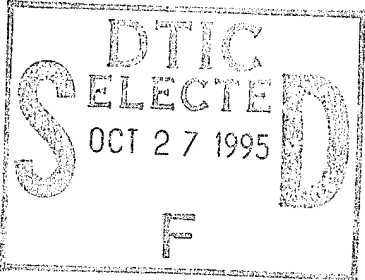


# REPORT DOCUMENTATION PAGE

Form Approved  
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE		3. REPORT TYPE AND DATES COVERED <b>Final Technical Report</b>	
4. TITLE AND SUBTITLE <b>1994 Gordon Research Conference on Ceramics</b>				5. FUNDING NUMBERS  <b>DAAH04-94-G-0234</b>	
6. AUTHOR(S)  <b>David J. Green</b>					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Gordon Research Conferences University of Rhode Island PO Box 984 West Kingston, RI 02892-0984</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) <b>U.S. Army Research Office P.O. Box 12211 Research Triangle Park, NC 27709-2211</b>				10. SPONSORING/MONITORING AGENCY REPORT NUMBER  <b>ARO 32673.1-MS-CF</b>	
11. SUPPLEMENTARY NOTES <b>The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.</b>					
12a. DISTRIBUTION/AVAILABILITY STATEMENT  <b>Approved for public release; distribution unlimited.</b>				12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words)  <p style="text-align: center;">See Attached</p> <div style="text-align: right; margin-right: 100px;">  <p style="font-size: 2em; font-weight: bold; margin-top: 20px;">19951025 012</p> </div>					
14. SUBJECT TERMS				15. NUMBER OF PAGES	
17. SECURITY CLASSIFICATION OF REPORT <b>UNCLASSIFIED</b>				16. PRICE CODE	
18. SECURITY CLASSIFICATION OF THIS PAGE <b>UNCLASSIFIED</b>		19. SECURITY CLASSIFICATION OF ABSTRACT <b>UNCLASSIFIED</b>		20. LIMITATION OF ABSTRACT  <b>UL</b>	

# Gordon Research Conference Solid State Studies in Ceramics

## FINAL PROGRESS REPORT

DAAHC4-94-G-0234

The Gordon Conference on "Architectural Design of Ceramic Structures for Optimum Performance" was held August 14th to 19th, 1994 at New Hampton School, New Hampton, NH. The conference had ninety-nine participants, with representatives from 10 different countries (attendee list attached). There was a healthy mixture of scientists from universities, national laboratories, military research establishments and private industry. In addition, the poster session allowed a large number of post-doctoral fellows and graduate students to attend the conference (30). Of these 30 young scientists, financial support was available for 24 from the funding agencies that supported the conference (ONR, ARO, NSF, Sandia and the Gordon Research Conference Special Fund). There was a total of 39 posters presented (program attached) and although this was substantially more than previous years, there was general agreement that this approach was very successful. If one includes the rest of the speakers and the discussion leaders with the poster presenters, one finds that two-thirds of the conference attendees were formally involved in the conference.

The program for the oral presentations brought together scientists from several different areas, e.g., statistical mechanics, geology, industrial processing, physics, engineering mechanics, computer simulation, who shared an interest in the conference theme. An important aspect of the program was to ask the speakers to integrate their ideas into the conference theme and the response to this idea was excellent. The topics of the oral presentations were 1) Theoretical Aspects of Structure/Property Relationships, 2) Processing of Novel Ceramic Structures, 3) Nanoscale Effects, 4) Challenges in Property Evaluation, 5) Microstructural Effects on Mechanical Behavior, 6) Design of Fiber Composites and 7) Macrostructural Effects on Mechanical Behavior (see attached program). The number of speakers was limited to two per session and this has been found to be a very successful format, as it allows for 45 minute discussion periods at the end of each talk. The discussion periods were vigorous throughout the conference and many attendees indicated they often learnt as much from the discussion as the talks. There was a total of 16 speakers and 9 discussion leaders. The Thursday evening talk was somewhat more informal and Professor Kroto gave a very entertaining talk on the discovery of Buckminsterfullerene yet it was full of insight into the research process.

In the talks, the speakers from the theoretical mechanics showed how the progress in effective medium theories and statistical theories of fiber failure could be applied to ceramic

<input checked="" type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

Codes

1/ or

Dist	Special
A1	

materials. These were areas that were not fully appreciated by the ceramics community. Speakers from industry showed how computer simulation and processing developments could be used to lead to property improvement, while another speaker gave example of how processing could lead to structure control at all scale levels. Another important challenge to ceramic scientists is the measurement of properties at fine scales and two of the talks showed the latest development in these areas. It was also clear after one of the talks that there is a strong need to develop a better understanding of electrically-induced failure in ceramic materials. The other talks discussed the latest developments in controlling properties by manipulating structure from nanoscale levels (e.g., grain boundary phases) to the macroscopic level (laminates). Overall, from the comments of the conferees, it was clear that the conference was very successful and will, I believe have a strong impact on new developments in the field.

## FINAL PROGRAM

### SUNDAY EVENING

6:00 pm Reception

### MONDAY MORNING: Theoretical Aspects of Structure/Property Relationships

Discussion Leader: \* Craig Carter, NIST.

- \* S. Torquato, Princeton University, Microstructure-Property Relations for Composite Materials
- \* M. Anderson, Exxon Research, Computer Simulations of Structure/Property Relationships

### MONDAY EVENING. Processing of Novel Ceramic Structures

Discussion Leader: \* M. P. Harmer, Lehigh University

- \* I. A. Aksay, Princeton Univ., Processing Techniques for Design of Novel Microstructures
- \* A. Pyzik, Dow Chemical, Processing and Properties of Self-Reinforced Silicon Nitride

### TUESDAY MORNING. Nanoscale Effects

Discussion Leader: \* D. A. Bonnell, University of Pennsylvania

- \* R. Raj, Cornell U., Design of Grain Boundary Phases for Optimum Mechanical Performance
- \* W. Pompe, Max Planck Society, The Role of Microscopic Residual Stresses in the Design of Ceramic Structures

### TUESDAY EVENING. Challenges in Property Evaluation

Discussion Leader: \* H. M. Chan, Lehigh University

- \* G. M. Pharr, Rice U., Evaluation of Mechanical Properties at the Micro- and Nanoscale
- POSTER SESSION

### WEDNESDAY MORNING. Microstructural Effects on Mechanical Behavior

Discussion Leader: \* B. R. Lawn, NIST

- \* M. V. Swain, CSIRO, Australia, Mechanical Behavior of Thin Films
- \* Z. Suo, UCSB, Fracture and Breakdown in Dielectric Ceramics

### WEDNESDAY EVENING. Design of Fiber Composites

Discussion Leader: \* W. Curtin, VPI.

- \* S. L. Phoenix, Cornell Univ, Stochastic Effects in the Failure of Fiber Composites
- \* B. Cox, Rockwell Intl., Optimization of Fiber Architecture in Fiber Composites

### THURSDAY MORNING. Microstructural Effects on Mechanical Behavior

Discussion Leader: \* D. B. Marshall, Rockwell International

- \* J. Lamon, Domaine Universitaire, Interface Design in Composite Materials
- \* D. K. Shetty, Univ of Utah, Role of Dispersed Al<sub>2</sub>O<sub>3</sub> on Strength and Toughness in Ce- and Y-TZP

### THURSDAY EVENING. Guest Speaker

Discussion Leader: \* D.J. Green, Penn State

- \* H. Kroto, University of Sussex, C<sub>60</sub>: Buckminsterfullerene, the Celestial Star that Fell to Earth.

### FRIDAY MORNING. Macrostructural Effects on Mechanical Behavior

Discussion Leader: \* D. S. Wilkinson, McMaster University

- \* R. F. Cook, IBM Corporation, Effects of Macroscopic Residual Stresses on Fracture
- \* T-F Wong, SUNY Stony Brook, Fracture Mechanisms in Geological Structures

## POSTER SESSION

### THEORETICAL ASPECTS

1. SIMULATION OF STRESS-STRAIN BEHAVIOR OF FIBRE-TOUGHENED CERAMIC COMPOSITES,  
Konstanza Lambrinou, E. Vanswijgenhoven, M. Wevers and O. Van Der Biest.
2. FRACTURE OF HETEROGENEOUS MATERIALS WITH CONTINUOUS DISTRIBUTIONS OF LOCAL BREAKING STRENGTHS,  
Paul Leath, Rutgers Univ. and Phil Duxbury, Michigan State.
3. EVOLUTION OF MICROCRACKING IN LAYERED CERAMIC COMPOSITES  
Sandeep Muju\* and Peter Anderson, Ohio State University
4. MICROSTRUCTURE DESIGN OF HETEROGENEOUS BRITTLE MEDIA,  
Fred Haubensack\* and Ali Argon, Massachusetts Institute of Technology.
5. MODELLING TRANSFORMATION STRESSES & CRYSTALLIZATION KINETICS OF THE AMORPHOUS PHASE IN  $Si_3N_4$   
Hannes Kessler\* Arthur H. Heuer, Case Western Reserve University, Cleveland, Ohio, Mathias Herrmann, Fraunhofer-Institute for Ceramic Technologies and Sintered Materials and Wolfgang Pompe, Max-Planck-Research-Group, Dresden, Germany.
6. SPACE CHARGE DIFFUSIONAL CREEP IN IONIC CERAMICS  
J. Jamnik\* and R. Raj, Cornell University

### PROCESSING OF NOVEL STRUCTURES

1. RHEOLOGICAL BEHAVIOR OF POLYMER-STABILIZED CERAMIC SUSPENSIONS: ROLE OF "FREE" POLYMERIC SPECIES  
Jennifer Lewis, A.L. Ogden, and R. Siliaty, University of Illinois, Urbana
2. BIOLOGICALLY MOTIVATED PROCESSING OF AN ALL-CERAMIC CROWN,  
William Wolf\*, Kaushik Vaidya and Lorraine Francis, University of Minnesota.
3. SYNTHESIS OF NANOCRYSTALLINE  $TiO_2$  THIN FILM ONTO SELF-ASSEMBLED ORGANIC MONOLAYER  
Hyunjung Shin\*, R. Collins, M. R. De Guire, C. N. Sukenik and A. H. Heuer, Case Western Reserve University.
4. TEXTURED ALUMINA,  
Thierry Carisey and David Brandon, Technion- Israel Institute of Technology.
5. MICROSTRUCTURAL CONTROL THROUGH GRAIN BOUNDARY PINNING  
Laura Stearns\* and Martin P. Harmer, Lehigh University
6. NANO-SIZED CORUNDUM & A NEW NANO-SIZED ALUMINA FROM LOW TEMPERATURE CONVERSION OF DIASPORE.  
Tony Perrotta, Charles Misra, Dean Tzeng, Mark Weaver, Neil Dando and Alan Pearson, Alcoa Technical Center  
and Altaf Carim, Penn State.

### INTERFACES

1. FRACTURE TOUGHNESS OF  $Ni/Al_2O_3$  INTERFACES  
Alan Zehnder and Mark Thurston, Cornell University

---

\* Conference Scholarship

2. THE EFFECT OF FLAWS ON THE PROPAGATION OF CRACKS AT BI-MATERIAL INTERFACES  
Ivar Reimanis, A. Mammoli, A. Graham and D. Tullock, Los Alamos National Laboratory.
3. AFM MEASUREMENTS OF METAL-CERAMIC INTERFACE PLASTICITY,  
Jim Kiely\* and Dawn Bonnell, University of Pennsylvania.
4. STRENGTH-STRUCTURE-CHEMISTRY RELATIONSHIPS FOR METAL-CERAMIC INTERFACES.  
Vijay Gupta, Jun Yuan and Alexander Pronin\*, Dartmouth College.
5. STRUCTURAL AND MECHANICAL PROPERTIES OF SAPPHIRE-ALUMINA INTERFACES,  
Tony Cazzato\*\* and Kathy Faber, Northwestern University.
6. SOLID SOLUBILITY AND INTERDIFFUSION IN ZIRCONIA/ALUMINA INTERFACES,  
Matt Stough\* and John Hellmann, Penn State.
7. THERMAL DEPENDENCIES OF STUDIES ON CHEMICAL VARIATION IN YAG SINGLE CRYSTALS AND FIBERS  
Kelly Brown\* and Dawn Bonnell, The University of Pennsylvania.
8. COMPUTATIONAL AND EXPERIMENTAL STUDY OF CRACK PROPAGATION NEAR METAL/CERAMIC INTERFACES,  
Jim McNaney, R. M. Cannon and R. O. Ritchie, LBL, UC Berkeley..
9. THE ROLE OF INTERFACIAL MICROMECHANICS ON THE MICRO- AND MACRO- MECHANICAL RESPONSE OF FIBER REINFORCED COMPOSITES  
Liz Butler\*, Rutgers University and Ed Fuller, Jr., NIST

#### MICROSTRUCTURAL EFFECTS ON FRACTURE AND DEFORMATION

1. EFFECTS OF MICROSTRUCTURE ON SUBSURFACE DAMAGE & MECHANISMS OF MATERIAL REMOVAL IN SCRATCHING, Hockin Xu, NIST.
2. MICROSTRUCTURAL CONTROL AND MECHANICAL PROPERTIES OF MULLITE-ZRO<sub>2</sub>-AL<sub>2</sub>O<sub>3</sub> CERAMICS,  
Takashi Mitamura and H. Kobayashi, Saitama University,  
Y. Kubota and H. Yamamura, TOSOH Co.
3. IN-SITU TOUGHENED SILICON CARBIDE  
Nitin Padture and Brian Lawn, NIST.
4. MICROSTRUCTURE AND ITS RELATIONSHIP TO STRENGTH VARIABILITY IN ALUMINA CERAMICS,  
Desi Kovar\*, Carnegie Mellon University, Mike Readey, Sandia National Laboratories and Brian Lawn, NIST.
5. EFFECT OF GRAIN MORPHOLOGY ON THE MECHANICAL BEHAVIOR OF IN-SITU TOUGHENED CERAMIC COMPOSITES,  
L. An\* and Helen Chan, Lehigh University.
6. FLAW TOLERANT BEHAVIOR OF ALUMINA MULLITE CERAMICS WITH BIMODAL GRAIN SIZE DISTRIBUTION  
A. Khan\*, Martin Harmer and Helen Chan, Lehigh University.
7. EFFECT OF THE GRAIN BOUNDARY PHASE ON THE FRACTURE TOUGHNESS OF SILICON NITRIDE  
Irene Petersen\* and T. Y. Tien, University of Michigan
8. INFLUENCE OF ANNEALING ON RESIDUAL STRESS INTENSITY OF INDENTATION CRACKS IN Si<sub>3</sub>N<sub>4</sub>,  
R. Kurth and Rolf Steinbrech, Forschungszentrum Julich GmbH, Germany.

---

\* Conference scholarship

9. MECHANICAL PROPERTIES OF POROUS CERAMICS

Jurgen Rodel, T. Ostrowski, TH Damstadt, M. Knechtel, TU Hamburg-Harburg and R. Bordia, University of Washington.

10. STRENGTH AND RELIABILITY OF METAL/CERAMIC COMPOSITES WITH INTERPENETRATING NETWORKS

Mathias Knechtel\*, H. Prielipp, Nils Claussen and Jurgen Rodel, TU Hamburg-Harburg.

11. WAKE ZONE MODIFICATIONS OF LINEAR ELASTIC COMPLIANCE CURVES

Jack Hay\* and Ken White, University of Houston

12. R-CURVE BEHAVIOR AND SUB-CRITICAL CRACK GROWTH AT ELEVATED TEMPERATURES,

Jim Webb\*, Karl Jakus and John E. Ritter, University of Massachusetts.

13. TENSILE CREEP BEHAVIOR OF  $Al_2O_3$ -SiC NANOCOMPOSITES

Mark Thompson, Helen Chan and Martin Harmer, Lehigh University

14. THE EFFECT OF PLATELET ORIENTATION ON THE CREEP BEHAVIOUR OF SiC REINFORCED ALUMINA

Rosaura Ham-Su\* and David Wilkinson, McMaster University.

15. TIME-DEPENDENT STRENGTH OF POLYCRYSTALLINE SILICON CARBIDE FIBERS AT HIGH TEMPERATURE

Kevin Rugg\* and Richard E. Tressler, Penn State.

16. EFFECTS OF TEXTURES AND PLASTIC ANISOTROPY IN IONIC CERAMICS

Keith Kruger\* and Keith Bowman, Purdue University.

MACROSCOPIC EFFECTS IN FRACTURE

1. EFFECTS OF CRACK VELOCITY ON FRACTURE FEATURES OF ALUMINA

Kaiyang Zeng and David J. Rowcliffe, Royal Institute of Technology, Sweden

2. PROCESSING AND MECHANICAL PROPERTIES OF HIGH TEMPERATURE HYBRID MULTILAYER COMPOSITES,

Willard Cutler\*, Frank Zok and Fred Lange, University of California Santa Barbara

---

\* Conference scholarship

**Gordon Research Conference  
Solid State Studies in Ceramics  
New Hampton School  
August 15-19, 1994**

**Ilhan Aksay**  
Princeton University  
Dept. of Chemical Engineering & Princeton  
Materials Institute  
A313 EQuad  
Princeton, NJ 08544  
Fax: 609-258-6835  
Bus.: 609-258-4393  
e-mail: iaksay@princeton.edu

**Linan An**  
Whitaker Lab, Dept. of Mat. Sc.  
Lehigh University  
Bethlehem, PA 18015  
Fax: 610-758-4244  
Bus.: 610-758-4243  
e-mail: LA01@LEHIGH.EDU

**Michael P. Anderson**  
Exxon Research & Engineering  
Route 22 East  
Annandale, NJ 08801  
Fax: 908-730-3355  
Bus.: 908-730-2756

**Stephen J. Bennison**  
EI DUPONT DE NEMOURS & CO, INC  
EXPERIMENTAL STATION, E356/311  
WILMINGTON, DE 19880-0356  
Fax: 302-695-1664  
Bus.: 302-695-3368  
e-mail:  
BENNISSJ@ESVAX.DNET.DUPONT.COM

**John E. Blendell**  
NIST  
223/A215  
Gaithersburg, MD 20899  
Fax: 301-990-8729  
Bus.: 301-975-5796  
e-mail: Blendell@NIST.GOV

**Dawn A. Bonnell**  
University of Pennsylvania  
3231 Walnut St.  
Philadelphia, PA 19104  
Fax: 215-573-2128  
Bus.: 215-898-6231  
e-mail: BONNELL@sol1.lrsm.upenn.edu

**Keith J. Bowman**  
Purdue University  
School of Materials Engineering  
1289 MSEE Building  
West Lafayette, IN 47907-1289  
Fax: 317-494-1204  
Bus.: 317-494-6316  
e-mail: kbowman@bank.ecn.purdue.edu

**David G. Brandon**  
Dept. of Materials Engineering  
Technion - Israel Inst. of Tech.  
Haifa 32000  
Israel  
Fax: 972-4-32978  
Bus.: 972-4-294577  
e-mail: mtrdbav@umsa.technion.ac.il

**Linda M. Braun**  
NIST  
Bldg. 223 Rm. A329  
Gaithersburg, MD 20899  
Fax: 301-990-8729  
Bus.: 301-975-5777

**Kelly R. Brown**  
University of Pennsylvania  
Materials Science Department, LRSM  
3231 Walnut St.  
Philadelphia, PA 19104  
Fax: 215-573-2128  
Bus.: 215-898-3446  
e-mail: kbrown@eniach.seas.upenn.edu

**Elizabeth P. Butler**  
CCR, Brett & Bowser Rds.  
Rutgers University  
Piscataway, NJ 08855-0909  
Fax: 908-445-3258  
Bus.: 908-445-5684  
e-mail: epbutler@aluminia.rutgers.edu



**W. Craig Carter**  
NIST, Ceramics  
223/A256  
Gaithersburg, MD 20899  
Fax: 301-990-8729  
Bus.: 301-975-3971  
e-mail: [wrcraig@pruffle.nist.gov](mailto:wrcraig@pruffle.nist.gov)

**Anthony Cazzato**  
Northwestern University  
Department of Materials Sciences & Eng  
2225 North Campus Drive  
Evanston, IL 60208-3108  
Bus.: 708-491-2140  
e-mail: [acazzato@casbah.acns.nwu.edu](mailto:acazzato@casbah.acns.nwu.edu)

**Helen M. Chan**  
Dept. of Materials Science and Engineering  
5 E. Packer Ave.  
Lehigh University  
Bethlehem, PA 18015  
Fax: 215-758-4244  
Bus.: 215-758-554

**Yet-Ming Chiang**  
Massachusetts Institute of Technology  
Room 13-4086  
77 Massachusetts Avenue  
Cambridge, MA 02139  
Fax: 617-253-6201  
Bus.: 617-253-6471

**Michael K. Cinibulk**  
Wright Lab / MLLM  
Wright-Patterson AFB, OH 45433  
Fax: 513-255-9339  
Bus.: 513-255-9339  
e-mail: [cinibulk@ml.wpafb.af.mil](mailto:cinibulk@ml.wpafb.af.mil)

**Robert F. Cook**  
IBM Research  
TJ Watson Research Center  
PO Box 218  
Yorktown Heights, NY 10598  
Fax: 914-945-2973  
Bus.: 914-945-2308  
e-mail: [rfc@watson.ibm.com](mailto:rfc@watson.ibm.com)

**Brian N. Cox**  
1049 Camino Dos Rios  
Thousand Oaks, CA 91360  
Fax: 805-373-4775  
Bus.: 805-373-4128  
e-mail: [bncox@scimail.remnet.ab.com](mailto:bncox@scimail.remnet.ab.com)

**William A. Curtin**  
Dept. of Materials Science and Engineering  
and Engineering Science & Mechanics  
VPI&SU  
Blacksburg, VA 24061  
Fax: 703-231-4574  
Bus.: 703-231-7039  
e-mail: [curtinw@vtvm1.cc.vt.edu](mailto:curtinw@vtvm1.cc.vt.edu)

**Willard A. Cutler**  
UCSB  
Materials Dept., Engr III  
Bldg 446  
Santa Barbara, CA 93106  
Fax: 805-893-8486  
Bus.: 805-893-8654  
email: [6500wac@ucsbuxa.ucsb.edu](mailto:6500wac@ucsbuxa.ucsb.edu)

**Goffredo De Portu**  
Research Institute for Ceramics Technology  
via Granarolo, 64  
48018 Faenza, Italy  
Fax: + 39 456 46381  
Bus.: +39 546 46147

**Brian Derby**  
University of Oxford  
Department of Materials  
Parks Road  
Oxford, UK OX1 3PH  
Fax: +44-865-273783  
Bus.: +44 -865-273760  
e-mail: [brian.derby@materials.ox.ac.uk](mailto:brian.derby@materials.ox.ac.uk)

**Alan L. Dragoo**  
US Department of Energy  
Division of Material Sciences  
ER-131 M.S. F240  
Washington, DC 20585  
Fax: 301-903-9513  
Bus.: 301-903-4895  
e-mail: [alan.dragoo@mailgw.er.do.gov](mailto:alan.dragoo@mailgw.er.do.gov)

**Anthony C. Fischer-Cripps**  
NIST  
223/B309  
Gaithersburg, MD 20899  
Fax: 301-926-8249  
Bus.: 301-975-5776

**Steven G. Fishman**  
Office of Naval Research  
800 North Quincy St.  
Arlington, VA 22217  
Fax: 703-696-0934  
Bus.: 703-696-0285

**Craig A. Folsom**  
WL/MLLM Bldg. 655  
Wright-Patterson AFB, OH 45433-7817  
Fax: 513-476-4296  
Bus.: 513-255-4691

**Lorraine F. Francis**  
Dept. of Chemical Engineering & Materials  
Science  
421 Washington Ave SE  
Minneapolis, MN 55455  
Fax: 612-626-7246  
Bus.: 612-625-0559  
e-mail: lfrancis@maroon.tc.umn.edu

**Jonathan D. French**  
NIST  
MSEL, Building 223, Room B309  
Gaithersburg, MD 20899  
Fax: 301-926-8349  
Bus.: 301-975-5742  
e-mail: jdfrench@enh.nist.gov

**Roger H. French**  
DuPont Co. Central Research  
E 356-323 Exp. Sta.  
Wilmington, DE 19880  
Fax: 302-695-1664  
Bus.: 302-695-1319  
e-mail: frenchrh@e5vax.dnet.dupont.com

**Jill Glass**  
Sandia National Lab  
Dept. 1845  
Mail Stop 0607  
Albuquerque, NM 87185-0607  
Fax: 505-844-2974  
Bus.: 505-845-8050

**David J. Green**  
201 Steidle  
University Park, PA 16802  
Fax: 814-865-2917  
Bus.: 814-865-4992  
e-mail: green@ems.psu.edu

**Rosaura Ham-Su**  
Dept. of Materials Science and Engineering  
1280 Main Street West  
Hamilton, Ontario Canada L8S 4L7  
Fax: 905-528-9295  
Bus.: 905-525-9140 x27226

**Martin P. Harmer**  
Lehigh University  
Whitaker Lab.  
5 East Packer Ave.  
Bethlehem, PA 18015  
Fax: 215-758-4244  
Bus.: 215-758-4227  
email: MPH2@LEHIGH.EDU

**Fred G. Haubensak**  
MIT 1-007  
77 Mass Ave  
Cambridge, MA 02139  
Fax: 617-258-8742  
Bus.: 617-253-4414  
e-mail: hauben@prager

**Jack C. Hay**  
University of Houston  
Department of Mech. Eng.  
Houston, TX 77204-4792  
Fax: 713-743-4503  
Bus.: 713-743-4548

**Randall S. Hay**  
Wright Laboratory, Materials Directorate  
WPAFB  
Dayton, OH 454333  
Fax: 513-476-4296  
Bus.: 513-255-8975  
email: hayrs@ml.wpafb.af.mil

**Karl Jakus**  
University of Massachusetts  
Department of Mechanical Engineering  
Amherst, MA 01003  
Fax: 413-545-1027  
Bus.: 413-545-2424

**Janko Jamnik**  
Cornell University  
Bard Hall  
Ithaca, NY 14853  
Fax: 607-255-4994  
Bus.: 607-255-4994

**Paul D. Jero**  
WL/MLLM Bldg. 655  
2230 10th St.  
Wright-Patterson AFB, OH 45433-7817  
Fax: 513-476-4296  
Bus.: 513-255-9818

**Ronald J. Kerans**  
WL/MLLM  
Wright-Patterson AFB, OH 45433  
Fax: 513-476-4296  
Bus.: 513-255-9823  
e-mail: keransrj@mlgate.ml.wpafb.af.mil

**Helen M. Kerch**  
Division of Material Sciences  
Office of Basic Energy Sciences, ER-131  
Washington, DC 20585  
Fax: 301-903-9513  
Bus.: 301-903-3428  
e-mail: helen.kerch@mailgw.er.doe.gov

**Hannes Kessler**  
Dept. of Mat. Sci. & Eng.  
10900 Euclid Ave  
Cleveland, OH 44106-7204  
Fax: 216-368-8932  
Bus.: 216-368-6495  
e-mail: kessler@cw.mse.mse.cwru.edu

**Ajmal Khan**  
Dept. of Materials Science  
Whitaker Lab. no. 5  
Bethlehem, PA 18015-3195  
Fax: 610-758-4244  
Bus.: 610-758-4275

**James D Kiely**  
MSE Dept.  
3231 Walnut St.  
Philadelphia, PA 19104  
Fax: 215-373-2128  
Bus.: 215-898-3446  
e-mail: kiely@eniach.seas.upenn.edu

**Kazunori Kijima**  
Kyoto Institute of Technology  
Matsugasaki Sakyo-ku  
Kyoto, 606 Japan  
Fax: +81-75-724-7508  
Bus.: +81-75-724-7505

**Mathias C. Knechtel**  
Denickestr. 15  
Hamburg, Germany D-21073  
Fax: 0049-40-7718-2647  
Bus.: 0049-40-7718-2836

**Desidero Kovar**  
NIST  
Building 223 Room B309  
Gaithersburg, MD 20899  
Fax: 301-926-8349  
Bus.: 301-975-6183  
e-mail: desik@enh.nist.gov

**Harry Kroto**  
University of Sussex  
School of Chemistry and Molecular Sciences,  
Falmer  
Brighton, UK BN1 9QJ  
Fax: 0273-677196  
Bus.: 814-863-2011

**Keith Kruger**  
Purdue University  
School of Materials Engineering  
1289 MSEE Building  
West Lafayette, IN 47907-1289  
Fax: 317-494-1204  
Bus.: 317-494-8715  
e-mail: krugerk@bank.ecn.purdue.edu

**Konstantza E. Lambrinou**  
Katholieke Universiteit Leuven, MTM  
de Croylaan 2  
Heverlee, Belgium B-3001  
Fax: 32-16-22-17-01

**Jacques L. Lamon**  
Laboratoire Des Composites Thermostructuraux  
Domaine Universitaire  
3 Allee La Boetie  
Pessac, France 33600  
Fax: 3356841225  
Bus.: 3356844703

**Bruno A. Latella**  
Material Science & Eng. Lab.  
Building 223  
Div 850 Room B309  
Gaithersburg, MD 20899  
Fax: 301-926-8349  
Bus.: 301-975-5774  
e-mail: latella@enh.nist.gov

**Brian R. Lawn**  
NIST  
Bldg. 223/room B309  
Gaithersburg, MD 20899  
Fax: 301-926-8349  
Bus.: 301-975-5775  
e-mail: lawnbr@enh.nist.gov

**Paul L. Leath**  
Rutgers University  
Department of Physics  
Piscataway, NJ 08855-0849  
Fax: 908-445-4400  
Bus.: 908-445-2521  
e-mail: leath@physics.rutgers.edu

**William E. Luecke**  
NIST  
Bldg. 223 Room B309  
Gaithersburg, MD 20899  
Fax: 301-926-8349  
Bus.: 301-926-8349  
e-mail: luecke@enh.nist.gov

**Jennifer A. Lewis**  
University of Illinois  
Material Science and Engineering  
Room 212D Ceramics Bldg.  
105 Goodwin Avenue  
Urbana, IL 61801  
Fax: 217-244-6917  
Bus.: 217-244-4973  
e-mail: jalewis@uxl.cso.uiuc.edu

**Tai-il Mah**  
UES, Inc  
4401 Dayton-Xenia Rd.  
Dayton, OH 45432  
Fax: 513-476-7292  
Bus.: 513-255-9829  
email: mahtaiil@ml.wpafb.af.mil

**David B. Marshall**  
Rockwell Science Center  
1049 Camino Dos Rios  
Thousand Oaks, CA 91360  
Fax: 805-373-4775  
Bus.: 805-373-4170

**James M. McNaney**  
University of California  
Lawrence Berkley Lab  
Center for Advanced Materials  
1 Cyclotron Rd.  
Berkeley, CA 94720  
Fax: 510-486-4995  
Bus.: 510-486-5544  
e-mail: jmnan@cipher.lbl.gov

**Takashi Mitamura**  
Saitama University  
Dept. Appl. Chem. Fac. Eng.  
255 Shimo-ohkubo  
Urawa, Japan 338  
Fax: Japan-048-858-3501

**Edmund H. Moore**  
WL/ML Bldg. 655  
2230 10th St STE 1  
Wright-Patterson AFB, OH 45433-7817  
Fax: 513-476-4296  
Bus.: 513-255-9834  
e-mail: mooreeh@ml.wpafb.af.mil

**Bivi Samidou Mouhamath**  
RCAST- University of Tokyo  
4-6-1 Komaba, Meguro-ku  
Tokyo, Japan 153  
Fax: 81-03-3481-4477  
Bus.: 81-03-3481-4450

**Sandeep Muju**  
209 Boyd Lab. Engineering Mechanics  
155 W. Woodruff  
Columbus, OH 43210  
Fax: 614-292-1537  
Bus.: 614-292-2731  
e-mail: smuju@magnus.acs.ohio\_state.edu

**Sharmila M. Mukhopadhyay**  
Polytechnic University  
6 Metrotech Center  
Brooklyn, NY 11201  
Fax: 718-260-3136  
Bus.: 718-260-3814  
e-mail: smukhopa@vm.poly.edu

**George A. Newsome**  
Martin Marietta-Knolls Power Lab  
Materials Development Operation,  
G2-154  
PO Box 1072  
Schenectady, NY 12301  
Fax: 518-395-4422  
Bus.: 518-395-7364

**T. A. Parthasarathy**  
UFS, Inc.  
4401 Dayton-Xenia RD.  
Dayton, OH 45432  
Fax: 513-476-7292  
Bus.: 513-255-9809  
e-mail: parthata@picard.mlwpatb.af.mil

**Nitin P. Padture**  
NIST  
Room B309 Bldg. 223 NIST  
Gaithersburg, MD 20899  
Fax: 301-926-8349  
Bus.: 301-925-5782  
e-mail: padture@enh.nist.gov

**Anthony J. Perrotta**  
Alcoa Technical Center  
Alcoa Center, PA 15069  
Fax: 412-337-1138  
Bus.: 412-337-2582

**Irene M. Peterson**  
University of Michigan  
Dept. of Materials Science and Eng  
Dow Bldg  
Ann Arbor, MI 48109  
Fax: 313-763-4788  
e-mail: meteor@engin.umich.edu

**George M. Pharr**  
Rice University  
Dept. of Mech. Eng.  
PO Box 1892  
Houston, TX 77251  
Fax: 713-285-5423  
Bus.: 713-527-8101 x 3573  
e-mail: pharr@ricevm1.rice.edu

**S. Leigh Phoenix**  
Dept. of Theoretical and Applied Mech  
321 Thurston Hall  
Cornell University  
Ithaca, NY 14853  
Fax: 607-255-2011  
Bus.: 607-255-8818  
e-mail:  
leigh\_phoenix@qmmsetam.mail.cornell.edu

**Wolfgang Pompe**  
Max-Planck Gesellschaft  
Hallwachtstrasse 3  
D-O 8027 Dresden, Germany  
Fax: 011493514659544  
Bus.: 011493514659340

**Alexander N. Pronin**  
Thayer School of Engineering  
Dartmouth College  
8000 Cummings Hall  
Hanover, NH 03755  
Fax: 603-646-2230  
Bus.: 603-646-2859  
e-mail: anpronin@ns.dartmouth.edu

**Alexander J. Pyzik**  
The Dow Chemical Company  
Ventures Research & Development  
1776 Bldg.  
Midland, MI 48674  
Fax: 517-638-9716  
Bus.: 517-636-8801

**Rishi Raj**  
Cornell University  
Bard Hall  
Ithaca, NY 14853-1501  
Fax: 607-255-2365  
Bus.: 607-255-4040  
e-mail: rishi@raj5.tn.cornell.edu

**Ivar E. Reimanis**  
Los Alamos National Lab  
MS: G771 L.A.N.L.  
Los Alamos, NM 87545  
Fax: 505-665-3363  
Bus.: 505-665-3458  
e-mail: ivar@lanl.gov

**Jurgen W. Rodel**  
Hilpertshasse 31  
Building D  
Darmstadt, Germany 64295  
Fax: +49-6151-813240  
Bus.: +49-6151-813233  
e-mail: dh39@hrzpub.th-darmstadt.de

**Kevin L. Rugg**  
Penn State  
226 Steidle Bldg.  
University Park, PA 16802  
Fax: 814-865-2917  
Bus.: 814-865-3953  
e-mail: klr128@psu.edu

**Thomas M. Shaw**  
T.J. Watson Research Center  
PO Box 218  
Yorktown Heights, NY 10598  
Bus.: 914-945-3196  
e-mail: tshaw@watson.ibm.com

**Dinesh K. Shetty**  
University of Utah  
304 EMRO  
Dept. Of Materials Science  
Salt Lake City, UT 84112  
Fax: 801-581-4816  
Bus.: 801-581-6449  
e-mail: dinesh.k.shetty@mse.utah.edu

**Hyunjung Shin**  
10900 Euclid Ave.  
Dept. of Materials Sci & Engr.  
Cleveland, OH 44106  
Fax: 216-368-8618  
Bus.: 216-368-6492  
e-mail: hxs20@po.cwru.edu

**Wilbur C. Simmons**  
Box 12211  
Research Triangle Park N.  
RTP, NC 27709  
Fax: 919-549-4310  
Bus.: 919-549-4329

**Mrityunjay Singh**  
MS 106-5, Ceramics Branch  
NASA Lewis Research Center  
Cleveland, OH 44135  
Fax: 216-433-5544  
Bus.: 216-433-8883  
e-mail: msingh@limso1.LeRC.NASA.GOV

**Laura C. Stearns**  
PO Box 218  
Yorktown Heights, NY 10598  
Fax: 914-945-2141  
Bus.: 914-945-2351  
e-mail: c1lcs@watson.ibm.com

**Rolf W. Steinbrech**  
Institute for Materials In Energy Systems  
52425 Julich, Germany  
Fax: 02461 61 3699  
Bus.: 2461 61 3061

**Ronald Stevens**  
Houldsworth School of Applied Science  
Leeds, UK LS2 9JT  
Fax: 0532 422531  
Bus.: 0532 332549

**Matthew A. Stough**  
114 Research Building West  
University Park, PA 16802  
Fax: 814-863-4718  
Bus.: 814-863-0917  
email: matthewas@aol.com

**Zhigang Suo**  
Mechanical Engineering Dept.  
University of California  
Santa Barbara, CA 93106-5070  
Fax: 805-893-8651  
Bus.: 805-893-8501  
e-mail: Zhigang@sulu.ucsb.edu

**Michael V. Swain**  
CSIRO Div. of Applied Physics  
PO Box 218  
Lindfield, NSW Australia 2070  
Fax: 612-413716  
Bus.: 612-4137544  
e-mail: swain@dap.csiro.au

**A. Mark Thompson**  
Lehigh University  
Materials Science Dept.  
Whitaker Lab # 5  
Bethlehem, PA 18015  
Fax: 215-758-4224  
Bus.: 215-758-4232  
e-mail: at04@lehigh.edu

**Salvatore Torquato**  
Princeton Materials Institute  
70 Prospect Ave  
Princeton, NJ 08540  
Fax: 609-258-1309  
Bus.: 609-258-3341  
e-mail: torquato@matter.princeton.edu

**Kaushik J. Vaidya**  
Dept. Of Chem. Eng. and Mat. Sci.  
421 Washington Ave. SE  
Minneapolis, MN 55455  
Fax: 612-626-7246  
Bus.: 612-625-4809  
e-mail: vaidyoo6@maroon.tc.umn.edu

**Jay S. Wallace**  
NIST  
Bldg. 223/A329  
Gaithersburg, MD 20899  
Fax: 301-990-8729  
Bus.: 301-975-5984  
e-mail: jwallace@enh.nist.gov

**James E. Webb**  
UMASS  
Dept. Of Mechanical Engineering  
Amherst, MA 01003  
Fax: 413-545-1027  
Bus.: 413-545-2670  
email: jwebb@ECS.umass.edu

**Lanhua Wei**  
NIST  
Bldg. 223/ RA361 Ceramics Division  
Gaithersburg, MD 20899  
Fax: 301-990-8729  
Bus.: 301-975-4181

**Kenneth W. White**  
University of Houston  
Dept. of Mechanical Engineering  
Houston, TX 77204-4792  
Fax: 713-743-4527  
Bus.: 713-743-4526  
e-mail: ken\_white@mail.me.uh.edu

**Sheldon M. Wiederhorn**  
NIST  
Blg. 223/Rm. 13309  
Gaithersburg, MD 20899  
Fax: 301-926-8349  
Bus.: 301-975-5772  
email: wieder@enh.gov.nist

**David S. Wilkinson**  
McMaster University  
Dept. of Material Sci. & Eng.  
1280 Main St. W.  
Hamilton, Ontario  
Canada L8S 4L7  
Fax: 905-528-9295  
Bus.: 905-525-9140 X.24790  
e-mail: wilkinson@mcmaster.ca

**William D. Wolf**  
University of Minnesota  
421 Washington Ave. SE  
Minneapolis, MN 55455  
Fax: 612-626-7246  
Bus.: 612-625-4809  
e-mail: wolfx004@staff.tc.umn.edu

**Teng-Fong Wong**  
Dept. of Earth & Space Science  
State University of New York  
Stony Brook, NY 11794-2100  
Fax: 516-632-8240  
Bus.: 516-632-8212  
e-mail: tfwong@ccmail.sunysb.edu

**Hockin Xu**  
NIST  
Bldg. 223, Rm. A329  
Gaithersburg, MD 20899  
Fax: 301-990-8729  
Bus.: 301-975-6385

**Alan T. Zender**  
Dept. of Theoretical and Applied Mechanics  
Cornell University  
Ithaca, NY 14853  
Fax: 607-255-2011  
Bus.: 607-255-9181  
e-mail: atz@msc.cornell.edu

**Kaiyang Zeng**  
Dept. of Materials Science and Engineering  
Royal Institute of Technology  
Stockholm, Sweden S-10044  
Fax: (46) 8 100411  
Bus.: (46) 8 7909021  
e-mail: kaiyang@prima.met.kth.se