein tumor

45.90% cell human activ cancer cultur
41.05% cell human activ cancer inhibit tumor
40.46% cell human endotheli activ endothelial.cells cultur
39.70% cell human endotheli activ inhibit endothelial.cells protein
39.28% cell human express epitheli gene cultur
40.95% cell human express epitheli protein gene
39.82% cell human express receptor epitheli cultur
41.49% cell human express receptor epitheli protein
44.40% cell human express activ gene cultur
46.07% cell human express activ protein gene
44.94% cell human express activ receptor cultur
43.53% cell human express activ receptor inhibit protein

Sample Cluster Record Titles

Induction and regulation of Fas-mediated apoptosis in human thyroid epithelial cells

Aldosterone makes human endothelium stiff and vulnerable

Mechanochemically activated doxorubicin nanoparticles in combination with 40 MHz frequency irradiation on A-549 lung carcinoma cells

Membrane toxicity accounts for apoptosis induced by realgar nanoparticles in promyelocytic leukemia HL-60 cells

Detection of HSP60 on the membrane surface of stressed human endothelial cells by atomic force and confocal microscopy

Novel metal clusters isolated from blood are lethal to cancer cells

Integrity of endothelium in cryopreserved human cornea

Selective reduction of the interaction of magnetic nanoparticles with leukocytes and tumor cells by human plasma

Folate conjugated fluorescent silica nanoparticles for labeling neoplastic cells

Cluster Metrics

Authors

hong, sh 10
kim, hr 9
kim, hm 9

chae, hj 9
weissleder, r 5
tan, wh 4
chan, wh 4
teitell, ma 3
santra, s 3
oberleithner, h 3
moudgil, bm 3
ludwig, t 3
kim, yk 3
kim, js 3
kim, ch 3

Sources

journal of biological chemistry 8
biomaterials 7
biochemical and biophysical research communications 7
on the convergence of bio-information-, environmental-, energy-, space- and nano-technologies, pts 1 and 2 6
journal of virology 5
journal of nanoscience and nanotechnology 5
journal of ethnopharmacology 5
journal of cell science 5
anticancer research 5
biophysical journal 4
proceedings of the national academy of sciences of the united states of america 3
nano letters 3
langmuir 3
lab on a chip 3
journal of medicinal chemistry 3

Keywords

biochemistry & molecular biology 50
in-vitro 31
expression 31
cell biology 28
apoptosis 28
cells 24
cancer 24
chemistry, multidisciplinary 23
pharmacology & pharmacy 20
cell biology 19
oncology 18
cells 18
engineering, biomedical 17
biophysics 17

activation 17

Publication Year
2005 302
2004 32
2006 5

Country
usa 133
germany 42
south korea 31
japan 27
peoples r china 23
canada 16
italy 15
france 12
england 11
sweden 9
switzerland 8
taiwan 7
israel 7
austria 7
netherlands 6

Institution
harvard univ 12
wonkwang univ 8
kyung hee univ 8
johns hopkins univ 8
chonbuk natl univ 7
univ munster 6
univ florida 6
univ penn 5
univ michigan 5
seoul natl univ 5
hebrew univ jerusalem 5
univ turin 4
univ missouri 4
univ calif los angeles 4
osaka univ 4

DataBase
science citation index 339

- # CLUSTER 195

  Investigation of cell surface and plasma membrane (especially of bacteria), focusing on cell adhesion, labeling for detetion, imaging techniques, and intercellular transfer (608 Records)

(Countries: USA very dominant, Japan, Germany, followed by China, France, England. Institutions: University of Tokyo, Harvard University, University of Texas, National University of Singapore, CNRS. Other USA include JHU, Stanford University, University of Wisconsin, University of Washington, University of Pennsylvania, MIT).

Cluster Syntax Features

Descriptive Terms

cell 65.4%, membran 1.6%, adhes 1.2%, cultur 0.9%, cellular 0.8%, surfac 0.7%, label 0.6%, live 0.5%, imag 0.4%, tissu 0.4%, forc 0.4%, cell.adhesion 0.4%, protein 0.3%, bacteri 0.3%, cell.wall 0.3%

Discriminating Terms

cell 45.0%, film 2.0%, temperatur 0.6%, nanotub 0.6%, carbon 0.6%, cultur 0.6%, adhes 0.6%, membran 0.5%, crystal 0.5%, cellular 0.5%, deposit 0.5%, si 0.4%, particl 0.4%, structur 0.4%, phase 0.4%

Single Word Terms

cell 603, surfac 259, microscopi 210, structur 177, membran 155, electron 147, function 141, system 125, mechan 124, applic 123, protein 119, adhes 116, forc 116, cultur 114, model 113

Double Word Terms

electron.microscopy 104, atomic.force 83, force.microscopy 72, scanning.electron 64, cell.adhesion 63, cell.surface 54, transmission.electron 53, cell.wall 39, plasma.membrane 33, microscopy.afm 33, stem.cells 31, cells.cell 30, living.cells 29, single.cell 28, cell.membrane 28

Triple Word Terms

atomic.force.microscopy 71, scanning.electron.microscopy 48, transmission.electron.microscopy 42, force.microscopy.afm 33, magnetic.resonance.imaging 18, green.fluorescent.protein 16, electron.microscopy.tem 15, atomic.force.microscope 14, scanning.electron.microscope 12, ray.photoelectron.spectroscopy 12, superparamagnetic.iron.oxide 11, electron.microscopy.sem 11, iron.oxide.nanoparticles 11, red.blood.cells 11, smooth.muscle.cells 10

Term Cliques
34.95% cell live forc bacteri
33.68% cell label live bacteri
35.00% cell surfac forc bacteri cell.wall
33.52% cell cellular label tissu protein
32.99% cell cellular label live protein
32.73% cell cellular label live imag
37.53% cell adhes surfac forc bacteri
38.06% cell adhes surfac forc cell.adhesion
33.22% cell adhes cellular forc cell.adhesion
30.51% cell adhes cellular tissu cell.adhesion protein
32.28% cell adhes cultur surfac tissu cell.adhesion protein
46.71% cell membran surfac protein
38.55% cell membran surfac forc cell.wall
35.30% cell membran cellular live protein
32.37% cell membran cellular live imag forc

Sample Cluster Record Titles

Effect of surface roughness of ground titanium on initial cell adhesion

Vesicle traffic through intercellular bridges in DU 145 human prostate cancer cells

Fluorescence imaging of two-photon linear dichroism: Cholesterol depletion disrupts molecular orientation in cell membranes

Membrane-wall attachments in plasmolysed plant cells

Vascular smooth muscle cells on polyelectrolyte multilayers: Hydrophobicity-directed adhesion and growth

Not just another hole in the wall: understanding intercellular protein trafficking

Methods for magnetically labeling stem and other cells for detection by in vivo magnetic resonance imaging

Methods for magnetically labeling stem and other cells for detection by in vivo magnetic resonance imaging

Investigating cellular signaling reactions in single attoliter vesicles

Cluster Metrics

Authors

chen, y 6
zhang, zl 5
pang, dw 4
kobayashi, t 4
honda, h 4
frank, ja 4
chen, j 4
arbab, as 4
yan, f 3
vo-dinh, t 3
van der mei, hc 3
sastry, m 3
ratner, bd 3
nealey, pf 3
murphy, cj 3

Sources

biomaterials 22
biophysical journal 17
langmuir 16
journal of biomedical materials research part a 14
analytical chemistry 11
proceedings of the national academy of sciences of the united states of america 9
biomacromolecules 9
journal of the american chemical society 8
applied and environmental microbiology 8
tissue engineering 6
science 6
magnetic resonance in medicine 6
biosensors & bioelectronics 6
biochemistry 6
ultramicroscopy 5

Keywords

biochemistry & molecular biology 50
engineering, biomedical 49
biotechnology & applied microbiology 41
materials science, biomaterials 40
cells 39
atomic-force microscopy 38

adhesion 36
chemistry, multidisciplinary 35
cell biology 35
microscopy 33
nanoparticles 30
chemistry, physical 29
growth 29
biophysics 29
in-vitro 27

Publication Year

2005 526
2004 74
2006 7
2003 1

Country

usa 231
japan 69
germany 63
peoples r china 40
france 34
england 31
south korea 25
switzerland 24
canada 24
italy 16
brazil 15
singapore 12
netherlands 12
taiwan 11
sweden 11

Institution

univ tokyo 13
harvard univ 13
univ texas 10
natl univ singapore 10
cnrs 10
johns hopkins univ 9
stanford univ 8
russian acad sci 8
nagoya univ 8
wuhan univ 7
univ wisconsin 7
univ washington 7

univ penn 7
mit 7
korea adv inst sci & technol 7

DataBase
science citation index 608

- # CLUSTER 135
  Connective and anatomical support tissue (especially bone and its main component, collagen), focusing on studies on osteoblasts, cell proliferation, and orthopedic implants (226 Records)

(Countries: USA dominant, Japan, China, Singapore. Institutions: National University Singapore, Sichuan University, MIT. Other USA include University of Michigan, Harvard University, Northwestern University, JHU, UCLA).

Cluster Syntax Features

Descriptive Terms
collagen 14.4%, tissu 10.7%, cell 9.7%, scaffold 8.7%, bone 7.4%, cultur 4.7%, osteoblast 3.3%, prolifer 1.5%, vitro 0.8%, human 0.8%, miner 0.8%, fibril 0.7%, implant 0.6%, biomateri 0.6%, extracellular 0.6%

Discriminating Terms
collagen 9.7%, tissu 6.9%, scaffold 5.8%, bone 4.9%, cell 4.2%, cultur 3.1%, osteoblast 2.2%, film 1.8%, prolifer 1.0%, nanoparticl 0.7%, particl 0.6%, temperatur 0.6%, carbon 0.6%, nanotub 0.6%, magnet 0.6%

Single Word Terms
cell 182, tissu 146, surfac 116, cultur 104, collagen 102, microscopi 98, electron 91, structur 88, vitro 82, scaffold 81, bone 79, matrix 76, growth 75, scan 74, materi 72

Double Word Terms
electron.microscopy 77, scanning.electron 63, extracellular.matrix 41, three.dimensional 35, microscopy.sem 27, alkaline.phosphatase 26, transmission.electron 25, cell.adhesion 25, atomic.force 24, collagen.fibrils 22, force.microscopy 21, bone.marrow 19, endothelial.cells 18, cells.cultured 18, bone.tissue 17

Triple Word Terms
scanning.electron.microscopy 56, electron.microscopy.sem 26, transmission.electron.microscopy 22, atomic.force.microscopy 20, alkaline.phosphatase.alp 14, extracellular.matrix.ecm 13, alkaline.phosphatase.activity 11, phosphatase.alp.activity 10, ray.photoelectron.spectroscopy 10, polymerase.chain.reaction 10, force.microscopy.afm 8, mesenchymal.stem.cells 7, smooth.muscle.cells 7, poly.lactic.glycolic 7, lactic.glycolic.acid 7

Term Cliques
41.04% tissu cell bone cultur osteoblast vitro human miner
37.81% tissu cell scaffold cultur osteoblast vitro implant biomateri extracellular
39.18% tissu cell scaffold cultur osteoblast prolifer vitro implant extracellular
39.33% tissu cell scaffold bone cultur osteoblast vitro implant biomateri
40.71% tissu cell scaffold bone cultur osteoblast prolifer vitro implant
42.13% tissu cell scaffold bone cultur osteoblast prolifer vitro human
31.86% collagen tissu fibril biomateri extracellular
33.85% collagen tissu miner fibril
42.16% collagen tissu cell cultur osteoblast biomateri extracellular
43.93% collagen tissu cell cultur osteoblast prolifer extracellular
44.12% collagen tissu cell bone cultur osteoblast biomateri
42.15% collagen tissu cell bone cultur osteoblast human miner
44.03% collagen tissu cell bone cultur osteoblast prolifer human

Sample Cluster Record Titles

The human spiral ganglion: New insights into ultrastructure, survival rate and implications for cochlear implants

The development and identification of constructing tissue engineered bone by seeding osteoblasts from differentiated rat marrow stromal stem cells onto three-dimensional porous nano-hydroxylapatite bone matrix in vitro

Novel assessment of bone using time-resolved transcutaneous Raman spectroscopy

Osteoblasts generate harder, stiffer, and more delamination-resistant mineralized tissue on titanium than on polystyrene, associated with distinct tissue micro- and ultrastructure

Mechanical properties of collagen gels derived from rats of different ages

[Osteoblast MC3T3-E1 culture on a fast-setting carbonated hydroxyapatite bone-like material]

[Mineralization of SaOS-2 cells on enzymatically (sillicatein) modified bioactive osteoblast-stimulating surfaces]

[SEM observation of collagen fibrils secreted from the body surface of osteoblasts on a CO(3)apatite-collagen sponge]

[The in vitro growth and activity of sheep osteoblasts on three-dimensional scaffolds from poly(L/DL-lactide) 80/20%]

Cluster Metrics

Authors

ramakrishna, s 14
yu, h 5
yong, t 5
cui, fz 5
wang, s 4
venugopal, j 4
tan, yf 4
ma, zw 4
he, w 4
fan, hs 4
zhou, y 3
zhang, xd 3
zhang, sg 3
yang, f 3
teo, we 3

Sources

biomaterials 40
tissue engineering 16
journal of biomedical materials research part a 15
journal of biomedical materials research part b-applied biomaterials 5
asbm6: advanced biomaterials vi 5
journal of periodontology 4
journal of biomaterials science-polymer edition 4
nanotechnology 3
lasers in surgery and medicine 3
journal of materials science-materials in medicine 3
calcified tissue international 3
surface & coatings technology 2

mrs bulletin 2
matrix biology 2
macromolecular research 2

Keywords
engineering, biomedical 73
materials science, biomaterials 69
collagen 37
in-vitro 31
adhesion 25
cell biology 24
biotechnology & applied microbiology 23
tissue 21
growth 20
expression 20
culture 19
cells 19
bone 18
scaffolds 15
collagen 14

Publication Year
2005 195
2004 26
2006 5

Country
usa 66
japan 27
peoples r china 25
singapore 23
south korea 17
italy 14
germany 13
england 13
canada 7
australia 7
switzerland 6
belgium 6
taiwan 5
austria 5
brazil 4

Institution
natl univ singapore 18
sichuan univ 7

mit 7
univ michigan 6
harvard univ 6
tsing hua univ 5
seoul natl univ 5
osaka univ 5
inst bioengn & nanotechnol 5
yonsei univ 4
northwestern univ 4
johns hopkins univ 4
univ coll london 3
univ calif los angeles 3
univ bologna 3

DataBase
science citation index 226

- # CLUSTER 134
  Biomaterials, bioactive substances, and biodegradable composites (especially chitosan, poly(lactide-co-glycolide) [PLGA], alginate, and poly(lactic acid)), focusing on microspheres and encapsulation, tissue engineering scaffolds, and hydrogels (119 Records)

(Countries: China dominant, USA, South Korea, Japan. Institutions: National University Singapore, Zhejiang University, Sichuan University, CAS. USA includes Lousiana Technical University.).

Cluster Syntax Features

Descriptive Terms
chitosan 29.8%, microspher 12.4%, scaffold 5.8%, plga 4.1%, algin 1.7%, releas 1.5%, composit 1.2%, bone 1.2%, tissu 1.0%, poli 0.9%, hydrogel 0.9%, bioactiv 0.7%, biodegrad 0.5%, dextran 0.5%, encapsul 0.5%

Discriminating Terms
chitosan 20.1%, microspher 8.1%, scaffold 3.8%, plga 2.8%, film 1.2%, algin 1.1%,

releas 0.7%, bone 0.7%, carbon 0.6%, nanotub 0.6%, magnet 0.5%, tissu 0.5%, temperatur 0.5%, hydrogel 0.5%, crystal 0.4%

Single Word Terms
surfac 61, poli 51, electron 48, scan 48, chitosan 46, microscopi 44, sem 40, structur 40, acid 39, size 37, composit 35, solut 35, form 34, materi 34, releas 34

Double Word Terms
scanning.electron 43, electron.microscopy 42, poly.lactic 19, microscopy.sem 19, glycolic.acid 15, fourier.transform 14, molecular.weight 14, transform.infrared 13, poly.lactide 13, bone.tissue 11, ray.diffraction 11, lactic.acid 11, mechanical.properties 11, acid.plga 10, pore.size 10

Triple Word Terms
scanning.electron.microscopy 39, electron.microscopy.sem 19, fourier.transform.infrared 13, glycolic.acid.plga 10, lactic.glycolic.acid 10, poly.lactic.acid 10, poly.lactic.glycolic 10, poly.lactide.glycolide 9, simulated.body.fluid 9, transmission.electron.microscopy 7, lactide.glycolide.plga 7, body.fluid.sbf 7, differential.scanning.calorimetry 6, ray.diffraction.xrd 5, electron.microscopy.tem 5

Term Cliques
8.96% algin hydrogel dextran
22.35% plga poli bioactiv biodegrad encapsul
15.13% scaffold hydrogel
23.63% scaffold plga composit bone tissu poli bioactiv biodegrad
21.51% microspher algin poli dextran encapsul
25.55% microspher algin releas poli encapsul
22.55% microspher plga poli biodegrad dextran encapsul
25.91% microspher plga releas poli biodegrad encapsul
23.53% chitosan hydrogel
28.85% chitosan releas biodegrade

Sample Cluster Record Titles

Fabrication, characterization, and in vitro degradation of composite scaffolds based on PHBV and bioactive glass

Chitin and chitosan: Novel biomaterials waiting for future developments

Preparation and characterization of bFGF and BSA-loaded microspheres

Chemical modification of chitosan by phosphorylation: an XPS, FT-IR and SEM study

[Novel biodegradable films and scaffolds of chitosan blended with poly(3-hydroxybutyrate)]

[Positively charged rifampicin-loaded microspheres for lung delivery]

[Preparation and in vitro evaluation of chitosan microspheres containing prednisolone: Comparison of simple and conjugate microspheres]

[A novel amine-shielded surface cross-linking of chitosan hydrogel beads for enhanced metal adsorption performance]

[Preparation of porous polylactide microspheres by emulsion-solvent evaporation based on solution induced phase separation]

Cluster Metrics

Authors

uchida, m 4
oyane, a 4
ito, a 4
chang, j 4
zhang, l 3
srivastava, r 3
shen, jc 3
mcshane, mj 3
li, hy 3
lee, hb 3
zhu, kj 2
zhu, hg 2
zhang, xd 2
zhang, x 2
zhang, jx 2

Sources

journal of materials science-materials in medicine 7
biomaterials 7
asbm6: advanced biomaterials vi 7
journal of biomaterials science-polymer edition 5
journal of microencapsulation 4
journal of biomedical materials research part a 4
polymer-korea 3
journal of controlled release 3
polymer international 2
polymer degradation and stability 2

polymer 2
journal of drug delivery science and technology 2
journal of applied polymer science 2
international journal of pharmaceutics 2
european journal of pharmaceutical sciences 2

Keywords

engineering, biomedical 26
materials science, biomaterials 26
polymer science 21
chitosan 20
release 18
chitosan 17
in-vitro 16
pharmacology & pharmacy 11
nanoparticles 11
microspheres 11
chemistry, multidisciplinary 10
polymer 9
pharmacology & pharmacy 9
alginate 8
surface 8

Publication Year

2005 107
2004 11
2006 1

Country

peoples r china 32
usa 17
south korea 14
japan 13
india 8
singapore 7
england 7
france 5
brazil 5
taiwan 4
portugal 4
italy 4
germany 4
belgium 4
serbia monteneg 2

Institution

natl univ singapore 7
zhejiang univ 6
sichuan univ 6
chinese acad sci 5
natl inst adv ind sci & technol 4
univ london imperial coll sci technol & med 3
seoul natl univ 3
louisiana tech univ 3
korea res inst chem technol 3
chonbuk natl univ 3
wuhan univ 2
univ porto 2
univ oxford 2
univ marburg 2
univ liege 2

DataBase
science citation index 119

- # CLUSTER 82
  Preparation and investigation of membranes, emphasizing proton conductivity, permeability studies, filtration applications, preparation by grafting, sulfonated membranes, and methanol fuel cell applications (253 Records)

(Countries: China dominant, USA, Japan, South Korea. Institutions: National University Singapore, CAS, Zhejiang University.).

Cluster Syntax Features

Descriptive Terms

membran 68.8%, water 1.5%, pore 1.1%, proton 0.8%, composite.membranes 0.7%, flux 0.7%, graft 0.7%, permeabl 0.6%, foul 0.6%, permeat 0.5%, sulfon 0.5%, polym 0.5%, acid 0.4%, composit 0.4%, methanol 0.4%

Discriminating Terms
membran 43.9%, film 1.5%, magnet 0.6%, nanoparticl 0.6%, nanotub 0.6%, composite.membranes 0.5%, carbon 0.5%, structur 0.5%, particl 0.5%, crystal 0.5%, deposit 0.4%, quantum 0.4%, proton 0.4%, electron 0.4%, oxid 0.4%

Single Word Terms
membran 243, water 130, surfac 113, solut 90, polym 89, properti 87, scan 86, composit 86, structur 82, microscopi 79, electron 75, sem 73, poli 73, pore 73, acid 72

Double Word Terms
scanning.electron 67, electron.microscopy 62, membrane.surface 38, composite.membranes 36, pore.size 36, fuel.cells 27, atomic.force 25, microscopy.sem 25, proton.conductivity 24, contact.angle 23, force.microscopy 23, ray.photoelectron 22, photoelectron.spectroscopy 21, differential.scanning 21, scanning.calorimetry 20

Triple Word Terms
scanning.electron.microscopy 58, electron.microscopy.sem 25, atomic.force.microscopy 23, ray.photoelectron.spectroscopy 21, differential.scanning.calorimetry 20, force.microscopy.afm 15, direct.methanol.fuel 14, photoelectron.spectroscopy.xps 13, pore.size.distribution 12, proton.exchange.membrane 11, methanol.fuel.cells 10, exchange.membrane.fuel 9, fourier.transform.infrared 9, membranes.scanning.electron 9, scanning.electron.microscope 9

Term Cliques
35.57% membran permeabl foul sulfon
36.92% membran composite.membranes permeabl permeat composit
29.18% membran composite.membranes graft sulfon acid methanol
34.88% membran composite.membranes graft permeat
30.39% membran proton composite.membranes permeabl sulfon polym acid composit methanol
44.66% membran water permeabl polym acid composit
44.35% membran water permeabl permeat composit
45.06% membran water flux polym acid composit
44.82% membran water flux permeat composit
42.61% membran water flux graft acid
37.68% membran water pore permeabl foul permeat
38.08% membran water pore flux foul permeat
38.47% membran water pore flux graft permeat

Sample Cluster Record Titles

[Composite nanofiltration polyamide membrane: A study on the diamine ratio and its performance evaluation]

[Nafion/PTFE composite membranes for fuel cell applications]

[12-tungstophosphoric acid composites with sulfonated or unsulfonated epoxies for high-temperature PEMFCs]

[Statistical mechanics of a colloidal suspension in contact with a fluctuating membrane]

[Design of novel biointerfaces (II). Fabrication of self-organized porous polymer film with highly uniform pores]

[Preliminary studies on F26 microporous membranes in membrane distillation]

[SEM investigation of photografting polymerization on pet nucleopore membranes]

[Pore size determination of supported organic-inorganic hybrid membranes by modified gas permeation method]

[Recent progress in proton conducting membranes for PEFCs]

Cluster Metrics

Authors

li, y 6
ulbricht, m 4
sridhar, s 4
qin, jj 4
ping, zh 4
chung, ts 4
yang, mc 3
yamada, m 3
xu, zk 3
xu, tw 3
thangamuthu, r 3
smitha, b 3
oo, mh 3
mohammad, aw 3
lin, wc 3

Sources

journal of membrane science 48
journal of applied polymer science 18

desalination 12
polymer 9
journal of power sources 9
european polymer journal 6
electrochimica acta 6
separation and purification technology 4
langmuir 4
journal of colloid and interface science 4
environmental science & technology 4
polymer science series a 3
macromolecules 3
macromolecular research 3
industrial & engineering chemistry research 3

Keywords
engineering, chemical 72
polymer science 60
polymer science 50
membranes 31
separation 28
chemistry, physical 24
membranes 21
transport 20
electrochemistry 18
chemistry, multidisciplinary 17
water 17
performance 16
composite membranes 15
membrane 14
water resources 14

Publication Year
2005 230
2004 21
2006 2

Country
peoples r china 62
usa 36
japan 24
south korea 23
singapore 18
germany 18
france 13
taiwan 12
india 12

italy 11
england 10
spain 7
russia 7
australia 6
malaysia 5

Institution
natl univ singapore 11
chinese acad sci 10
zhejiang univ 6
tianjin univ 5
russian acad sci 5
indian inst chem technol 5
univ sci & technol china 4
univ calabria 4
seoul natl univ 4
natl taiwan univ sci & technol 4
natl inst adv ind sci & technol 4
korea inst sci & technol 4
inst mat res & engn 4
gkss forschungszentrum geesthacht gmbh 4
fudan univ 4

DataBase
science citation index 253

- CLUSTER 142
  Lipid (especially phospholipid) bilayers, focusing on properties of vesicles, channel interactions, membrane binding, and dipalmitoyl phosphatidylcholine (DPPC) and cholesterol structures (231 Records)

(Countries: USA very dominant, Germany, France, Japan. Institutions: University of Illinois, University of Munster, RAS, CAS. Other USA include UCR, Stanford University, UCLA, Cornell University).

Cluster Syntax Features

Descriptive Terms

membran 39.5%, lipid 19.3%, bilay 5.7%, vesicl 3.6%, channel 1.5%, phospholipid 1.0%, cholesterol 0.9%, fluoresc 0.6%, protein 0.6%, support 0.5%, dppc 0.5%, lipid.bilayers 0.5%, lipid.bilayer 0.5%, domain 0.4%, bind 0.3%

Discriminating Terms

membran 25.4%, lipid 13.3%, bilay 3.8%, vesicl 2.4%, film 1.9%, phospholipid 0.7%, channel 0.7%, nanoparticl 0.6%, carbon 0.6%, cholesterol 0.6%, magnet 0.6%, temperatur 0.6%, particl 0.5%, nanotub 0.5%, crystal 0.5%

Single Word Terms

membran 194, lipid 121, structur 95, bilay 94, surfac 84, microscopi 73, model 71, protein 66, form 66, two 62, interact 62, measur 59, molecul 58, vesicl 55, support 54

Double Word Terms

atomic.force 41, force.microscopy 40, lipid.bilayer 38, lipid.bilayers 30, lipid.membranes 28, supported.lipid 20, microscopy.afm 18, electron.microscopy 16, lipid.membrane 14, membrane.surface 14, surface.plasmon 13, bilayer.membranes 13, plasmon.resonance 12, phase.transition 12, lipid.vesicles 12

Triple Word Terms

atomic.force.microscopy 40, force.microscopy.afm 18, surface.plasmon.resonance 12, supported.lipid.bilayers 12, differential.scanning.calorimetry 11, scanning.electron.microscopy 8, supported.lipid.bilayer 7, quartz.crystal.microbalance 7, scanning.calorimetry.dsc 6, lipid.bilayer.membranes 6, microscopy.atomic.force 6, fluorescence.recovery.photobleaching 5, ray.photoelectron.spectroscopy 5, plasmon.resonance.spr 4, air.water.interface 4

Term Cliques

22.80% lipid bilay phospholipid cholesterol fluoresc support dppc lipid.bilayers domain
23.67% lipid bilay vesicl phospholipid cholesterol fluoresc support dppc lipid.bilayers
36.47% membran channel protein lipid.bilayer
30.45% membran lipid phospholipid fluoresc protein support lipid.bilayers domain bind
29.83% membran lipid vesicl phospholipid fluoresc protein support lipid.bilayers lipid.bilayer bind
30.78% membran lipid bilay phospholipid fluoresc support dppc lipid.bilayers domain
33.14% membran lipid bilay phospholipid fluoresc protein support lipid.bilayers domain
30.13% membran lipid bilay vesicl phospholipid fluoresc support dppc lipid.bilayers lipid.bilayer

32.25% membran lipid bilay vesicl phospholipid fluoresc protein support lipid.bilayers lipid.bilayer

Sample Cluster Record Titles

Interaction of the macrolide antibiotic azithromycin with lipid bilayers: Effect on membrane organization, fluidity, and permeability

Effect of pressure on the Prodan fluorescence in bilayer membranes of phospholipids with varying acyl chain lengths

Interaction of nonelectrolytes, the derivatives of 5-hydroxybenzimidazole, with erythrocyte membrane

Protons may leak through pure lipid bilayers via a concerted mechanism

Following the formation of supported lipid bilayers on mica: A study combining AFM, QCM-D, and ellipsometry

Intermolecular communication on lipid bilayer membrane. Tuning of enzymatic activity with phase transition of the matrix membranes

Role of curvature and phase transition in lipid sorting and fission of membrane tubules

The lipid/protein interface as xenobiotic target site - Kinetic analysis of tadpole narcosis

Involvement of water channels in synaptic vesicle swelling

Cluster Metrics

Authors

xu, zk 5
cheng, q 5
boxer, sg 4
stahelin, rv 3
bassereau, p 3
wu, j 2
wattraint, o 2
wang, jl 2
tian, wj 2
tantimongcolwat, t 2
strzalka, k 2
smith, bd 2
shahin, v 2

seantier, b 2
schafer, c 2

Sources
langmuir 25
biophysical journal 22
journal of physical chemistry b 10
journal of biological chemistry 6
journal of membrane science 5
biochimica et biophysica acta-biomembranes 5
journal of the american chemical society 4
international journal of pharmaceutics 4
ieee transactions on nanobioscience 4
biochemistry 4
biochemical and biophysical research communications 4
analytical biochemistry 4
proceedings of the national academy of sciences of the united states of america 3
journal of controlled release 3
chemistry and physics of lipids 3

Keywords
chemistry, physical 45
biochemistry & molecular biology 41
atomic-force microscopy 31
biophysics 28
membranes 24
biophysics 20
chemistry, multidisciplinary 19
cholesterol 17
membranes 16
chemistry, analytical 16
bilayers 14
transport 13
protein 13
vesicles 12
model membranes 12

Publication Year
2005 209
2004 20
2006 2

Country
usa 83
germany 27
france 23

japan 21
peoples r china 16
england 14
italy 11
singapore 7
russia 7
netherlands 7
canada 7
spain 6
austria 6
sweden 5
thailand 4

Institution
univ illinois 8
univ munster 7
russian acad sci 6
chinese acad sci 6
zhejiang univ 5
univ calif riverside 5
stanford univ 5
osaka univ 5
univ halle wittenberg 4
univ calif los angeles 4
univ barcelona 4
inst curie 4
cornell univ 4
cnrs 4
univ strasbourg 1 3

DataBase
science citation index 231

- # CLUSTER 97
  Drug delivery systems, focusing on drug release, especially of nanoparticles and from nanocapsules (219 Records)

(Countries: USA, China, followed by India, South Korea, Japan. Institutions: National University of Singapore, Institute of Bioengineering and Nanotechnology, Bharati Vidyapeeth Deemed University. USA includes University of Notre Dame).

Cluster Syntax Features

Descriptive Terms
drug 37.6%, releas 22.5%, drug.release 2.4%, load 1.5%, deliveri 1.4%, nanoparticl 1.1%, dissolut 0.9%, formul 0.9%, polym 0.8%, drug.delivery 0.7%, encapsul 0.7%, poli 0.5%, nanocapsul 0.5%, vitro 0.5%, tablet 0.4%

Discriminating Terms
drug 24.3%, releas 14.4%, drug.release 1.6%, film 1.5%, deliveri 0.8%, load 0.6%, carbon 0.6%, surfac 0.6%, structur 0.6%, magnet 0.6%, nanotub 0.5%, dissolut 0.5%, formul 0.5%, drug.delivery 0.4%, oxid 0.4%

Single Word Terms
drug 183, releas 167, scan 98, load 94, control 90, size 87, polym 85, deliveri 83, microscopi 80, poli 80, surfac 79, properti 78, electron 76, particl 76, system 76

Double Word Terms
drug.release 87, scanning.electron 67, electron.microscopy 66, drug.delivery 59, differential.scanning 54, scanning.calorimetry 53, particle.size 40, controlled.release 39, calorimetry.dsc 36, drug.loading 28, release.rate 27, model.drug 26, microscopy.sem 24, release.profile 23, delivery.system 22

Triple Word Terms
scanning.electron.microscopy 62, differential.scanning.calorimetry 53, scanning.calorimetry.dsc 36, electron.microscopy.sem 24, drug.delivery.systems 14, poly.lactide.glycolide 12, vitro.drug.release 12, poly.lactic.acid 12, fourier.transform.infrared 12, atomic.force.microscopy 12, drug.delivery.system 11, controlled.drug.release 10, powder.ray.diffraction 9, transform.infrared.spectroscopy 9, polyethylene.glycol.peg 8

Term Cliques
29.00% load polym drug.delivery encapsul poli nanocapsul

26.94% load formul polym encapsul nanocapsul
42.60% drug releas load deliveri nanoparticl polym drug.delivery encapsul poli vitro
42.97% drug releas load deliveri nanoparticl formul polym encapsul vitro
41.55% drug releas drug.release dissolut formul polym tablet
44.88% drug releas drug.release dissolut formul polym vitro
43.61% drug releas drug.release load deliveri polym drug.delivery encapsul poli vitro
44.09% drug releas drug.release load deliveri formul polym encapsul vitro

Sample Cluster Record Titles

Protective properties of melatonin-loaded nanoparticles against lipid peroxidation

Effect of MePEG molecular weight and particle size on in vitro release of tumor necrosis factor-alpha-loaded nanoparticles

Novel PCL-based honeycomb scaffolds as drug delivery systems for rhBMP-2

pH-triggered thermally responsive polymer core-shell nanoparticles for drug delivery

Properties of hot-melt extruded tablet formulations for the colonic delivery of 5-aminosalicylic acid

Influence of hydroxyethylcellulose on the drug release properties of theophylline pellets coated with Eudragit (R) RS 30 D

Evaluation of the in vitro drug release from resorbable biocompatible coatings for vascular stents

Effects of formulation variables and characterization of guaifenesin wax microspheres for controlled release

Phospholipid-based catalytic nanocapsules

Cluster Metrics

Authors

yang, yy 4
yang, xl 4
xu, hb 3
sharma, s 3
paradkar, a 3

mura, p 3
liu, cs 3
lee, hb 3
kim, ms 3
khuller, gk 3
khang, g 3
gonzalez-rodriguez, ml 3
fessi, h 3
doelker, e 3
alonso, mj 3

Sources

international journal of pharmaceutics 30
journal of controlled release 22
drug development and industrial pharmacy 9
biomaterials 9
european journal of pharmaceutics and biopharmaceutics 8
journal of microencapsulation 7
aaps pharmscitech 6
pharmaceutical research 5
langmuir 5
european journal of pharmaceutical sciences 5
journal of pharmacy and pharmacology 4
journal of pharmaceutical sciences 4
drug delivery 4
colloids and surfaces b-biointerfaces 4
polymer-korea 3

Keywords

pharmacology & pharmacy 68
pharmacology & pharmacy 51
release 40
chemistry, multidisciplinary 34
delivery 30
nanoparticles 26
microspheres 24
nanoparticles 23
polymer science 22
engineering, biomedical 22
materials science, biomaterials 22
chemistry, medicinal 21
in-vitro 17
drug-release 17
drug release 15

Publication Year

2005 190
2004 27
2006 1
2003 1

Country

usa 37
peoples r china 33
india 24
south korea 21
japan 20
germany 15
italy 14
england 14
singapore 11
france 11
spain 9
brazil 7
taiwan 5
switzerland 4
canada 4

Institution

natl univ singapore 8
inst bioengn & nanotechnol 5
bharati vidyapeeth deemed univ 5
univ geneva 4
korea res inst chem technol 4
huazhong univ sci & technol 4
zhejiang univ 3
univ sao paulo 3
univ notre dame 3
univ lyon 1 3
univ london 3
univ ljubljana 3
univ helsinki 3
univ bologna 3
postgrad inst med educ & res 3

DataBase

science citation index 219

- # CLUSTER 93

  Drug delivery systems, emphasizing targeting of cancer cells, oral delivery, and lipid and nanoparticle-based carriers (169 Records)

(Countries: USA very dominant, Germany, India. Institutions: University of Michigan, University of Frankfurt, University of Texas, University of Nebraska. Other USA include Washington University, NCI, Wayne State University, University of Washington.).

Cluster Syntax Features

Descriptive Terms

drug 38.8%, deliveri 14.8%, drug.delivery 4.9%, target 2.1%, formul 1.4%, cancer 1.4%, cell 1.3%, therapeut 1.2%, system 1.0%, oral 0.9%, nanoparticl 0.8%, releas 0.8%, carrier 0.7%, lipid 0.7%, conjug 0.6%

Discriminating Terms

drug 23.6%, deliveri 9.1%, drug.delivery 3.0%, film 1.7%, target 1.0%, cancer 0.8%, formul 0.8%, therapeut 0.7%, surfac 0.7%, structur 0.6%, temperatur 0.6%, carbon 0.6%, oral 0.5%, layer 0.5%, nanotub 0.5%

Single Word Terms

drug 147, deliveri 119, system 90, cell 82, target 69, nanoparticl 61, formul 50, carrier 50, releas 48, potenti 47, applic 44, therapeut 43, new 42, treatment 42, control 41

Double Word Terms

drug.delivery 85, delivery.systems 33, delivery.system 26, drug.release 17, drug.targeting 13, cellular.uptake 13, cancer.cells 13, targeted.drug 12, drug.carriers 11, drug.carrier 10, vitro.vivo 9, oral.administration 9, targeted.delivery 8, controlled.release 8, differential.scanning 7

Triple Word Terms

drug.delivery.systems 23, drug.delivery.system 20, targeted.drug.delivery 11, differential.scanning.calorimetry 7, transmission.electron.microscopy 5, dynamic.light.scattering 5, poly.ethylene.glycol 5, poly.lactic.glycolic 5, lactic.glycolic.acid 5, solid.lipid.nanoparticles 4, lipid.nanoparticles.slns 4, atomic.force.microscopy 4, magnetic.drug.targeting 4, scanning.calorimetry.dsc 4, human.serum.albumin 4

Term Cliques
28.80% formul system oral releas carrier lipid
35.67% deliveri system oral nanoparticl releas carrier lipid
37.02% deliveri therapeut system oral nanoparticl releas carrier
40.63% drug formul system releas carrier lipid
36.69% drug formul cancer carrier conjug
39.29% drug formul cancer releas carrier
46.61% drug deliveri drug.delivery cell system nanoparticl releas carrier lipid
46.98% drug deliveri drug.delivery target cell therapeut system nanoparticl releas carrier
42.54% drug deliveri drug.delivery target cancer cell therapeut nanoparticl carrier conjug
43.85% drug deliveri drug.delivery target cancer cell therapeut nanoparticl releas carrier

Sample Cluster Record Titles

Inorganic nanoparticles as carriers for efficient cellular delivery

Nanoscale polymer carriers to deliver chemotherapeutic agents to tumours

Targeted nanoparticles for drug delivery through the blood-brain barrier for Alzheimer's disease

The design and evaluation of a novel targeted drug delivery system using cationic emulsion-antibody conjugates

First report implants on the efficacy of L-alanine-based in situ-forming for the long-term parenteral delivery of drugs

Nanosystems in drug targeting: Opportunities and challenges

Sonic activation of molecularly-targeted nanoparticles accelerates transmembrane lipid delivery to cancer cells through contact-mediated mechanisms: Implications for enhanced local drug delivery

Nanotechnology-based drug delivery for cancer

Polymeric particulates to improve oral bioavailability of peptide drugs

Cluster Metrics

Authors

zimmer, a 4
weyermann, j 4
lochmann, d 4
baker, jr 4
wickline, sa 3
pandey, r 3
majoros, ij 3
lanza, gm 3
kreuter, j 3
khuller, gk 3
kabanov, av 3
jain, nk 3
batrakova, ev 3
yamamoto, h 2
wouters, d 2

Sources

journal of controlled release 17
journal of drug targeting 6
international journal of pharmaceutics 6
journal of magnetism and magnetic materials 5
european journal of pharmaceutics and biopharmaceutics 5
technology in cancer research & treatment 4
journal of pharmacy and pharmacology 4
drug delivery 4
pharmaceutical research 3
journal of pharmaceutical sciences 3
journal of nanoscience and nanotechnology 3
journal of drug delivery science and technology 3
current pharmaceutical biotechnology 3
current opinion in chemical biology 3
bioconjugate chemistry 3

Keywords

pharmacology & pharmacy 44
chemistry, multidisciplinary 35
pharmacology & pharmacy 29
nanoparticles 25
liposomes 21
nanoparticles 19
in-vitro 18
delivery 17
drug delivery 14

drug-delivery 13
microspheres 12
delivery 10
systems 10
polymers 10
in-vivo 10

Publication Year
2005 152
2004 14
2006 3

Country
usa 51
germany 19
india 18
switzerland 10
peoples r china 10
france 10
japan 9
netherlands 8
italy 7
england 7
canada 7
spain 6
south korea 6
taiwan 4
singapore 4

Institution
univ michigan 5
univ frankfurt 5
univ texas 4
univ nebraska 4
sch pharm 4
washington univ 3
postgrad inst med educ & res 3
nci 3
natl univ singapore 3
karl franzens univ graz 3
dr hs gour univ 3
wayne state univ 2
univ zurich 2
univ washington 2
univ utrecht 2

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science citation index 169

- # CLUSTER 81
  Ethical, health, and social issues of nanotechnology (especially biological applications), weighing the risks and benefits to the public (142 Records)

(Countries: USA very dominant, Germany. Institutions: NSF, UCSD, NCI. Other USA include University of Wisconsin, UCB, Cornell University, University of Texas, University of Pennsylvania, University of Michigan, UCSB, Thomas Jefferson University, SNL).

Cluster Syntax Features

Descriptive Terms
nanotechnolog 66.7%, scienc 1.7%, technolog 1.4%, diatom 1.3%, ethic 0.9%, public 0.8%, health 0.8%, new 0.8%, applic 0.7%, innov 0.6%, inform 0.6%, biologi 0.5%, risk 0.4%, global 0.4%, human 0.4%

Discriminating Terms
nanotechnolog 38.8%, film 1.7%, scienc 0.9%, diatom 0.8%, surfac 0.7%, technolog 0.7%, temperatur 0.5%, ethic 0.5%, carbon 0.5%, layer 0.5%, particl 0.5%, public 0.5%, health 0.5%, magnet 0.5%, structur 0.5%

Single Word Terms

nanotechnolog 109, applic 51, new 50, system 39, materi 37, field 35, potenti 34, scienc 33, paper 31, inform 30, technolog 28, molecular 28, advanc 25, gener 25, on 25

Double Word Terms

real.time 7, nanotechnology.new 7, emerging.technologies 6, materials.devices 6, nanotechnology.applications 6, new.materials 5, materials.science 5, nanotechnology.science 5, molecular.biology 5, application.nanotechnology 5, united.states 5, nanoscale.materials 5, nanotechnology.nanotechnology 5, new.technologies 5, human.health 5

Triple Word Terms

physical.chemical.properties 3, three.dimensional.structures 2, potential.new.class 2, central.nervous.system 2, nervous.system.cns 2, new.class.materials 2, drug.delivery.systems 2, properties.nanoscale.materials 2, length.scale.100 2, polymerase.chain.reaction 1, materials.nano.scale 1, low.cost.large 1, positron.emission.tomography 1, quantum.dots.molecular 1, chemistry.materials.science 1

Term Cliques

21.48% health new applic inform risk human
21.71% health new applic inform biologi human
15.02% ethic public health new risk human
17.78% diatom applic inform global
22.07% technolog health new applic inform risk
22.30% technolog health new applic inform biologi
17.61% technolog public health new risk
26.06% nanotechnolog ethic public new risk human
24.88% nanotechnolog ethic public new innov risk
31.19% nanotechnolog scienc new applic inform risk human
28.52% nanotechnolog scienc new applic inform biologi global human
31.46% nanotechnolog scienc new applic innov global
28.99% nanotechnolog scienc public new risk human
31.69% nanotechnolog scienc technolog new applic inform risk
31.89% nanotechnolog scienc technolog new applic inform biologi
29.98% nanotechnolog scienc technolog new applic innov risk
26.66% nanotechnolog scienc technolog public new innov risk

Sample Cluster Record Titles

Nanotechnology: Scientific challenges and societal benefits and risks

Nanotechnology: From Feynman to the grand challenge of molecular manufacuring

The politics of small things: Nanotechnology, risk, and uncertainty

[Anticipating military nanotechnology]

[Societal dimensions of nanotechnology]

[Application of nanotechnology in construction - Summary of a state-of-the-art report]

[Imagining nanotechnology: cultural support for technological innovation in Europe and the United States]

[Ethical issues on nanotechnology in Asia]

[Environmentally responsible development of nanotechnology]

Cluster Metrics

Authors
roco, mc 4
[anon] 3
suk, wa 2
singer, pa 2
silva, ga 2
scheufele, da 2
salamanca-buentello, f 2
romig, ad 2
lopez, pj 2
lewenstein, bv 2
jain, kk 2
hahn, sh 2
freitas, ra 2
ferrari, m 2
daar, as 2

Sources
on the convergence of bio-information-, environmental-, energy-, space- and nano-technologies, pts 1 and 2 7
journal of nanoscience and nanotechnology 7
journal of nanoparticle research 6
ieee technology and society magazine 6
science communication 4
issues in science and technology 4
gaia-ecological perspectives for science and society 4
current nanoscience 4
toxicological sciences 2
technovation 2

small 2
science and technology of advanced materials 2
science and engineering ethics 2
revue scientifique et technique-office international des epizooties 2
public understanding of science 2

Keywords

nanotechnology 22
chemistry, multidisciplinary 20
materials science, multidisciplinary 19
nanotechnology 18
materials science, multidisciplinary 10
nanoparticles 8
science 7
engineering, industrial 7
engineering, electrical & electronic 7
communication 7
biotechnology & applied microbiology 7
engineering, multidisciplinary 6
dna 6
multidisciplinary sciences 5
engineering, chemical 5

Publication Year

2005 123
2004 19

Country

usa 68
germany 15
england 7
france 6
switzerland 5
italy 5
south korea 4
thailand 3
japan 3
canada 3
taiwan 2
scotland 2
new zealand 2
israel 2
india 2

Institution

natl sci fdn 5

univ calif san diego 4
nci 4
univ wisconsin 3
univ calif berkeley 3
cornell univ 3
vdi technol zentrum gmbh 2
univ toronto 2
univ texas 2
univ penn 2
univ michigan 2
univ calif santa barbara 2
thomas jefferson univ 2
stn zool 2
sandia natl labs 2

DataBase
science citation index 142

- CLUSTER 99
  Network and self-organization processes, with emphasiss on self-organizing neural networks, self-organized maps (SOMs), and learning systems (132 Records)

(Countries: USA very dominant, China, Japan, Germany. Institutions: Riken, Northwestern University. Other USA include University of Massachusetts, University of Florida, Rice University, Ohio University, North Carolina State University, Boston University, Arizona State University).

Cluster Syntax Features

Descriptive Terms
network 17.6%, self.organizing 8.5%, neural 6.6%, self 5.6%, learn 5.3%, organ 4.9%,

map 4.1%, neural.network 2.5%, som 1.6%, algorithm 1.6%, self.organization 1.5%, neural.networks 1.0%, system 1.0%, data 1.0%, model 0.9%

Discriminating Terms
network 10.2%, self.organizing 5.5%, neural 4.2%, learn 3.4%, map 2.4%, self 2.2%, organ 2.0%, film 1.8%, neural.network 1.6%, som 1.1%, self.organization 0.9%, algorithm 0.9%, surfac 0.8%, neural.networks 0.6%, carbon 0.6%

Single Word Terms
self 110, organ 96, network 84, structur 69, paper 67, model 50, system 48, neural 47, map 45, gener 39, data 39, learn 36, two 35, new 35, set 33

Double Word Terms
self.organizing 66, neural.network 32, self.organization 24, neural.networks 24, organizing.map 22, organizing.maps 17, data.set 10, map.som 9, artificial.neural 9, network.model 7, paper.new 7, network.structure 7, networks.paper 6, three.dimensional 6, multilayer.perceptron 5

Triple Word Terms
self.organizing.map 22, self.organizing.maps 17, organizing.map.som 9, artificial.neural.networks 7, growing.self.organizing 5, self.organizing.neural 5, neural.network.model 5, artificial.neural.network 4, mechanism.self.organization 3, mean.square.error 3, neural.networks.paper 3, three.dimensional.space 3, data.two.dimensional 2, neural.network.ann 2, organizing.maps.som 2

Term Cliques
52.65% self organ self.organization system
49.24% self organ algorithm self.organization
39.17% self.organizing neural self learn organ map neural.network som algorithm data
37.65% network neural self learn map neural.network algorithm neural.networks data model
55.56% network self.organizing self learn organ system
41.94% network self.organizing neural self learn organ map neural.network algorithm neural.networks data

Sample Cluster Record Titles

Neural-network midcourse guidance with consideration of the head-on attack condition

Curve and surface reconstruction from points: an approach based on self-organizing maps

Self-organization scenario relevant for nanoscale science and technology

[Optimization of supervised self-organizing maps with genetic algorithms for classification of urinary calculi]

[Self-organizing information fusion and hierarchical knowledge discovery: a new framework using ARTMAP neural networks]

[Trellis-based virtual regular addressing structures in self-organized networks]

[Clustering high-dimensional data using growing SOM]

[Combining classifiers in software quality prediction: A neural network approach]

[Network structure, self-organization, and the growth of international collaboration in science]

Cluster Metrics

Authors
tani, j 3
zhu, z 2
starzyk, ja 2
oh, sk 2
kim, d 2
jalan, s 2
fortes, jab 2
amritkar, re 2
zupan, j 1
zhu, yw 1
zhu, lp 1
zhu, j 1
zhu, b 1
zhou, jl 1
zhong, cj 1

Sources
neural information processing 5
artificial neural networks: biological inspirations - icann 2005, pt 1, proceedings 5
physical review e 4
on the convergence of bio-information-, environmental-, energy-, space- and nano-technologies, pts 1 and 2 4
computational intelligence and bioinspired systems, proceedings 4
ieee transactions on neural networks 3
biosystems 3

advances in neural networks - isnn 2005, pt 2, proceedings 3
physica a-statistical mechanics and its applications 2
pattern recognition 2
neurocomputing 2
neural networks 2
nano letters 2
international journal of neural systems 2
expert systems with applications 2

Keywords
computer science, artificial intelligence 18
self-organization 6
self-organizing map 5
engineering, electrical & electronic 5
electronic 5
biology 5
self-organization 5
physics, mathematical 5
engineering, electrical & 5
dynamics 5
self-organizing maps 4
physics, fluids & plasmas 4
networks 4
network 4
systems 4

Publication Year
2005 105
2004 25
2006 1
2001 1

Country
usa 38
peoples r china 13
japan 10
germany 10
south korea 9
england 9
spain 7
italy 7
india 6
taiwan 5
france 4
poland 3
canada 3

sweden 2
russia 2

Institution
riken 3
northwestern univ 3
zhejiang univ 2
univ southampton 2
univ massachusetts 2
univ heidelberg 2
univ granada 2
univ florida 2
univ bologna 2
rice univ 2
phys res lab 2
ohio univ 2
n carolina state univ 2
boston univ 2
arizona state univ 2

DataBase
science citation index 132

- # CLUSTER 22
  Microtubule motor proteins (kinesin and dynein), with models and analysis of movement mechanism (106 Records)

(Countries: USA very dominant, Japan, England, China. Institutions: University of Illinois, University of Tokyo, CAS. Other USA include

University of Washington, University of Texas, University of Michigan, UCSC, UCSD, UCI.).

Cluster Syntax Features

Descriptive Terms

motor 52.8%, kinesin 7.7%, molecular.motors 5.7%, microtubul 3.3%, atp 2.2%, molecular 1.8%, cargo 1.5%, transport 1.5%, dynein 1.2%, movement 1.0%, protein 0.8%, filament 0.6%, motion 0.6%, walk 0.6%, molecular.motor 0.5%

Discriminating Terms

motor 31.2%, kinesin 4.6%, molecular.motors 3.4%, microtubul 1.9%, film 1.7%, atp 1.3%, cargo 0.9%, surfac 0.8%, dynein 0.7%, nanoparticl 0.6%, carbon 0.5%, movement 0.5%, temperatur 0.5%, layer 0.5%, magnet 0.5%

Single Word Terms

motor 98, molecular 72, mechan 45, protein 41, model 40, kinesin 40, transport 37, function 36, microtubul 35, two 31, motion 31, cell 29, forc 28, molecul 27, direct 27

Double Word Terms

molecular.motors 48, molecular.motor 27, motor.proteins 20, motor.protein 10, atp.hydrolysis 10, single.molecule 8, cytoplasmic.dynein 7, kinesin.motor 7, cytoskeletal.filaments 6, intracellular.transport 6, adenosine.triphosphate 6, transport.microtubules 5, brownian.motor 5, kinesin.dynein 5, two.state 5

Triple Word Terms

two.state.model 4, protein.kinase.pka 3, adenosine.triphosphate.atp 3, single.molecule.level 3, single.molecule.experiments 3, dependent.protein.kinase 2, monte.carlo.simulations 2, green.fluorescent.protein 2, pre.steady.state 2, monte.carlo.simulation 1, temperature.ionic.strength 1, flight.mass.spectrometry 1, desorption.ionization.time 1, single.particle.tracking 1, ionization.time.flight 1

Term Cliques

46.46% motor protein motion molecular.motor
42.30% motor molecular movement filament motion molecular.motor
38.95% motor molecular cargo transport movement filament molecular.motor
36.39% motor microtubul cargo transport dynein protein molecular.motor
33.96% motor microtubul cargo transport dynein movement molecular.motor
41.24% motor microtubul molecular cargo transport movement molecular.motor
37.42% motor microtubul atp cargo protein molecular.motor
42.30% motor microtubul atp molecular cargo molecular.motor
40.57% motor molecular.motors molecular movement filament motion walk
41.78% motor molecular.motors molecular cargo transport movement filament
49.53% motor kinesin protein motion
38.14% motor kinesin microtubul cargo transport dynein protein

39.47% motor kinesin microtubul atp cargo protein
43.53% motor kinesin molecular.motors molecular movement motion walk
36.91% motor kinesin molecular.motors microtubul cargo transport dynein movement
43.28% motor kinesin molecular.motors microtubul molecular cargo transport movement
44.47% motor kinesin molecular.motors microtubul atp molecular cargo

Sample Cluster Record Titles

Evidence for glucocorticoid receptor transport on microtubules by dynein

Transport of Drosophila fragile X rental retardation protein-containing ribonucleoprotein granules by kinesin-1 and cytoplasmic dynein

Transport in a molecular motor system

Exploring molecular motors and switches at the single-molecule level

Analytical model of a Brownian motor with a fluctuating potential

Molecular motors and mechanisms of directional transport in neurons

Effective potential of a two-state model for molecular motor

Walks of molecular motors interacting with immobilized filaments

Mechanism for unidirectional movement of kinesin

Cluster Metrics

Authors

lipowsky, r 5
klumpp, s 5
tagerud, s 3
sundberg, m 3
omling, p 3
nieuwenhuizen, tm 3
nicholls, ia 3
montelius, l 3
mansson, a 3
bunk, r 3
wang, py 2
wang, hy 2

unger, e 2
stukalin, eb 2
serpinskaya, as 2

Sources
physical review e 6
physica a-statistical mechanics and its applications 6
proceedings of the national academy of sciences of the united states of america 5
journal of biological chemistry 5
ieee transactions on advanced packaging 5
biophysical journal 5
physical review letters 3
nature chemical biology 3
europhysics letters 2
european physical journal e 2
communications in theoretical physics 2
chinese physics letters 2
chinese physics 2
cell 2
biochemistry 2

Keywords
biochemistry & molecular biology 23
physics, multidisciplinary 18
molecular motors 18
kinesin 18
molecular motors 15
protein 13
microtubules 12
mechanism 12
hand-over-hand 10
dynamics 9
model 8
force 8
cytoplasmic dynein 8
transport 7
motion 7

Publication Year
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Country
usa 41
germany 16

japan 13
england 10
peoples r china 9
france 6
netherlands 5
switzerland 3
sweden 3
russia 3
ukraine 2
scotland 2
israel 2
canada 2
argentina 2

Institution

univ illinois 7
univ tokyo 5
chinese acad sci 5
univ leeds 3
univ kalmar 3
lund univ 3
kyoto univ 3
univ washington 2
univ texas 2
univ michigan 2
univ edinburgh 2
univ calif santa cruz 2
univ calif san diego 2
univ calif irvine 2
univ amsterdam 2

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- # CLUSTER 4
  Microfilament proteins (myosin and actin), emphasizing dynamics of muscle contraction and function of myosin heads (84 Records)

(Countries: USA dominant, England, followed by France, Japan, Germany. Institutions: University of Vermont, University of London, University of Florence, RAS, Osaka University, NHIBI, National Institute of Medical Research, European Synchrotron Radiation Facility. Other USA include Yale University, University of Pennsylvania, University of Massachusetts).

Cluster Syntax Features

Descriptive Terms
myosin 58.6%, actin 10.8%, filament 4.4%, muscl 3.2%, head 2.5%, motor 2.1%, domain 1.0%, myosin.heads 0.5%, actomyosin 0.4%, actin.filaments 0.4%, atpas 0.4%, forc 0.3%, skelet 0.3%, atp 0.3%, protein 0.3%

Discriminating Terms
myosin 34.0%, actin 6.2%, filament 2.4%, muscl 1.8%, film 1.7%, head 1.3%, motor 1.1%, surfac 0.7%, nanoparticl 0.6%, carbon 0.5%, magnet 0.5%, particl 0.5%, temperatur 0.5%, layer 0.5%, nanotub 0.5%

Single Word Terms
myosin 68, actin 56, motor 44, molecular 42, filament 40, structur 40, head 36, muscl 35, mechan 33, function 33, forc 32, singl 30, model 29, two 28, bind 27

Double Word Terms
molecular.motor 20, actin.filaments 17, myosin.heads 17, actin.myosin 13, ray.diffraction 9, myosin.motor 9, myosin.actin 9, myosin.head 9, actin.binding 8, light.chain 8, actin.filament 8, skeletal.muscle 8, force.microscopy 8, atomic.force 8, molecular.motors 8

Triple Word Terms
atomic.force.microscopy 8, myosin.molecular.motor 4, angle.ray.diffraction 3, myosin.light.chain 3, atomic.force.microscope 3, mechanical.properties.single 2, green.fluorescent.protein 2, scanning.electron.microscopy 2, yeast.two.hybrid 2, force.microscopy.afm 2, nucleotide.binding.site 2, low.angle.ray 2, small.angle.ray 2, dissociation.rate.constant 2, thermodynamic.kinetic.properties 1

Term Cliques
33.50% myosin head myosin.heads actin.filaments forc skelet atp
30.27% myosin head myosin.heads actomyosin actin.filaments skelet atp

38.29% myosin head domain actin.filaments forc atp
38.10% myosin muscl domain atpas forc atp
36.56% myosin muscl head myosin.heads forc skelet atp
33.33% myosin muscl head myosin.heads actomyosin skelet atp
41.87% myosin muscl head domain forc atp
41.67% myosin filament head myosin.heads actin.filaments forc
43.25% myosin filament head domain actin.filaments forc
45.24% myosin filament muscl head myosin.heads forc
46.83% myosin filament muscl head domain forc
50.48% myosin actin motor actin.filaments protein
40.48% myosin actin motor domain actomyosin atpas atp
39.58% myosin actin head motor myosin.heads actomyosin actin.filaments atp
40.77% myosin actin head motor domain actomyosin actin.filaments atp
38.95% myosin actin muscl domain actomyosin atpas atp
40.82% myosin actin muscl head myosin.heads actomyosin atp
42.18% myosin actin muscl head domain actomyosin atp
42.01% myosin actin filament head myosin.heads actomyosin actin.filaments
43.37% myosin actin filament head domain actomyosin actin.filaments
45.07% myosin actin filament muscl head myosin.heads actomyosin
46.43% myosin actin filament muscl head domain actomyosin

Sample Cluster Record Titles

Switch movements and the myosin crossbridge stroke

Slip sliding away: Load-dependence of velocity generated by skeletal muscle myosin molecules in the laser trap

Myosin-X: a molecular motor at the cell's fingertips

Thermodynamic characterization of different actin isoforms

Packaging actomyosin-based biomolecular motor-driven devices for nanoactuator applications

Vertebrate myosin VIIb is a high duty ratio motor adapted for generating and maintaining tension

Covalent immobilization of myosin for in-vitro motility of actin

The requirement for mechanical coupling between head and S2 domains in smooth muscle myosin ATPase regulation and its implications for dimeric motor function

Actomyosin systems of biological motility

Cluster Metrics

Authors
narayanan, t 5
sellers, jr 4
ferenczi, ma 4
sweeney, hl 3
sun, yb 3
reconditi, m 3
piazzesi, g 3
lombardi, v 3
linari, m 3
irving, t 3
yanagida, t 2
warshaw, dm 2
wang, f 2
tsaturyan, ak 2
sun, sx 2

Sources
biophysical journal 9
journal of molecular biology 7
journal of biological chemistry 6
philosophical transactions of the royal society of london series b-biological sciences 5
proceedings of the national academy of sciences of the united states of america 4
journal of muscle research and cell motility 3
cell motility and the cytoskeleton 3
structure 2
sliding filament mechanism in muscle contraction: fifty years of research 2
nature 2
journal of theoretical biology 2
journal of physiology-london 2
trends in cell biology 1
tissue & cell 1
russian journal of plant physiology 1

Keywords
biochemistry & molecular biology 22
molecular motor 16
actin 16
cell biology 12
biophysics 10
skeletal-muscle 10
myosin 10

complex 9
biology 8
molecular motors 8
mechanism 8
myosin 7
muscle 7
light-chain 7
cell biology 7

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2005 72
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Country
usa 41
england 17
france 11
japan 10
germany 10
russia 5
italy 5
hungary 4
switzerland 3
peoples r china 2
australia 2
vietnam 1
slovenia 1
singapore 1
poland 1

Institution
univ vermont 4
univ london kings coll 4
univ london imperial coll sci technol & med 4
univ florence 4
russian acad sci 4
osaka univ 4
nhlbi 4
natl inst med res 4
european synchrotron radiat facil 4
yale univ 3
univ penn 3
univ massachusetts 3
univ leeds 3
univ basel 3
moscow mv lomonosov state univ 3

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