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**AUTHORITY**

USAEAA ltr, 28 Sep 1967

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BIBLIOGRAPHY ON ELECTROSTATIC PHENOMENA IN AEROSOL DISSEMINATION

Prepared for:
COMMANDING OFFICER
U.S. ARMY CHEMICAL RESEARCH AND DEVELOPMENT LABORATORIES
EDGEOOOD ARSENAL, MARYLAND

ATTN: MR. JACOB CHERNACK
CHIEF, WEAPONS RESEARCH DIVISION

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SRI Project PAU/4900

Approved: NEVIN K. HESTER
DIRECTOR, CHEMICAL SYNTHESIS AND DEVELOPMENT DIVISION

Copy No. 6
This bibliography represents a survey of published information relevant to the manner in which electrostatic phenomena might influence dissemination of chemical warfare agents, covering both the open literature and reports of government-sponsored research. Abstracts are included for most of the 1028 references cited.
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INTRODUCTION

This bibliographic survey was undertaken to reveal information relevant to the influence of electrostatic phenomena in dissemination of chemical warfare agents. Pertinent to the survey are all ways in which electrostatic charges or fields, (1) could affect the properties of materials (powders, solids, liquids, or aerosols) or the physical or chemical behavior of materials, (2) could be utilized for purposes of dissemination, (3) could be generated, controlled, or dispelled, or (4) could be measured. A critical analysis based on the information provided by this survey will appear as a chapter entitled "Electrostatic Phenomena" in another report entitled "Aerosol Dissemination Processes--A Critical Review."

The survey was conducted in three phases: (a) a primary survey covering open literature appearing through the end of September 30, 1964; (b) a supplementary survey of the open literature through May 31, 1965, including additional references missed in the primary survey and revealed during the actual analysis of articles obtained as the result of the primary survey, and (c) a review of government-sponsored research projects.

The common reference sources consulted for the primary survey are summarized in Table I. In addition to these sources, other private sources were also consulted, including Stanford Research Institute files, files of individuals, and listings obtained from CRDL.

In the supplementary survey all the reference sources indicated in Table I for the period September 30, 1964 to May 31, 1965, as well as the additional sources listed in Table II were examined. During this phase additional references were also found as various specific articles were analyzed, and were included in the supplementary list.

References to government project reports were obtained (1) by reference to contractors known to have worked in this area, (2) by reference to specific private and CRDL listings, (3) by review of files at the
Sunnyvale, California, Center of DDC, and (4) by reference from some of the sources listed in Table I.

Although it was intended to have a reasonably comprehensive survey, much of the pertinent information is to be found in other related areas. Since many of these areas are quite large in themselves, no attempt was made to be all-inclusive in each area, although it is felt that a sufficient collection of articles was obtained in these areas to be reasonably representative of the more important aspects. These related areas that were not comprehensively surveyed include: (1) electrical discharge in gases, (2) ion propulsion, (3) electrical contacts and switch gear, (4) electrets and ferroelectrics, (5) polarization of materials, (6) electrostatic printing, (7) atmospheric electricity, (8) effect of charges or electric fields on material properties, and (9) electrolysis, electrical endosmosis, electrophoresis, and electrodialysis.

The references are listed alphabetically by the last name of the first author, with the most recent article of that author given first. Where available, the reference is followed by an abstract, with the abstract source indicated by code at the end of the abstract. This code is identified in Tables I and II and is the abbreviation given in the first column. When the abstract was by the author, the word "Author" is indicated as the abstract source.

The following individuals or organizations are extended special thanks for their permission to include their copyrighted materials.

Prof. K. J. De Juhasz ("Spray Literature Abstracts")
Academic Press (J. Coll. Sci.)
American Physical Society (Phys. Rev.)
Franklin Institute (J. Franklin Inst.)
Institute of Electrical Engineers (Physics Abstracts)
Pergamon Press (Chem. Eng. Sci.)
The Combustion Institute (Symposia on Combustion)
The American Chemical Society refused to grant permission to reproduce abstracts from any of their journals or from Chemical Abstracts, and the abstracts from these were omitted. Fortunately, there was only a total of some 50 references from all ACS sources; the Chemical Abstract reference number has been indicated in those cases.

Approved:

D. E. Blake
Chemical Engineer

C. E. Lapple
Senior Scientist

Nevin K. Hiester
Director, Chemical Synthesis and Research Division
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* In the "Technical Translations" and "Translation Monthly" abstracts the following abbreviations are used to indicate the source of the available translation described:

ATS
Associated Technical Services, Inc.
P.O. Box 271
East Orange, New Jersey

CB
Consultants Bureau Enterprises, Inc.
207 West 50th Street
New York, II, New York

CSIRD
Commonwealth Scientific and Industrial Research Organization
Information Service
314 Albert Street
East Melbourne C. 2, Victoria
Australia

BR
Henry Bratcher
P. O. Box 157
Alta Loma, California

LC
Photoduplication Service
Publication Board Project
Library of Congress
Washington, 25, D.C.

NASC
National Aeronautics and Space Administration
1220 N Street, N.W.
Washington, 25, D.C.

NRC
National Research Council, Library
Ottawa, 2, Canada

OTC
Office of Technical Services
Department of Commerce
Washington, 25, D.C.
(Also available through Department of Commerce Field Offices)

SLA (in Technical Translations)
SLA, Inc., Scientific Library
The John Carter Library
80 East Randolph Street
Chicago, 1, Illinois
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PRIMARY SURVEY

(Open literature references through September 30, 1964)
1. Anonymous

2. Anonymous

3. Anonymous
   "Electrostatic Air Cleaning." Steel 115, No. 17, 86-88 (October 23, 1944).

4. Anonymous

5. Anonymous
   "Trapping Dust Electrically." Westinghouse Engineer (May 1942).

6. Anonymous
   "Dust Collection at Hams Hall Power Station." Ind. Chemist, 507-511 (December 1938).

7. Anonymous
   "Suppression of Ink Misting," Battelle Tech. Review, 15, pp. 10 (July 1964). The following is the complete article.

   Printing presses, particularly those used for printing newspapers, generate enough black mist from the ink rolls to produce dirty working conditions and even fire hazards. Despite intensive studies, the industry has been only partially successful in eliminating this nuisance.

   As reported by Robert B. Reif, Lewis E. Walkup of Battelle, and C. W. Warner of Cutler-Hammer, Inc., before the recent annual Pittsburgh meeting of the Technical Association of the Graphic Arts, such a mist is formed at the exit side of two ink rolls running in contact. As the ink layer splits, fine threads of ink are pulled out. These threads can break and pull back into the ink film. However, some of them break at two points, and the isolated sections from dots that fly into the air.

   In studies at Battelle and at Cutler-Hammer, Inc., an electrostatic method for suppressing ink mist was conceived whose basic principle involves electrically charging the mist particles and using electrical fields to drive them back onto the rolls. The small gravitational and centrifugal forces on the droplets are easily overcome by such electrical forces. In an electrical
field of 8000 volts per centimeter, the electrical force on a 200-micron particle can be 15 times that of gravitational forces, 150 times for a 20-micron particle. Therefore, the ink mist can be driven back to the roll.

Basically, the electrostatic unit for suppressing mist is simple—it consists of a single 0.10-inch stainless-steel wire placed about one inch from the exit side of each nip in the taking train. However, a number of knotty practical problems had to be solved before commercial installations could be considered. Commercial equipment utilizing the electrostatic method for controlling this pressroom annoyance is now in use.

8. Anonymous
N94-20301
Janet Publications Research Service, Washington, D.C.
TURBULENT DIFFUSION IN THE SURFACE LAYER OF THE EARTH'S ATMOSPHERE
May 1964, 221 p; transl. into English by T. Lentz, St. Petersburg, No 16, 1963 p 1-240,
IPPS-34405c OTS-64-31213 OTS: $5.00
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PART I: THEORETICAL WORK
1. DIFFUSION OF FOREIGN MATTER FROM POINT SOURCES IN THE SURFACE LAYER OF THE ATMOSPHERE D. L. Lythgoe and S. N. Kaplan p 1-10 refs (See N94-20201 13-21)
2. DIFFUSION OF FOREIGN MATTER FROM A HIGH SOURCE G. Kh. Tusyam p 11-19 refs (See N94-20203 13-21)
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8. EFFECT OF BREEZES ON THE DIFFUSION OF PASSIVE CONTAMINATION FROM A CONTINUALLY ACTING SOURCE G. Kh. Tusyam p 61-80 refs (See N94-20209 13-21)
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10. EFFECTIVE COEFFICIENT OF CAPTURE OF AEROSOL PARTICLES BY RAIN AND CLOUD DROPLETS E. K. Bykova and F. A. G-guide p 101-151 refs (See N94-20211 13-21)
11. DIFFUSION OF AN ADMIXTURE IN THE ATMOSPHERE IN PRESENCE OF CLOUDS AND PRECIPITATION F. A. G-guide p 152-167 (See N94-20212 13-21)
12. DISPERSION OF PASSIVE PARTICLES FROM A POINT SOURCE IN A HETEROGENEOUS MEDIUM E. K. Bykova and D. L. Lythgoe p 168-178 refs (See N94-20213 13-21)

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13. STATIONARY PHOTOELECTRONIC ANEMOGRAPH WITH AUTOMATIC NUMERICAL AVERAGING OF THE RESULTS OF MEASUREMENT. L. G. Kuchin, B. Ya. Tolstobrev, and N. S. Yelnychev p 179-188 refs (See N94-20214 13-21)
14. DEVICE FOR THE SHAPING OF SQUARE Pulses FROM ELECTRIC SIGNALS OF ARBITRARY FORM OF SUBSONIC FREQUENCIES. I. I. Prokopyev and N. S. Yelnychev p 189-192 refs (See N94-20215 13-21)
15. REMOTE-CONTROLLED CURVE ANEMOMETER WITH HIGH-FREQUENCY DATA UNIT. A. I. Merezhkevsky p 193-196 (See N94-20216 13-21)
18. AN UNBALANCED AUTOMATIC TEMPERATURE GRADIENT METER FOR FIELD USE. L. G. Kuchin, B. Ya. Tolstobrev, V. M. Ushakov, and N. S. Yelnychev p 220-231 refs (See N94-20219 13-21)
19. AN AUTOMATICALLY RECORDING DIFFERENTIAL BALANCE METER B. Ya. Tolstobrev p 232-241 refs (See N94-20220 13-21)
20. AUTOMATIC INTEGRAL FLUCTUATION METERS L. G. Kuchin p 242-248 (See N94-20221 13-21)
21. ELECTRONIC ANEMO-FLUCTUATION METER M. I. Gutogenberg p 249-253 (See N94-20222 13-21)
22. A SEMICONDUCTOR VARIATION OF THE INTEGRAL FLUCTUATION METER S. G. Gerasimov p 254-258 (See N94-20223 13-21)
23. INERTIA CHARACTERISTICS OF AIR CURRENT DIRECTION SENSORS L. G. Kuchin and V. P. Popenov p 259-263 refs (See N94-20224 13-21)
24. AERODYNAMIC INVESTIGATIONS OF THE PARAMETERS OF AIR FLOW DIRECTION SENSORS. O. S. Oloznianski p 270-278 (See N94-20225 13-21)
25. STANDARD DESIGN OF A LOW-INERTIA HOT-WIRE RESISTANCE ANEMOMETER WITH TEMPERATURE COMPENSATION L. G. Kuchin and Li Song Kang p 279-288 refs (See N94-20226 13-21)
27. COMPARISON OF THE CHARACTERISTICS OF ATMOSPHERIC TURBULENCE OBTAINED USING THE AUTOMATIC INTEGRAL FLUCTUATION METER (AIM) AND THE METHOD OF INSTANTANEOUS SMOKE PUFFS. P. M. Mushniko p 291-307 refs (See N94-20228 13-21)
28. EXPERIMENTAL INVESTIGATION OF THE DISPERSION OF IMPURITIES FROM INSTANTANEOUS SOURCES P. M. Mushniko p 307-318 refs (See N94-20229 13-21)
N94-20201
9. Anonymous

MICROMETEOROLOGY, AEROSOLS, AND AIR POLLUTION: BIBLIOGRAPHY. 25 Apr 63 (16p, 198 refs).
AID rep. 8-43-30, AD-403 864
Order from OMS or SLA $1.60 63-19353


This bibliography is based on Soviet and Soviet-bloc open-source materials available at the Aerospace Information Division and the Library of Congress. The bibliography is divided into two parts: Part I. Micrometeorology and Part II. Aerosols and Air Pollution. Titles of monographs are given in transliterated form, followed by the English translation. Library of Congress call numbers are included at the end of each entry when the item is cataloged and available in the collections of the Library. The 108 entries are arranged alphabetically by author. An author index is provided.

T10-363

10. Anonymous

"Device Leads to Speedy Process for Encapsulating Tiny Particles."

11. Anonymous

"Electrostatic Flocking Makes Gains."
A-1. Abounenc, L.

1893. Formation of Drops in an Electric Field. L. Abounenc. (Comptes Rendus, 123, pp. 1031-1032, April 28, 1896.)—The diminution in weight of drops formed at the extremity of a cylindrical tube, under the influence of variously disposed electric fields, is studied, and it is noted that its amount decreases with liquids more nearly approaching perfect dielectrics. It is concluded that the effects are not due to alteration by the electric field of the viscosity, or, in the case of insulating liquids, of the surface-tension, but are due to forces resulting from electric charges spread over the surface of the drop, and, to a less extent, to forces arising from the polarization of the dielectric, comparable with those occurring during the formation of a drop in a magnetic field.

PA-29-1893


STABILITY OF AN ELECTRICALLY CHARGED DROPLET. (Glattla/Mitreal and Latiity.) Journ. of Philos. (1923), Vol. 5, No. 2, 519-526 (May, 1925).

The stability of an electrically charged droplet with respect to mechanical deformations is studied under the assumption that the liquid is perfectly conducting, the medium devoid of external fields of force, and the sole of the electrical and mechanical energies in the system conserved. Unlike Rayleigh’s case, which dealt with small perturbations of spherical drops, the deformations considered in the present case are allowed to be large in size but confined in shape to ellipsoids of revolution. The energy of the deformed droplet is expressed as a function of a geometrical parameter and the ratio of the electrical and surface energies of the corresponding spherical shape. It follows, the dependence of the critical points on the parameter is investigated. Conforming with Rayleigh, the spherical droplet is shown to be unstable for $a > 4$ and stable for $a < 4$. However, for a certain range of $a$, the latter case, it is found to be only in a metastable state. In addition, both one prolate and one oblate ellipsoid of minimal energy are shown to exist for every $a > 4$.

PA-65-11345

A-3. Allan, R. S., and S. G. Mason


The deformation and burst of liquid drops suspended in liquid dielectrics in an electric field were measured. At low electric fields, the deformations of conducting drops into prolate spheroids showed good quantitative agreement with theoretical equations based on electorstatic theory. Dielectric drops exhibited appreciable deviation from the theory, especially in a number of systems where oblate spheroids were formed. The mode of electrical burst rate of drops showed considerable variation with the electrical properties of the systems. The deformations, orientation, and burst under the combined action of shear and electric field were also studied and found to agree with a theory based upon a superposition of electric- and shear-deformation. The study of the burst was found to depend on the ratio of the velocity gradient to the electric field strength, on the interfacial tension, and on the values of dielectric constants and of viscosions of the two liquids.

Author

A-4. Allan, R. S., and S. G. Mason


The rotation and orientation of rigid conducting rods suspended in a dielectric medium in combined shear and electric fields were studied. Excellent agreement with predictions based on a theoretical analysis of the problem by Demetriou was obtained. The use of rigid conducting spheres in an electric field due to electromagnetic attractive forces was studied and found to be in accord with theory.

Collisions of rigid conducting spheres in shear and electric fields were also investigated. It was found that in many cases, permanent deformations could be formed as a result of particle collisions. The technique affords a sensitive method of measuring adhesion forces. Author

A-5. Alty, T.

233. Origin of the Electrical Charge on Small Particles in Water. T. Alty. (Roy. Soc., Proc., 112, pp. 235-236, Aug. 3, 1926.)—In continuation of earlier work (Abstract 234 (1925)), the electrical charge on an air bubble in water is measured under various conditions, and an examination is made of the mode of formation of this surface charge. For bubbles ranging in diameter from 3.0 to 0.2 mm, the total charge is independent of the diameter when equilibrium conditions obtain at the surface. The constitution of the surface layer is examined theoretically, and a new method of measuring the potential difference between the surface and the interior of the liquid is suggested.

PA-30-233

A-6. Anderson, E.

447. Electric Wind in Electrical Precipitation in Gases. E. Anderson. Physics, 8, pp. 23-28, July, 1923.—It is at present a moot point what is the rôle played by the electric wind in the electric precipitation process. On the one hand it is held that the electric wind, through its effect on the motion of the particles towards the collecting electrode is the determining factor in the process, while on the other hand it is argued that the net action of the wind is unidirectional and that its chief rôle is to promote uniform distribution of the particles in the gas. The electrical precipitation process consists in the "ionisation" of suspended material particles through adhering gas ions, and the consequent motion of these ionised particles to the collecting electrode under the action of the electric field. The author, studying the complex stream of moving ions and gas molecules in a point-to-plate precipitation, concludes that with conducting particles the total rate of precipitation may be determined as much by the rate of ionisation as by the rate of transmission, while with non-conducting particles that tend to hold their charges the rate of desionisation at the electrode is the determining factor. When the transportation or ionisation rate is a determining factor, these being affected by the electric wind, the electric wind affects the precipitation-rate; while the rate of desionisation is the determining factor, the electric wind can have no direct effect on the precipitation rate.

PA-35-4472
A-7. Arabadzhi, V. I.

KINETICS OF THE COLLISION OF DROPS. [1959] 3p. (3 figs. om. 2 add.) Order from LC or sla st. $1.80, pl. $1.80 59-17159

Trans. of Meteorologiya i gidrostologiya (USSR) 1956, no. 4, p. 35-36.

An analysis of motion pictures (at 1500 frames/sec) of the collision of 2 mutually perpendicular streams of 2- to 6-mm dia. drops having an initial velocity of about 2 m/sec and directed respectively toward the ground and horizontally indicates that on collision an annular water belt is formed which undergoes a gradual disintegration. Motion pictures of the fall of drops on a plane water surface showed that the latter breaks up is bent downward, then water is ejected upwards which sometimes terminates in its summit by a fairly symmetrical bubble. After the ejection recedes there may occur a second small ejection. The ejections are caused by brief damped oscillations of the water surface caused by the impact of the drop. By using colored drops it was ascertained that a vertical ring of the substance of the impacting drop moves out and permeates several centimeters of the body of the liquid. The motion picture recordings of the fall of drops upon a water surface show that the bubbles are formed at the summit of the ejection of water or, less frequently, at the lateral or sections thereof. This confirms the theory of the hallow-electric effect of Leonad-Frenkel according to which electrolization of liquids on their impacting takes place by a drawing of the charge from the double layer extending to a certain depth into the liquid.

T2-524

A-8. Arabadzhi, V. I.

5834. ON SOME ELECTRICAL PROPERTIES OF WATER AND ICE. V.L.Arabadzhi.


These properties are important in studying atmospheric electricity. Four experiments are described: (A) Positive charges obtained on ice when it is sun or scratched. They are of order 10⁶ coulomb per gramme of ice and depend on its temperature. (B) E.m.f. of ice polarization after the application of a direct voltage for one hour to it. It was roughly equal to 3 volts for every volt per cm applied. (C) Contact potential between water and ice was measured with a radio-photometer collector. The average result was 1.6 volts. (D) The potential difference produced in a jet of steam and water droplets at different pressures as a function of the distance from an orifice, showed a maximum of up to 5 kV/m for 6 atm at a distance of 10 m.

PA-59-5834


TM 3-4

A-10. Arabadzhi, V. I.


A-11. Archbold, J. W.

Preliminary note on condensation in the form of clouds and dew. ARCHBOLD, J. W. Phil. Mag., 34, pp. 632-42, Sept., 1943. The author uses classical statistical mechanisms to assess the distribution of water drops according to size and to exhibit the comparison for growth amongst an assemblage of drops. Gravity has a negligible effect. If there are no electric charges, condensation occurs in large drops, with no cloud. In the presence of charges, the size distribution depends on the charge distribution; if all the drops are similarly charged, condensation still takes place in large drops, but these are accompanied by a cloud of small drops which is perhaps visible. Ordinary cloud formation is associated with temperature variations and departure from equilibrium conditions. Similar conclusions are reached for dew formation, though here the degree of affinity of water for the cooled surface is important.

PA 46-2803


PA 29-1083

CONTACT ELECTRIFICATION AND POLARIZATION OF NYLON THREADS. R.G.C. Arridge.


A study was made at different relative humidities of the way in which electric charge is distributed on nylon threads. For relative humidities of less than about 40%, the charge remains localized and decay to magnitude at very nearly an exponential rate. Relative humidities greater than 75% the charges spread out along the thread and the decay of peak charge with time can be approximately represented by an exponential law rather than by an exponential one. If a diffusion equation of the type \( \rho = A e^{-\frac{t}{\tau}} \) is applied to the latter results, values of the diffusion constant \( D \) are obtained which are independent of the accuracy of the experiment, of (I) the sign of charge and (II) whether it was a contact charge or a polarization charge. \( D \) varies exponentially with relative humidity.

PA-63-7056


EQUILIBRIUM EMISSION OF PARTICLES. A.A. Arshinov and A.K. Musin.


General solution of the problem of equilibrium ionization of a particle is derived. The solution covers all cases from multiple ionization of atoms to ionization of macroscopic particles.

PA 61-8064


THERMAL EMISSION OF ELECTRONS FROM CARBON PARTICLES. A.A. Arshinov and A.K. Musin.


Derives formulae for the calculation of concentration of electrons in carbon filaments. The derivation is based on the Richardson-Dushman equation, taking into account recombination of electrons with positively charged carbon particles. Electron work function of 6.9 eV was calculated for carbon particles at temperatures between 1300 and 3500°K, using above formulae and the experimental values of electron concentrations in scintillators—orange flames given by Blauer and Wexler (Abstr. 653/1954). It is shown that the observed concentrations are due to carbon particles of radius of the order of 10^-6 cm.

PA 61-4094

A-17. Ashcraft, T. L.; J. Riney, and N. Hackerman


The apparatus contains a reference surface (gold) and provision for evaporating the experimental surface onto a rotating metal plate. Circuits used to measure the surface potential difference between the two metal surfaces are described. The apparatus has a rapid and continuous response to changes in the surface potential difference between the experimental and reference surfaces. As a result, the resolution of the initial variation of the SPD on removal of oxygen or evaporation of gold on the surface is improved. The apparatus can be modified to allow SPD measurement on single crystals or catalysts.

Author

A-18. ABC


A-19. Avak'yants, G. M.

THEORY OF ELECTRON EMISSION FROM METALS IN ELECTRIC FIELDS. tr. by L. B. Lade. May 61 [1951]. 7 refs.

Order from OTE or SLA $1. 60 61-23825


Calculations show that in the range of field intesnity from 10^16 v/cm to 10^17 v/cm there is noticeable penetration of an electric field into the metal. In the case
of field emission the field penetration leads to an apparent decrease in the work function \( \Phi \) by \( 2eV \).

In the case of thermionic emission, the field penetration leads to an apparent decrease of the work function half that of field emission. Within the framework of the Tamm–Blokshank theory the action of an external electric field noticeably changes the true work function, and, in particular, the true work function is increased by \( eV \). Thus, the region of field necessary from \( 10^6 \) to \( 10^8 \) \( \text{V/cm} \) does not appear to be a region of unrestricted use. However, for \( eV/\Phi \) as a function of \( E^{-1} \), a straight line is described with a slope which depends only on \( \Phi \) but not on \( \Phi^2 \). Even then the value of the emission current may noticeably change.

A-20. Avak'yan, G. M.

AVA'K'YAN'S, G. M.


A-21. Avy, A. P.

B-1. Bainakov, Iu. V.
"Improvement of Electric Filters for Dust Collection"
(in Russian), Elektrotechn ology No. 3, 60–6 (March 1947).

B-2. Banerji, S. K.
"On the Interchange of Electricity Between Solids,
Liquids, and Gases in Mechanical Actions," J. Indian

1948. Electric charge of rain drops. S. K.
18, 93–126 (March–April, 1952).
The recording equipment described includes a
Wilhem tilt electrometer for recording the charge on
individual rain drops. A Siemens apparatus giving
the charge on rain collected every 3 min and an
ion chamber for continuous recording of the
earth’s electric field were kept in simultaneous opera-
tion. A number of specimen records obtained during
and in absence of thunderous conditions are repro-
duced and the data obtained in 1941–42 in Bombay
and in 1933–34 in Poona are tabulated. Both pos-
tive and negative charges are found to be present on rain drops
from any part of the cloud. The same charge of
positive drops is 0.021 c.cm. in non-thunderstorm rain
and 0.051 in thunderstorm rain, the equivalent same
charge of negative drops being 0.023 and 0.007 c.cm.
respectively. It is shown that, initially, cloud particles
develop charge in the same way as colloidal particles
or particles floating in a medium and capturing ions.
These latter charges are augmented by the Siemens
process of the break-up of rain drops. At heights
above the freezing level the saline of ice particles is
believed to make them negatively charged.
PA 55-2248

B-4. Barret, P.
1904. CONTRIBUTION TO THE STUDY OF ELECTROLYSIS BY
SPARK. THE CATHODIC FORMATION OF ELECTROLYTES.
P. Barret.
Bull. Soc. Chim. France, 1856, No. 8–9, 1243–53 (July-Aug.). In
French.
An account of a phenomenon observed in the course of an inves-
tigation into the production of aerosea using electrical discharges.
The phenomenon is the formation of droplets on a platinum wire
cathode suspended over the surface of ionized liquids and the
formation of these to form aerosea. A brief description of the
apparatus and results obtained is given. A detailed discussion inter-
prets the results and gives a theory of the mechanism of the
phenomenon.
PA 60-3796

B-5. Beard, W. C., Jr.
"Powder Aerosols," Soap and Chemical Specialties,
31, pp. 139, 141, 169 (January 1955).

B-6. Beaver, C. E.
"Cottrell Electrical Precipitation Equipment,
Some Technical and Engineering Features, Recent
Developments and Application in the Chemical Field,"

244. Ice electricity. A. Becker and I. Schaper.
Z. Naturforsch., 4a, 194–8 (June, 1949). In German.
The fusion of ice in an electrical field is accom-
paied by the appearance of electrical charges which
are conveyed by charged particles into the sur-
rounding atmosphere. Full experimental details are
included in the paper for this new electrical effect.
PA-53 244
B-8. Beischer, U.

THE SURFACE PRESSURE OF IONIZED MONOLAYERS.
17/429 G.M.Bell, S.Levine and B.A.Pethica,
It is shown that the commonly accepted relation

\[ \sigma = \frac{1}{\infty} \frac{\partial \sigma}{\partial \epsilon} \]

for the increase in surface pressure resulting from the charging of a monolayer is not general. The surface pressure increase also includes a term relating to the change of the "non-electrostatic" contribution to the surface free energy. An important part of this additional term originates in the fluctuation or "self-atmosphere" electrostatic potential at an ion in the monolayer and may also be described in the "discreteness-of-change" contribution. The use of two-dimensional equations, of state for oriented films as a way of investigating the properties of the liquid double layer is briefly considered.

PA-65-17429

B-10. Bell, W.


CA-52-8682d

Experimental evidence is given to show that the collection efficiencies of droplets in an aqueous aerosol are a function of the electrolyte concentration. A semi-quantitative indication is given of the influence of the Dukhin-Derjaguin diffusional electrostatic effect on collection efficiencies of droplets of diameter approximately 3 μ. A fully quantitative test of the theory of Dukhin and Derjaguin must await further experimental data.

Author


Author

B-14. Berg, T. G. O., and N. Brunetz
"Behavior of Charged Particles on Glass Slides," Arch. Environ. Health 5, No. 1, pp. 16-20 (July 1964)

A charge analyzer is described that permits the rapid and convenient charge analysis of aerosols and sprays emerging from a nozzle at a high flow velocity. The charged particles are deposited on two collector electrodes. The rate of charge deposition is measured by means of a recording voltmeter, one for each electrode. The amount of material deposited is determined by weighing on a microbalance. Measurements have been conducted with several materials at flow rates between 1.5 and 15 m/sec. Such data are presented.

Author

B-16. Berg, T. G. O., G. C. Fernish, and T. A. Gaukler
The coalescence of two liquid drops, pressed against each other while a voltage is applied across the drops, was studied with high-speed photography. The delay between contact and coalescence is of the order of milliseconds for distilled water, alcohol, and aqueous solutions of hydrochloric acid. The inverted value of this time, the rate of coalescence, is proportional to the
volts between the drops at low voltages and to the square of the voltage at high voltages. In both cases, the plot of rate against voltage extrapolates to zero rate at zero voltage. In the linear case the rate is proportional to \( (V - 17)^2 \), in the parabolic case to \( (V + 17)^4 \), where \( V \) is the dielectric constant. The following interpretation of the data in different cases is effective by formation of bonds across the interface between the drops. This may occur in two ways, by breaking of bonds or formation of new bonds, or by gradual rearrangement of bonds. In the former case, the rate is proportional to the energy in the drops and thereby to \( c \) and the square of the voltage. In the latter case, the rate is proportional to \( (V - 17)^4 \) and the voltage.

PR 66-14131

B-17. Berg, T. G. O., Fernish, G. C., and Hunkins, M. J.


Recently, we reported that the contact potential difference between a metal and a suitably coated metal serving as a reference electrode could be used in clean air as a sensitive and reliable tool for studying adsorbed monomolecular films of polar compounds. This reports results of the study of the change \( \Delta V \) in the contact potential difference resulting from the adsorption on a metal of a film of each of the following pure nonpolar liquid compounds: benzene, octane, etc., through bromocyclohexane, diethyl ether, benzene, toluene, styrene, and carbon tetrachloride. Clean polished surfaces of Pt, Au, Ag, Cu, Ni, W, Cr, Sn, and Cd were the adsorbing metals. No attempt was made to avoid surface oxidation after polishing. Contact angles of water, glycerol, methanol iodide, and bromocyclohexane on the same adsorbed film supplied information about their nature, packing, and orientation. The following conclusions were made: (i) evaporation of the liquid always leaves on the metal an adsorbed monolayer oriented so that the maximum number of atoms contact the surface; (ii) when excess liquid is wiped off the metal by rubbing with clean filter papers, a monolayer adsorbed film remains whose properties are identical with those obtained by evaporation; (iii) the electric surface image field of the adsorbed molecule is not sufficient to cause the observed values of \( \Delta V \), and the parameters involved include the lattice spacing and atomic volume of the metal. Values of \( \Delta V \) obtained were reproducible and characteristic for each compound and metal. Theoretical calculations of \( \Delta V \) in terms of the molecular polarization induced in the adsorbed liquid molecules by the electric field just outside of the surface of the metal agreed in order of magnitude with experimental data. As theory predicted, \( \Delta V \) for any compound increased linearly with the electric field intensity in the vicinity of the adsorbed molecules, or with the total energy necessary to extract a conduction electron from the metal.

Author

Separation of charged particles
CA 49-10772c

B-20. Bierman, A.

B-21. Bierman, A.

The Voigt shear theory is extended to nonidentical particles and shown to be in need of revision. This revision is carried through by introducing an interaction dependent \( \phi \). It is shown that attractive forces can arise between nonidentical plates at small distances. The conditions for this attraction and the range of these forces are calculated. It is shown that the range can be as large as a few hundred Angstroms.

Author

B-22. Bisa, B.
Spatial density of electrical charges in dispersion aerosols

CA 51-32355b
B-23. Biss, R.

"Stabilization of Aerosols by Means of Electrets."

B-24. Biss, R.


Die bei der Rasenktzung beobachtete, nicht so schnelle Ablösung der Korn, wie man in den Konzentrationswerten von Elektroaerosolen erwartet hat, ist auf die Abbindungen der Kornkörner durch Elektrostatik und den daraus resultierenden Widerstand zurückzuführen. Es gelingt es, die Ablösung der Kornkörner durch diese Vorgänge zu verhindern, indem man die Kornkörner in einer Suspension in einem elektrischen Feld befindet, in dem sie sich auf oder in einem tragenden Teil befinden.

Author

B-25. Blanchard, D. C.

419. ELECTRICALLY CHARGED DROPS FROM BUBBLES IN SEA WATER AND THEIR METEOROLOGICAL SIGNIFICANCE.
D. C. Blanchard.

A modification of Millikan's oil-drop experiment was used to determine the electric charge and radius of drops that were ejected from a burning bubble at an air-sea water interface. Charge measurements were made of both the natural and the induced charges. The induced charge was considerably higher, ranging 10^{-6} elementary units on drops of 50 µM radius. The sign of the natural charge in positive on drops of -< 4 µM. For larger drops both the magnitude and the sign of the charge appear to be a function of the depth of water through which the bubble rises. The meteorological significance of the fact that rain and snow, as well as whitecaps, can produce great numbers of small bubbles in the surface waters of the oceans and the laboratory and field work suggest that the majority of these bubbles produce positively charged drops that contribute to the atmospheric space-charge of significance is the fact that, for positive induction less than about 25 V/cm, a positive charge is found on the small drops. For induction greater than 25 V/cm the induced negative charge exceeds the natural positive charge and so the drops carry a net negative charge. Consequently, small bubbles breach at the surface of the sea in the presence of the earth's fast-wether positive field of about 1 V/cm will produce drops that carry a positive charge. Calculations based on measurements of the net space-charge produced by whitecaps indicate that the charge on the drops may, under winter conditions, provide a greater-current of the same order of magnitude as the fast-wether induction current. Thus the sea may be a source as well as a sink for the charge that maintains the earth's positive electrification.

PA-62-4149

B-26. Bodenstein, E.


Describes a method for measuring the quantity and sign of charge associated with different types of dust of various particle sizes. Statistical analysis shows that the danger of self-excited dust explosions is greatest with dust of small particle size.

PA-52-269

B-27. Boehme, D. D., and H. Rabenhorst


In German.

Both positive and negative charge accumulations were observed in crystals after a high current was passed through them. The dependence of this charge on the magnitude of the field and the frequency when a.c. fields were used (both in the dark and with weak illumination) and its independence of the nature of the crystals, materials, can all be explained on the basis of a non-homogeneous bulk conductivity which also gives rise to dielectric polarization after effects. It is argued that the conduction process for high fields cannot be explained in terms of space-charge limited currents initiated by electron injection from the cathode as stated by Riese and Seith (Abstr. 6446/1955).

PA-61-3498

B-29. Bogdanov, V. S.


CA-58-1077c

B-30. Boguslawski, E.

411. Surface Tension and Electric Charge. E. Boguslawski.

Comments are made on certain errors in the calculations and observations of Ruff, Niese, and Thomas on charged drops in electric fields. [See Abstracts 2116, 2116 and 2116 (1927).]

PA-31-411
B-31. Böhm, J.


B-32. Böning, P.


The appearance of free electric charges in matter in a finely divided state in gaseous states may be traced, according to many observations and the research arranged by the author himself, to two occurrences which have an underlying causal connection with the observed facts: these are collision and disintegration. Similar cases are found in the case of electricity developed by friction.

PA-31-410

B-33. Bouilloud, A.


In French.

An inversion is used on the equivalent system of two contiguous spheres and the charge carried by the sphere is calculated using inversion theory. The charge is deduced by considering the area of the forces due to the external field and the image-charges on the other sphere, which is equivalent to the plane.

PA-61-6933

B-34. Bourot, J. M.; R. Brun and B. Morillon


The electrostatic field of a number of metal dusts (Al, Fe-Mn, Mg, Si, Zn) has been measured in two different experiments. These results, together with the electrostatic properties of the ignition of dust clouds of metal powders, provide a basis for the estimation of the electrostatic hazards likely to be encountered in handling quantities of materials.

PA 63-10360

B-35. Boyce, A. R., and F. J. Llewellyn

10000 ACTION OF A UNIFORM ELECTROSTATIC FIELD UPON THE ORIENTATION OF ALUMINIUM FLAKES WHICH ARE SUSPENDED IN AIR.


In French.

A uniform electrostatic field of the order of 1000 V/cm can be applied to orientate aluminium flakes suspended in an air stream so as to command any flow orientation of the particles.

PA-53-7677

B-36. Brasefield, C. J.

ELECTRIFICATION OF CARBON BLACK BY CONTACT WITH A METAL SURFACE.


A measured quantity of carbon black was allowed to slide down a steep surface of nickel (presumably oxidised) which was electrically grounded and the charge acquired by the carbon black was determined. Blacks were selected whose oxygen content varied from 0.4 to 11.6 per cent. It was found that the black of low oxygen content acquired a large positive charge and the charge decreased with increasing oxygen content, becoming zero for 4 per cent oxygen and negative for larger oxygen contents. This appears to be the equivalent of an increase in the electron affinity of carbon black with increasing oxygen content of the black. When a positive charge was produced by a black of low oxygen content that tended to decrease, the black was heated to higher temperatures, presumably because of the increase in oxygen content of the black. The oxidation of certain blacks is not permanent if it reaches 500°C. The oxygen content at a particular temperature decreases with the first 20 sec at the temperature. The oxidized surface of carbon black which is resistant to its high electron affinity is not produced in prolonged exposure of a black to atmospheres of CO, CO2, or CaO. Cigarette smoke is usually negatively charged, but if the cigarette is heated to 200°C, the smoke is positively charged, as though the electron affinity of the tobacco had been increased by oxidation.

PA-63-19591


Measurements are reported of the charge observed on separating two surfaces in contact. The charge increases rapidly with a small separation. In the case of two metals in contact, the charge is proportional to the difference between the work functions of the surfaces. In the case of contact of a metal with a semiconductor, the charge depends also on the type-carrier concentration in the semiconductor and on its dielectric constant.

PA-61-3966


1487. Electrostatis Charge on Glass Floats in Very Dry Liquids. H. V. A. Briscoe, P. L. Robinson and H. G. Smith, (Phil. Mag. 2, pp. 63-84, Jan. 1917) — During a series of tests on CC14 and BC14 to determine the density and thermal expansion by observations of rotation temperatures of calibrated glass floats, it was noticed that the floats became positively charged, if the liquid were saturated. The charge was probably due to friction between the liquid and the glass. The tendency to acquire the charge and the time required to dissipate it increase with lapse of time, due probably to increased conductivity of the liquid. The effect was greater for CC14 than for BC14.

PA-30-1487
B-39. Browning, J.


Experimental methods presented in the literature may prove of value in combustion studies of both solid and liquid suspensions. Such suspensions include the common liquid spray. Uniform droplets can be produced by orool generators, spinning disks, vibrating capillary tubes, and other techniques. Chemical, physicochemical, optical, and electrical means are available for determination of droplet size and distribution. The size distribution, aggregation, and electrical properties of suspended particles are discussed as well as their flow and wetting characteristics. The study of continuous spray flows includes both analytical and experimental procedures. Rayleigh's work on liquid jet breakup is reviewed and its subsequent verification and limitations are shown.

Author

B-40. Bühl, A.

4476. Waterfall Effect and the Surface Structure of Liquids. A. Bühl. Kolloid Z., 59, pp. 346-352, June, 1932.—An atomizing apparatus is described for the study of the waterfall (electrically-atomized-water) effect. When various gases are used it is found that the gas atmosphere (e.g., with H2, CH4, N2, CO, air, O2) does not influence the main result and that atomization in vacuo gives an exceedingly strong electrical effect. The mobilities of the electrical carriers are found to vary over a wide range. The mobility of the water greatly affects the electrical yield, electrolytes entirely affecting the effect of some cases; experiments are recorded of the atomization of dilute solutions of the LiOH and KOH and of HCl, LiCl, NaCl and KCl. In the case of colloids, the degree of dispersivity of the sol is of profound influence. The investigation has been extended to other liquids, e.g., benzene, benzene, xylene, ethyl ether, acetone, methyl and ethyl alcohols and nitrobenzene, when it was found that only those with a dipole moment gave the waterfall effect. Pure mercury and also the liquid amalgams give a well-defined effect, in the case of the former positive carriers being first formed and later negative ones. A Bibliography completes the paper.

PA 35-4470

B-41. Bühl, A.


An experimental investigation was made of the electrical effects obtained with jets of water impinging on an insulated metal disc in an evacuated chamber. The first simple apparatus used only established the existence of negative carriers, but further experiments with an improved type of apparatus, using a very fine jet, showed the existence of both positive and negative carriers, the latter being apparently more numerous than the former. With higher vapour pressures, the ratio of negative to positive carriers is greater than at lower pressures. The results generally show that the breaking up into drops of a water jet in vacuum produces electrification which is connected with the withdrawal of electrical carriers from the water surface. The results are briefly discussed.

PA 33-1949

B-42. Bulgin, D.


The electrostatic charge which originates at the separation of the tyre tread from the road raises the potential of road vehicles to a maximum of 100 kV, the value depending on roughness of the road surface, vehicle speed and tyre tread resistance. The interconnection of these factors is given in the paper with both experimental and theoretically derived values of voltage. Harmful effects include shock from the vehicle, radio interference (small) and puncture of the inner tube due to ozone originating between the tube and the inner wall of the tyre. Elimination of these effects is obtained using tyres of electrical resistance of $<10^6$ ohm.

PA 57-3432

B-43. Bulgin, D.


A theoretical treatment is given of the factors governing the voltage attained by surfaces under stated conditions of separation and electrical resistance. The results are supported by observed values and indicate that the resistance of rubber articles (measured under conditions defined by British Standard Specifications for anti-static and conductive rubbers) should be between 100,000 ohm and 10 M ohm. It is considered that only "anti-static" (conductive) rubber and cotton surfaces should be permitted in operating theatres and that the relative humidity of the atmosphere should exceed 65%.

PA 57-3430

B-44. Burkhart, E.

3967. Production of High Potentials by Use of a Unipolar Charged Air Current. E. Burkhart. Ann. d. Physik., 33, 2 pp. 289-297, July, 1933.—The different methods available for the production of ions are reviewed. In the method used, a jet of water is forced by compressed air through an atomizer in the presence of a strong electric field. A charge density of 12 e.s.u. per c.c. was produced per sec. in a volume of 5 x 10^-6 c.c.; an insulated electrode supported in the jet acquired a potential of 420 kV. The stream of ions produces an intense glow in the air up to a distance of 60 cm. from the jet. The change in electrical mobility of the droplets due to evaporation and agglomeration was investigated together with the variation in electric field strength and the pressure distribution in the ion stream. The effect of the back electric field was examined and the efficiency of the apparatus was found to be about 1%. A potential of 420 kV was reached, the value being limited by the electrical properties of air, which was the surrounding medium. By the use of two jets, two streams of ions of opposite sign may be obtained and a potential of double the previous value may be produced.

PA 38-3967
B-45. Burton, E. F., and W. B. Wiegand

"Effect of Electricity in Streams of Water Drops."
Phil. Mag. 23, 148-165 (1912).

B-46. Busch, H.

1922. The Potential Gradient in the Vicinity of a Thin Wire. H. Busch. (Zeits. f. Physik, 26, 2. pp. 185-192, 1922.)—This investigation has been undertaken to correct the erroneous view that in a cylinder condenser, whose inner conductor consists of a very thin wire, almost the entire potential decline takes place in the immediate neighbourhood of the wire. The paper is a criticism of a previous paper by Güntherschulte [see Abstract 337 (1926)], and an explanation of the Katsch observations [see Abstract 314 (1925)].

B-47. Bush, H. J.


B-48. Busse, W.

1902. Waterfall Electric Carrier-formation with Pur. Water and Salt Solutions. Their Surface Conditions. W. Busse. (Ann. d. Physik, 78. 2. pp. 453-333, April, 1925.)—After a short introduction the subject is dealt with as follows: Size distribution of negative and positive carriers generated by scattering distilled water; deciding the question whether groups of carrier-sizes are present; consideration of the travelling velocity formula; the origin of positive carriers in pure water; size and quantity of positive carriers generated by scattering in dependence on pressure; the positive carrier formation with bubbling action; carriers generated by solutions of common salt; the sign of the charge with carriers containing sodium; size of carriers and quantity of electricity developed in dependence upon the concentration; the surface conditions of salt solutions.

B-49. Butler, J. A. V. (ed)

C-1. Cade, R.

25444 SURFACE TENSION AS A DOUBLE-LAYER PHENOMENON.
R.Cade.
On the basis of classical theory of intermolecular forces as previously assumed by the author, it is shown that surface tension is, at least in part, accounted for in terms of the charge of excess water which occurs at a liquid boundary when there is a double layer. The conclusion is drawn from a formula identifying surface tension with a functional of the double-layer field. This formula, taken in conjunction with measured values of the surface tension, could have application to the study of double layers.
PA-66-23854

C-2. Chalilande, R.

L'analyse des aerosols se propose de depouvrir les particules en suspension dans l'air ou dans les gaz sur des supports convenables pour faciliter leur observation. L'analyse electromagnetique, haute sur les proprietes de l'effet couronne observe, et en plus sur un champ magnetique, les memes de charge sont differentes selon qu'elles et du cadre de la taille est inferieure ou superieure ou des particules microscopiques. L'apareil fonctionne convenablement dans des atmospheres assez pures (echappement des moteurs a explosion) ou tres pures en poussieres (fiergesee).
Author

C-3. Chalilande, R.

2972. CONDUCTION OF MICRONIC AND SUB-MICRONIC SPHERICAL CONDUCTING PARTICLES IN AN INTENSE IONIZING ELECTRIC FIELD. R.Chalilande.
In French.
A comprehensive treatment of the subject ranging from methods of production of particles, methods of detection, acquisition of charges, theory of precipitation in an electric field, discussion of experimental techniques and investigation in some applications of the phenomena to industrial processes. 80 refs. 6 pp. of plates.
PA-59 2073

C-4. Chalmers, J. A.


C-5. Chalmers, J. A.

1953. Electric charges from ice friction. J. A.
Experiments are described showing that, when ice is rubbed, the large fragments carry a negative charge, in agreement with the theory of Bumpson and Scrase for thunderstorm electrification. The present experiments extend the results of Pearce and Currie since they show charge separation even in the absence of air blast.
PA-57-11023

C-6. Chalmers, J. A.

Electricity of cloud and rain. CHALMERS, J. A.
Nature, Lond., 169, pp. 659-661, June 13, 1942.—The author discusses the electrical phenomena associated with continuous rain, as distinct from rain deposited by thunderclouds [see Abstr. 2006 (1942)]. The problem is to find a mechanism which will produce positively charged rain and a negative potential gradient. The ice-friction process of charge separation will give a negative potential gradient in which falling raindrops can acquire a positive charge by Wilson's influence mechanism. Observations of snowfall support this view, but are irreconcilable with Eiffel Tower observations of potential gradient. A series of experiments is suggested for investigating the apparent anomaly.
PA-45-2501

C-7. Chapman, S.


C-8. Chapman, S.

Mechanism of charge production in thunderclouds. CHAPMAN, S. Amer. Phys. Soc. (Proc., July, 1965). Abstr. in Phys. Rev., 68, 103 (Aug. 1 and 15, 1945).—Measurements of spray electrification showed negative and positive charges in the air in nearly equal numbers, negative predominating, but the charge ratio varied markedly with spraying or bubbling procedure. If the charge ratio approaches unity by the breaking drop mechanism of thunderclouds, another order of magnitude of charge is available. Thus the breaking drops may provide the required charges of both signs in the air, which may be separated by the Wilson mechanism in non-turbulent regions of the cloud, yielding, as observed, a positive cloud top and negative cloud bottom, except for a localized volume in the updraft region containing positive charge on the breaking drops.
PA-49-322

C-9. Chapman, S.

C-10. Chapman, S.

"Carrier Mobility Spectra of Spray-Electrified Liquids." S. Chapman, Phys. Rev. 65, pp. 184-186, June 1, 1937. — The mobility spectrum of spray-electrified salt solutions was investigated with an Ericksen mobility tube under conditions of high resolving power. In general there are no charged carriers of mobility greater than 1 cm/sec per volt/cm. Then the curves rise sharply, level off, and approach a broad maximum in the region between 0.05 and 0.10 cm/sec per volt/cm, and then very gradually decrease toward zero. Superposed on this background striking peaks are observed indicating groups of unique mobility. With sprayed distilled water the most prominent peaks occur at mobilities of 1-5 for the negatives and 0-9 for the positives. Carriers of both signs occur in about equal quantities. With salts in the water the electrification increases up to a concentration of about 1 x 10^4 N. It is then about double that for distilled water but at higher concentration it decreases. The salt solutions very strong peaks at mobility 0-8. It is concluded that the peaks represent stable groupings.

PA-40-4698

C-11. Chapman, S.

3413. Charges on Drops due to Electrification. S. Chapman, Physics, 6, pp. 100-102, June 1, 1934. — The Millikan oil-drop method was modified and applied to a study of the effect of drop size as related to charge in ammonia (a medicinally hydrocarbon, chiefly octane), nitrobenzene, acetic acid, and water. There is no preference for either sign of charge. The larger drops of both signs of charge have the larger charges, and the charge varies roughly in a linear fashion with drop-size except in the case of ammonia. There is a rough parallelism between dielectric constant and charge magnitude for drops of approximately the same size. Although there appears to be no correlation with viscosity, a parallelism between drop-size and surface tension exists which is, however, difficult to differentiate from the parallelism between drop-size and dielectric constant. The phenomena involved here, with slow drops differing radically from those observed (see Abstract 1460 (1818) with falling spray.

PA-37-3413


5445 THE MECHANISM OF PARTIAL COALESCENCE OF LIQUID DROPS AT LIQUID-LIQUID INTERFACES.

G.E. Charles and S.G. Mason.

J. Colloid Sci., Vol. 15, No. 2, 109-122 (April, 1960). — The mechanism of formation of a secondary drop from the coalescence of a liquid drop from a liquid-liquid interface was investigated. It was shown by means of high-speed photographs that partial coalescence results from the formation of a liquid column of Phase 1 in Phase 2 which contracts at the base and detaches itself to form the secondary drop. The diameter ratio, secondary to primary, varied with the viscosity ratio \( \eta_2/\eta_1 \) and passed through a maximum near \( \eta_2/\eta_1 \). When \( \eta_2 < \eta_1 \), or greater than 1, no secondary drops formed. Secondary drops could be suppressed by adding a high concentration of surfactant or by applying an electrostatic field. The experimental results were analyzed with reasonable success with the aid of Rayleigh's theorem of unstable liquid drops.

PA-63-8645

C-13. Chaussidon, J.


CA-53-16648b

C-14. Chih-En, G.

A note on the charge produced by spraying liquids with a jet of air. Com. Ph. Phil. Mag., 36, pp. 219-221, March, 1945. — The charge is calculated on the assumption that it arises from the change in surface tension produced when a drop, of radius \( R \), breaks up into a large number of smaller drops. If the charge on each small drop is \( \sigma \) it is shown that \( \sigma \approx R^2 \).

PA-48-3013

C-15. Childs, E. C.

Space charge in the Gouy layer between two plane, parallel nonconductive particles. E. C. Childs (Univ. Cambridge, Eng.). Trans. Faraday Soc. 50, 1309-1312 (1954). — The relation between the space charge and the particle charge was derived for plane parallel surfaces, such as many clay minerals, that are nonconducting and in which the charge distribution was constant and symmetrical about a median plane. The calculation of the potential distribution and repulsive pressure between the plates, by assuming that the Gouy layer charge was equal to the surface charge, was attended by negligible error. The Gouy layer and the charged particle on which it formed was a system in equilibrium, whatever the particle went, the Gouy layer accompanied it. The interaction between the charged surface and the ions in the layer produced mutual attraction between surface and layer, osmotic pressure variations in the layer, and accompanying hydrostatic pressure variations. None of these contributed any net force tending to translate the particle and its accompanying layer through the solid.

CA-49-10007c

C-16. Church, F. W., and F. R. Ingram

C-17. Ciborowski, J., A. Wlodarski
Abstract. The classical theory of fluidization does not take into consideration the possibility of the occurrence, in fluidized beds, of electrical forces conditioned by static electricity. The electric charges which accumulate on solid particles cannot...

C-18. Clark, J. F.
"Fair-weather Atmospheric Electric Potential and its
Gradient," on pp. 61-73, "Recent Advances in Atmo-
spheric Electricity, Proc. 2nd Conf. on Atom Elect.,
Portsmouth, New Hampshire (May 20-23, 1958)." Pergamon

C-19. Cochet, R.
1946. CHARGE OF SUBMICRON PARTICLES IN EMBEDDED
ELECTRIC FIELD. MEASUREMENT OF THE SPEED
OF PRECIPITATION OF THESE PARTICLES IN A UNIFORM
ELECTRIC FIELD. R. Cochet.
In French.
Experimental verification of a previously described theory
(Abstr. 1945 of 1947). An aerosol with particle sizes between 0.01
and 0.05 μ was extracted in an electric field across an ion beam.
The precipitated droplets were measured with an electron micro-
scope. In the early stages of precipitation large and small particles
(0.1 μ and 0.05 μ) were formed. The end of the precipitation pattern
showed only particles of the order of 0.1 μ. For electric fields
between 1800 and 8000 V/cm, the mean free path of the ions was
Lp ≈ 1/2.
PA-63-10361

C-20. Cochet, R.
1965. THEORY OF THE CHANGE OF SUBMICRONIC
PARTICLES IN EMBEDDED ELECTRIC FIELD. SPEED OF
PRECIPITATION OF SUCH PARTICLES. R. Cochet.
In French.
The classical law of charge for microscopc particles is
corrected to permit its application to submicronic particles.
Estimated of precipitation rates based on this law are com-
pared with those of Pothenier (Abstr. 821, 1954/55) and
PA-60-1265

C-21. Cochet, R.
7756. Evaporation of a charged water drop in a cloud
above 6°C. R. COCHET. Ann. Geophys., 8, 33-54
(No. 1, 1952). In French.
Various methods are examined to determine by
calculation and graphically the coefficient of growth
of an electrified water drop and next the growth of the drop
in a fog. The general theory was verified experimentally
in the particular case of cylinders, the trajectories of fog drops being photographed in the
proximity of a charged cylindrical conductor. In
the sending of neutral clouds with water drops,
electrically charged artificially or naturally, calculation showed
that (1) the small electrified water drops increase in
diameter rapidly in a short distance; (2) the electrifica-
tion of water drops can in general act efficiently only
on the initial stage which should start the precipita-
tion. A drop of diameter 30 μ carrying a charge of
4 × 10^-10 e.s.u. gives the same result as an uncharged
drop of diameter 120 μ. For success in seeding the
cloud must be of sufficient depth, possess an ascending
current and be saturated and holding enough moisture
to saturate layers below the cloud.
PA-55-7756

C-22. Cochet, R.
1922. Capture of uncharged particles by an electrified
4, 153-80 (June, 1922). In French.
Sci., 3, (No. 15) 337-42 (1951) and Abstr. 7756 (1952).
Further studies of losses in high voltage d.c. lines
through fog. The general equation for the behaviour
of a particle in the neighbourhood of a charged
obstacle is derived. Graphical methods are then
employed to trace the trajectories of fog droplets in the
vicinity of charge cylinders. From these curves
the coefficients of capture of droplets are deduced
for the obstacles. The form of the trajectories in the
neighbourhood of a h.v. conductor has been verified
experimentally for stationary air conditions. The
minimum quantity of water required to form drops
on a smooth conductor capable of emitting ions has
been determined and an estimate of the current loss
can be made. The evolution of an electrified water drop in a cloud above 6°C is also studied and it is
shown that small charged drops can grow rapidly
while falling a short distance.
PA-57-1922

C-23. Coehn, A., and E. Duhme
2826. Contact Electricity. A. Coehn and E. Duhme. (Zeits. f.
Physik, 27, 5-6, pp. 358-383, 1924.)—The charge on the bubbling of
gases through liquid metal is independent of the nature of the gas.
The only function of the gas is to break up the double layer always existing
within the surface of the liquid and to carry charges with it. With non-
nmetallic liquids the bubbling gas carries off negative charges; with pure
mercury, positive, positive ions being allowed to escape with the gas and
electrons retained. The sign of the escaping charge is reversed by the
addition of traces of certain metals to the mercury, and its quantity
greatly increased. The noble metals (Sn, Cu, Ag, Au) do not produce
this effect.
PA-27-2820
C-24. Coolidge, J. E., and G. Shultz


- Attention is drawn to earlier work (Whittam, Phys. Rev., 28, 1234 (1926)) which is in agreement. Kindly give added explanation.
PA-04-2056

C-25. Cooper, W. F.


The electrification of electrolyte by flow in pipes can be explained in terms of the Helmholtz electrical double layer, and it is suggested that some sort of double layer is also produced in commercial grades of organic liquids, such as petroleum, by impurities.

- The charge produced is expressed in terms of the electrokinetic potential and the Reynolds number. With an immersed discharge electrification will not be observed unless the resistivity exceeds about $10^9$ ohm cm. It is pointed out that the theory is closely associated with hydrodynamics and that, as experimental work is available is constant with the theory set out. The electrification of droplets, spray and wet steam is also discussed briefly.
PA-57-3419

C-26 Cooper, W. F.


Deals with experimental procedure and methods of calculation. An attempt is made to provide a basis for the quantitative study of electrostatic hazards met in industry and attention is drawn to several important details frequently overlooked. It is shown that a material cannot retain a bulk charge unless its resistivity exceeds about $10^8$ ohm cm and that vessels will not retain significantly charged unless they are very highly insulated. The degree varies greatly on the relative humidity of the air, and for this reason experimental work and measurements may present considerable difficulties in Britain. Problems of static electrification can be used coarsely by a generalization of Maxwell's coefficients; examples are given, including a discussion of the interpretation of the implications of certain instruments, and the surface potential of a charged liquid in an earthed container—such as a bowl or a storage tank. The notation is suitable for further electrostatics problems as well as those considered.
PA-57-3434

C-27. Cooperman, P.

3402. DUST SPACE CHARGE IN ELECTRICAL PRECIPITATION. P. Cooperman.


The problem under consideration is that of calculating the effective electric field on a charged particle in a cloud of dust particles. The major result is as follows: (1) the dust precipitators are twice as effective as the presence of charged particles as pipe precipitators of the same interelectrode spacing; and (2) the interelectrode spacing is the only geometric factor entering into the calculation. These results extend earlier work on pipe to dust precipitators.
PA-66-24202

C-28. Corn, M.


C-29. Couvertier, P.

652. ELECTROSTATIC PHENOMENA RESULTING FROM 1962. THE PRESENCE OF SOLID PARTICLES IN AERODYNAMIC FLOWS. P. Couvertier.

C.R. Acad. Sci. (France), Vol. 252, No. 12, 1726-7 (March 10, 1961).

In French.

Describes observations that the solid particles (e.g. talcum or aluminium powder) used for dust visualization in aerodynamics can become electrically charged in the course of their motion, causing solids placed in the flow to be polarized. A description of how this phenomenon may be used as an electrostatic generator is given, though the figures quoted indicate the process to be singularly inefficient. Thus upon a brass sphere of diameter 1 cm was placed in such a flow (of Mach number 0.5), a galvanometer between the sphere and earth indicated a mean current of 20 µA.
PA-64-5922

C-30. Crain, C. M.; D. C. Thorn, and J. E. Boggs

3844. THE DIELECTRIC CONSTANT OF SOLID PARTICLES. PA-60-7841

C. Crain, D. C. Thorn and J. E. Boggs.


The dielectric constants of aerosols consisting of polyethylene, silver iodide or iron powder suspended in dry nitrogen, or oil mists suspended in air have been measured at a frequency of 9400 MHz. The results are fitted well by simple expression, in spite of the complexity and wide diversity of the systems studied. The observed data were well fitted by the equation even in cases where magnetic as well as electric interactions would be expected.
C-31. Cree, K. H.

C-32. Crosby, E. J.

C-33. Cross, A. S.
Two electrostatic field-meters are described, one operating from a.c. mains and the other from dry batteries. An alternating potential proportional to the field is generated by the measuring head, amplified, and fed to a phase-sensitive rectifier. The mains-operated instrument gives, at full sensitivity, an output current of 1 mA for a field of about 400 V/m; the direction of the current depending upon the sign of the field. Its sensitivity can be adjusted over a range of 90:1; at maximum sensitivity the zero drift is no more than 2% of the full-scale reading in 15 hr. The battery-operated instrument, which is truly portable, has two fixed ranges giving full-scale current for fields of 5 and 30 kV/m; its sensitivity is hardly affected by normal changes in battery voltages.
PA-57-3415

C-34. Czyzak, S. J., and D. T. Williams
The change in potential of a polyethylene sheet which has previously been charged, is measured when sprays of various liquids and powders are deposited. No change in potential occurs in the case of water, carbon tetrachloride and glycerine sprays, but with aceton, charcoal, starch and a 1:1 mixture of charcoal and starch an exponential decay of potential is observed, the rate of decay being dependent on the material used and (in the case of charcoal) on the density of the spray.
PA-54-9436
D-1. Dakin, T. W., and Berg, D.

D-2. Dallavalle, J. W.


Aggregation of the individual particles composing an aerosol is a phenomenon of primary importance in the engineering of the aerosol. The influence of electrification and foreign vapors on the aggregation process has been investigated. Results indicate that electrification amounting to a few electron charges per particle has little effect on the rate of aggregation, but has a decided influence on the shapes of the aggregates. In the case of aerosols whose particles have significant vapour pressure, certain substances which lower this vapour pressure have been found to increase the rate of aggregation, presumably by reducing the vapour cushion surrounding the particles. When the particles are readily soluble in a substance whose vapour is present, the rate of aggregation also appears to be increased because of reduction of the vapour layer about the particles.

PA-58-1284

D-4. Daniel, J. H., and F. S. Brackett

A theoretical and experimental analysis of the current-voltage (d.c.) characteristic of a parallel-plate condenser through which the small, air-borne, charged particles of an aerosol are passed. Current studies show that a charge-weighted distribution of radius (or radius squared)-charge ratio may be obtained when certain experimental conditions are satisfied. Examination of such a distribution for an aerosol (particles ranging from 1 to 200 microns in diameter) shows that the mass of particles in the distribution that are sufficient to collect in the condenser are also the classes that disappear most rapidly in the chamber. It is pointed out that the methods employed would become less tedious and more powerful when used with a dispersion of constant-size particles, and that they are well adapted for certain fundamental investigations of aerosol properties.

PA 54-8875

D-5. Dautrebande, L.
MICROAEROSOLS

PHYSIOLOGY, PHARMACOLOGY, THERAPEUTICS

By Lucien Dautrebande, The Royal Academy of Medicine, Belgium
1962, 560 pp., illus., 813, 30

CONTENTS:

PART I

PART II
D-6. Davies, C. N.

D-7. Davies, C. N.

D-8. Davy, M.

The first two problems are solved by the Schwarz-Christoffel transformation, the following results being found:
1. The transformation is a function of a complex variable, which is a solution of a certain differential equation.
2. The field is a function of the complex variable, which is a solution of a certain differential equation.
3. The charge density is a function of the complex variable, which is a solution of a certain differential equation.
4. The electric potential is a function of the complex variable, which is a solution of a certain differential equation.

The solutions of these problems are given in the accompanying figures.


The results show that the electric potential produced on contact of quartz and of sodium chloride on nickel in atmospheres of air, oxygen, and nitrogen has been measured. Reproducible pressure-dependent results were obtained that indicate the contact electrification is a surface phenomenon and depends greatly on the nature of the surfaces involved. At least two layers of adsorbed gas play an important part in the phenomenon of contact electrification. In the pressure range from 0 to 300 mm at least one layer of adsorbed gas is removed. In this pressure range the surface covered with adsorbed gas makes the major contribution to the charge separation. At pressures below 0.1 mm at least a second layer of adsorbed gas is removed. In this pressure range the major contribution to the charge separation is made by the surface from which the second layer of gas has been removed. A Si of the data to Langmuir adsorption isotherms was obtained. Water vapor and perhaps hydrogen act as surface poisons in the phenomenon of contact electrification.

D-10. Deodhar, G. B.
2354. Electricity of Dust Clouds. Part I. G. B. Deodhar. (Phys. Soc., Proc. 35, pp. 243-248, Disc., 248-249, April, 1927.)—Observations have been made qualitatively on a considerable number of dusts by blowing a large volume of air at high speed over them and measuring the resulting charge. The results agree with those of Rudge in some cases only. The electrification produced is fractional in character. From quantitative tests NaN₂ is found to be more effective than KNO₃ and better than KCl and NaCl. Tests on graded dusts of different sizes show that, other things being equal, the voltage developed by blowing increases very rapidly as the size decreases. The results are to be extended. The bearing of these facts on the electrification of dust clouds and dust storms is dealt with. In the discussion, P. E. Shaw stated that the factor of humidity affects the result obtained and that the charge measured is a net one due to charges on the particle and on the ionised air. (Electr. Eng. 12, 296, 1927.)

D-11. Deodhar, G. B.
2424. Anomalies in Frictional Electricity. G. B. Deodhar. (Indian Assoc. for Cultivation of Science, Proc. 9, pp. 210-214, June, 1928.)—Anomalous frictional effects have been known since the time of Faraday. Rankine's observation about rough and smooth ebonite rods appears to depart from accuracy when the rubbing is prolonged; the ebonite pieces show reversals of sign. A few more substances are observed; of these india-rubber of red and grey varieties show similar reversals. From the considerable rise in temperature of the rubbing substance, Jones's observation about definite relationship between the potential and the temperature of the substance, it appears that thermodynamics play a considerable part in frictional electricity. Reversals in ebonite and rubber may be due to the non-homogeneous nature of these substances.

PA-48-3008

PA-30-2354

PA-29-2424
D-12. Deryagin, B. V.

Deryagin, B. V.
AEROSOLS (SMOKE AND MISTS) (Aerозоли (Dymy и Tusня)). 11 Aug 61 [36p. 12 refs. JPRS 9883.
Order from OTS or SLA $4.00 61-27669

Trans. of Vsesoyunno Obshchestvo po Raspro-
raznoznyi Politekhnicheskii i Nauchnyiz Znanii. Seriya 9

DESCRIPTORS: "Aerosols, Smokes, Particles, Condensation, Decomposition, Drops, Electrical
properties, Pest Control, Insecticides, Sprays, Drugs, Antibiotics, Artificial precipitation, Precipitatorino,
Air, Purification, Warfare, Coatings.

Contents:
What is an aerosol?
The study of aerosols
The formation of air-dispersed systems
Decomposition of aerosols
Ala for the incinerator
T8-453


Deryagin, B. V. and Dukhin, S. S.
MOTOR OF AEROSOL PARTICLES IN A DIFFU-
SION FIELD (О Диффузии Аэрозольных частиц в
Order from LC or SLA mi32 40, p63 30 61-15731

Trans. of Akademii Nauk SSSR. Doklady. 1956.
50, no. 5. p. 851-854.
The forces acting on a drop in a homogeneous field are
studied to clarify droplet behavior near surfaces at
which evaporation or condensation occurs. A first
approximation of a theory is mathematically derived.
The mechanism of interaction caused by diffusion
forces between uniform aerosol particles in which
condensation affects aerosol conduction is con-
connected with diffusion polarization of the particles.
T5-516

D-14. Deryagin, B. V. (ed.)

23498 RESEARCH IN SURFACE FORCES.
Edited by B.V.Deryagin.
New York: Consultants Bureau (1960) 190 pp. An authorized
translation from the Russian.
The 28 papers in this collection were first presented at the
Conference on Surface Forces, convened at the Institute of Physical
Chemistry of the Academy of Sciences, USSR, Moscow, in April,
1960. The collection was published in Russian in 1961 by the USSR
Academy of Sciences Press, in Moscow, under the title
"Issledovaniya v oblasti poverkhnostných sil" (Research in the Field
of Surface Forces). Abstracts of some of the papers will appear in
subsequent issues of Physics Abstract.
PA-66-23498


"Electrical Phenomena Accompanying the Formation of
New Surfaces, and their Role in Adhesion and Cohesion,"
in Second International Congress of Surface Activity
III—Electrical Phenomena, Butterworths, London
(1957).

D-16. Deutsch, W.

"Ist die Wirkung der elektrischen Gasreinigung dem
elektrischen Wind zu Verdanken?", Ann. Physik (5),
5, 249-264 (1931).

D-17. Deutsch, W.

2946. Charging of Particles Suspended in the Corona Dis-
Polenical gegen Schweitzer [see Abstract 2573 (1930)].
PA-33-2911

D-18. Deutsch, W.

Physik, 76, 7 pp. 729-736, May, 1925)—The point discharge and the
spectrum of the rays emitted have lately been the subject of investigation
[see Abstract 1596 (1925)]. In the present paper the sharp imprint of the
outer edges of the dust figure is seen in the radial diminution of the wind
velocity in conjunction with the electric field of force at the ground surface
of the point current. It is shown that, with higher tensions, not only the
point itself, but also the surrounding part of the point have an essential
share in the discharge, which is the cause of the dust being deposited in
several ring-formed layers. The paper is illustrated with diagrams and
photographs.
PA-28-1709

D-19. Deutsch, W.

"Bewegung und Ladung der Elektrizitätsträger im
Zylinder Kondensator," Ann. Physik (4), 68,
333-339 (1922).
D-20. Dingee, J. E.


A review of the work on the contact potential and its effects, the charging or discharging of a conductor by contact with a charged insulator is described. In general, a conductor is partially discharged by the contact with a charged insulator.

D-21. Dodd, E. E.


The erosion of liquid spray and dust collection by the Hopper and Laby method is investigated. The erosion occurs by the formation of a continuous stream of droplets, which are collected on the collector plate. The erosion rate is a function of the droplet size and the velocity of the gas stream.

D-22. Dougherty, T. J., and I. M. Krieger


The potential around a charged colloidal sphere is calculated using the method of images. The results are presented in the form of graphs showing the potential as a function of the distance from the sphere.

D-23. Doyle, A., Mowatt, D. R., Vonnegut, B.


Quantitative observations have been carried out on the behavior of evaporating charged droplets, 20 to 200 microns in diameter, while they are electrically supported in an electric field between two horizontal metal plates. As the droplet temperature increases, the electric charge density on its surface increases to values that produce potential gradients of several hundreds of kilovolts per meter, until finally one or more small highly charged droplets are ejected and the suspended droplet thereby loses about 30% of its charge. The phenomenon is explained by Rayleigh's criteria for charged droplet stability within the accuracy of the observations.


D-25. Drizin, V. G.


The dispersibility of a series of liquids at a high electric potential was investigated experimentally and theoretically. The results suggest that the dispersibility of a liquid is a function of the electrical properties of the liquid.

D-26. Drizin, V. G., and V. K. LaMorr

543. THE DETERMINATION OF THE PARTICLE SIZE DISTRIBUTION OF AEROSOLS BY PREPARATION OF CHARGED PARTICLES. V.G.Drizin and V.K.LaMor.

The method is based on the measurement of the macroscopic properties of a large number of charged particles. The electric current carried by a large number (-10^7) of particles charged in a normal discharge and precipitated in an electric field, when measured as a function of the particle diameter, is one such property. The number of charged particles is a single-valued function of particle size. From a knowledge of a function and measured values of current (or accumulated charge) versus time, the size distribution curve can be determined. The entire procedure, including the necessary calculation, takes about 10 min and requires relatively inexpensive equipment. All experiments were carried out with particles in the submicron range, the most efficient and at present the most important range.

PA-52-1891

PA-56-9433

PA-56-9434

PA-58-7479

PA-62-5230
D-27. Dubois, J.  
MEASUREMENT OF THE ELECTRIC CHARGE ON WATER AND SALT-SOLUTION DROPLETS DURING EVAPORATION AND CONDENSATION. J. Dubois.  
French.  
Describes work on electric charges on water and salt solution droplets during evaporation and condensation. The results are presented graphically and the theoretical and experimental results are compared.  
PA 67-5539

ELECTRICAL FIELD OF A MOVING DROPLET. I. THE THEORY OF THE ELECTRICAL FIELD OF A DROPLET CONTAINING AN IONIC CONDUCTING SURFACE-ACTIVE COMPOUND. I.  
J. Dukhin, S. S. and Deryagin, B. V.  
Russian.  
This article discusses the electrical field of a droplet containing an ionic conducting surfactant. The theoretical and experimental results are presented.  
PA 8-14086

D-29. Dukhin, S. S. et al.  
A new procedure for measuring the electric charge on aerosol particles is described, based on determination of the size of particles from a laminar flow. The procedure is suitable for aerosols with a particle size of 0.1 to 0.5 microns.  
PA 66-16996

D-30. Dunkski, V. F., and A. F. Funkov  
ELECTROSTATIC SPRAYING (Elektrostatische Sprayen).  
V. F. Dunkski and A. F. Funkov.  
Russian.  
This article discusses the electrostatic spraying of solutions and its applications. Theoretical and experimental results are presented.  
PA 67-5539

D-31. Dunkski, V. F., and A. V. Kitaev  
Precipitation of a Lipid Charged Aerosol in a Cylindrical Chamber.  
V. F. Dunkski and A. V. Kitaev.  
Russian.  
This article discusses the precipitation of a lipid charged aerosol in a cylindrical chamber. The theoretical and experimental results are presented.  
PA 7-5539

D-32. Dunkski, V. F., and A. V. Kitaev  
ELECTROSTATIC SPRAYING (Elektrostatische Sprayen).  
V. F. Dunkski and A. V. Kitaev.  
Russian.  
This article discusses the electrostatic spraying of solutions and its applications. Theoretical and experimental results are presented.  
PA 67-5539

D-33. Dunkski, V. F., and N. S. Shirkov  
14086 CONCERNING THE INFLUENCE OF IONIZING RADIATION ON THE DISPERSION OF AEROSOLS.  
V. F. Dunkski and N. S. Shirkov.  
Russian.  
This article discusses the influence of ionizing radiation on the dispersion of aerosols. Theoretical and experimental results are presented.  
PA 67-5539

D-34. Durand, E.  
16996 POTENTIAL OF A UNIFORM DISTRIBUTION OF CHARGE ON AN INFINITE PLANE.  
E. Durand.  
French.  
This article discusses the potential of a uniform distribution of charge on an infinite plane. Theoretical results are presented.  
PA 66-16996

D-35. Durand, E.  
4376 POTENTIAL OF A UNIFORM CHARGED DISK.  
E. Durand.  
French.  
This article discusses the potential of a uniform charged disk. Theoretical results are presented.  
PA 67-5539
INVESTIGATION ON VERY HIGH VOLTAGE
GENERATORS USING A STREAM OF ELECTRIFIED
PARTICLES UNDER INTERNAL PRESSURE. CONSTRUCTION OF
A PROTOTYPE UNDER 10 kg/cm². Trophas-Feuz Donoghue.

The usual types of high voltage generators are considered and
their shortcomings pointed out. A generator has been designed in
which the charge is carried on non-conducting particles which are
circulated by means of a blower. The particles are of glass of a few
microns diameter. The theory of the generator is given and the
construction and performance of a prototype is described. It is
found that the output current is proportional to the internal pressure
and so is the collector potential. Thus raising the pressure
increases both the power output and the efficiency of the generator.
The experimental results agree well with the theory.

PA-85-19882
E-1. Earhart, R. F.


E-2. Ehrenhaft, F.

531. Mobility of Small Spheres in a gas, and their Electrical Charges.

F. Ehrenhaft. (Zeits. f. Physik. 39. 1924. pp. 603-606, 1924.)—The constants of the law of resistance, as found by various observers for liquid and solid particles of radius greater than 10^{-6} cm., are collected. The mobility of all such particles is expressed in terms of the viscosity of the gas, the radius of the particle and the length of its mean free path. The charges on particles of smaller capacity than 2 \times 10^{-4} cm. are smaller than the quantum of electricity, being in some cases only half as great as the latter. [Abstracts 1920 (1925) and 2497 (1926).] PA-30-531

E-3. Einhörner, E.

234b. GENERALIZED EQUATIONS FOR THE KINETICS OF SOLID PARTICLES. E. Einhörner.


A generalized formula is derived for the interaction of spherical solid particles of submicroscopic size by allowing for multiple interaction. A system of simultaneous equilibrium equations is set up concerning successive states of orientation. The solution yields a generalized formula that reduces to the Sack equation when only single orientation can occur. When the particles are multiply sized, the equation can be simplified by the method of stopped descents,

\[ n_i / n_0 = (1 + i^2 / \pi) \frac{3}{4} / (i^2 / \pi - i^2 / 2) \]

where \( n_i \) is the electron concentration, \( n_0 \) is the number density of solid particles, \( r \) their radius and \( i = (n_0 - n_0^0) / n_0 \).

This equation is applied to the observations of Winter and Winter on the orientation of free carbon particles produced in high-temperature cops. Their data is consistent with a rough function of \( r = 6.80 \text{ in} \), identical with that of graphite, and particle radii between 15 and 50 A. PA-50-5436

E-4. English, W. N.


Studies of a water drop in a point-to-plane gap have yielded important results. Such a point has a very low secondary electron emission coefficient, and for the first time a large difference in positive and negative interelectrode space potentials in air, due to this, has been observed. The luminosity obtained with a negative drop point and the complex cathode-gas phase on both polarities have been accounted for by considering positive corona from charged droplets leaving the water point and assuming that true negative corona from a water surface is impossible. The space charge weakening of the field about a positive point, long assumed to explain the disappearance of the pre-crown streamers, is here confirmed by the reappearance of a stable drop point well above the initial potential required for disruption of the water surface.

Author

E-5. Eraldi, N., and A. Martinetti

ARRANGEMENT FOR ELIMINATING ELECTROSTATIC CHARGES FROM ANY MATERIAL CHARGED THEREWITH, PARTICULARLY BUT NOT EXCLUSIVELY SUITABLE FOR DISCHARGING STATIC ELECTRICITY ACCUMULATED IN YARNS OF TEXTILE FIBERS AND IN FABRICS. US. Pat. 3,214,815.

Order from O.P. or S.A. $1.10

Trans. of Italian patent 450,020, cl. 19, appl. 17 Dec. 48, granted 7 July 49, printed July 50.


The arrangement is characterized in that the material, which enters between drawing elements connected to a high voltage direct current source and insulated electrically from the rest of the machine, passes between plates that are interconnected electrically and equipped with points of suitable length inclined in the direction opposite to the (direction of) movement, and leaves at the other side.

PA-60-337

E-6. Ernserger, F. M.

237. MECHANISM OF FRICTIONAL ELECTRIFICATION OF DIELECTRIC LIQUIDS. F. M. Ernserger.


A new theory is proposed, based on the results of some experiments on the electrification of hydrocarbon fuels. It is suggested that a layer of chemically-adsorbed, electrolytically-neutral molecule exists at the interface between solid and liquid. The adsorption is assumed to be as work that thermal activation at ordinary temperatures is adequate for maintaining dynamic equilibrium between adsorption and desorption. To account for charge separation it is proposed that some of the desorptions are anomalous, that a molecule may desorb with either an excess or deficit of electrons. About one in \( 10^{15} \) desorptions need be anomalous to account for the current densities which are normally observed.

PA-60-337
F-1. Farcy, L., and E. Dermois

"On the Motion of Aerosol Particles in the Course of the Process of Molecular Diffusion."

[1964] [7] tests

Order from ELA $1.10

Types. of [Académie des Sciences, Paris. Comptes

rendus (France) 1964, v. 265, p. 102-104] (pub. by

Gauthier-Villars et Cie., Paris.), T12-43

F-2. Faraday Society: "Physical Phenomena at Interfaces"

1199. Physical Phenomena at Interfaces, with Special Reference to Molecular Orientation. (Faraday Soc., Trans. 23. pp. 545-600, Dec., 1929.)—A general discussion on the subject comprising the following nine papers, together with expressions of views by various contributors: "General Discussion on Physical Phenomena with Special Reference to Molecular Orientation (Introductory Survey)," by E. K. Rideal. In the case of insoluble films on a liquid surface, the evidence for a two-dimensional monomolecular phase capable of existing in the solid, two liquid, the condensed and expanded, vaporous, gaseous and allotropic solid states, etc. is considered and extended. The conditions of equilibrium of these films with crystals or layers of materials from which they are formed conform to the generalisations embraced by the phase rule. Interfacial electrification, the evidence supporting the view that adsorbed molecules are oriented, and allied subjects are also considered.—"Electrification at Interfaces," by H. Freundlich. Electrification at interfaces is governed by the distinction between the thermodynamic potential and the electrokinetic potential, this distinction necessitating two assumptions: (1) The electric double layer at the interface must be, not a strict double layer as suggested by the electrophoretic, but an adsorbed diffuse "double layer" in which the ions of the layer in the liquid phase are not all strictly bound to the one surface. (2) A thin film of the liquid adheres firmly to the solid wall of the other. The potential that is electrostatic is the true potential between the two phases, whereas the electrokinetic potential is the potential between the movable liquid phase and the thin film of liquid adhering to the solid wall. Experimental data referring to the behaviour of these two potentials are discussed, and it is shown that the distinction between the two is a valuable guide in the study of the phenomenon correlated with the electrification of surfaces.—"Electrification at Interfaces," by H. E. Schofield. By restraining free kinetic movement, the interfacial forces which cause adsorption and molecular orientation set up a distribution of volume electrification, whereby giving the surface an electric moment and hence a transverse difference of potential. The study of the electric moment of an interface by observation of the relation of its charge to the accompanying charge in surface tension is best carried out by means of the "double layer" as an adsorbed diffuse electric moment, which reveals the complex structure in the ionic and molecular arrangements making up the electric moment of an interface and shows the complete inadequacy of the simple electrostatic "condenser." Thus, it shows that the dispersion set up by a charged mercury surface in a neighbouring solution extends to a considerable depth (tensils of Å) and supports the view that throughout part...<text continues>... of the region carrying volume electrification the ions are separated...; a medium of which the dielectric constant does not differ greatly... of that of water in bulk. Molecules orientated at an interface and having electric moments either inherent or induced, though they contribute to the total p at., cannot cause electrokinetic electrification, for the appearance of which the possibility of a relative movement of two layers carrying volume electrification of opposite sign would appear to be essential.—"Adsorption on Solids," by W. E. Garner. Reference

is made to the part played by the fine structure of the solid surface in adsorption processes and in the kinetics of heterogeneous reactions, to surface energy and surface forces, to adsorption isotherms, monomolecular films, molecular orientation, etc.—"Molecular Orientation in Sorption," by G. Shearer. The bearing of X-ray measurements on this subject is considered. Study of the structure of long-chain carbon compounds shows that there is one set of planes in the crystal whose spacing is very much greater than with the other planes, and that this spacing increases uniformly with the carbon content of the molecule. Moreover, in any one series of carbon compounds the unit cells are of approximately the same cross-section, the area, about 41-4 Å², being a measure of the space occupied by the base of two molecules. Some doubt still exists as to the precise arrangement of the molecules throughout. The relative strengths of certain of the bonds joining molecule to molecule, the relationship between the type of orientation found in molecular aggregates other than solids and that which is the principal characteristic of the crystal, the probability that the double and single layers found in long-chain crystals have considerable bearing on the formation of oriented films, the inactivity of the groups at the outer ends of the double layer, etc., are also discussed.—"Insoluble Films on Liquid Surfaces," by N. K. Adams and G. Jessop. See Abstract 1199 and 1200 (1926).—"Spreading of Proteins," by E. Gorter and F. Grendel. Proteins able to spread on water in a monomolecular layer. Hemoglobin, casein, serum proteins and muscle proteins spread in a film only 8-7 Å in thickness if the suitable hydrogen ion concentration (mostly pH = 1) and temperature are chosen. Other proteins (gelatin, gluten) do not spread well, their behaviour being comparable to that of the short-chained fats. When spread on distilled water, proteins do not show this minimal value for the thickness of the layer; in this case time has a considerable influence, whereas it has none when strongly acid water is used. At the isoelectric point and at pH = 1 or 2, the very thin monomolecular film is obtained, but on either side of this point the thickness increases, often threefold. Rise of temperature enhances the spreading only of proteins of the hemoglobin and casein type, but the spreading of proteins of the gelatin-glucin group is better at lower temperatures. The spreading of proteins in thin films is due to the attraction of the C, NH groups of the molecule to the water. Certain points of technique are discussed.—"Some Physical Properties of Composite Surfaces," by W. Ramsden. Such questions as massed adsorbs, the viscosity or rigidity of adsorption surfaces, the re- or insolubility of massed adsorbs, surface rigidification, etc., are briefly discussed.—"Arrangement of Molecules on the Surface of Pure Liquids," by S. Sugden. The assumption of a particular orientation of the molecules of thin surface films furnishes the simplest and most complete interpretation of the behaviour of such films under compression and of the regular and consistent values found for the dimensions of molecules. In the present state of knowledge it is impossible to prove that orientation cannot occur at the surface of a pure liquid, but it has been shown that such an ordered arrangement of the surface molecules, if existing, does not affect the total surface energy as would be expected, and that the kinetic theory sets definite limits to the existence of any high degree of orientation. The author is of the opinion that the surface properties of pure liquids are best accounted for by the theory of a random distribution of the surface molecules.
PART I. EXPERIMENTAL METHODS AND RESULTS.

(A) Electrohydrodynamics.

"Microscopic method of electrophoresis and its application to the study of concentrated and non-concentrated systems," by H. A. Anderson (pp. 6-10).

- "Influence of electrolyte concentrations on electrophoretic mobility of egg albumin," by A. Thellung and H. Svensson (pp. 11-20).
- The influence of saline upon the electrophoretic mobility and isoelectric point of egg albumin has been determined by the moving boundary method; theories of the phenomena are advanced.

- "Mammalian potentials, valencies and theoretical and observed mobilities of haemoglobin and egg albumin," by G. S. Adair and M. E. Adams (pp. 21-35).

- "Membrane potentials, valencies and the excess of inorganic ions in the neighborhood of a protein ion have been studied in comparison with measurements of the electrophoresis of dissolved proteins. Observed mobilities of haemoglobin ions agree with results calculated by means of Henry's formula.

- "Influence of electrolyte on electrophoretic mobility of serum albumin and haemocyanin," by F. Putters and P. V. Van de Walle (pp. 25-35).

- The molecular dimensions of the proteins place them in the lower boundary of the regions between the two extremes represented by the theories of Smoluchowski and Helmholtz for electrolytes of different mobilities: the behavior of serum albumin and haemocyanin in the presence of electrolyte is studied.

- "Uses of this layer in electrophoretic separation," by J. Sr. L. Phulpot (pp. 36-46).

- "A large scale electrophoretic separator, made of "Perpex," in which the substance to be separated flows in a thin layer between layers of dilute electrophoretic, is described.

- "Observations at the electrophoretic boundary moving with Lamm's scale method," by R. A. Kerwick (pp. 47-53).

- "A survey of the use of Lamm's method.

- "Examination of electrostatic charge density as a function of the thickness of the double layer," by A. H. Ham and E. D. M. Dean (pp. 53-67).

- "Measurements of the electrophoretic mobilities, potentials and other properties of octadecane in the presence of the chlorides of Na, Ba, and Li at 25°C. at pH = 6 are recorded and discussed.


- "A mean value of 6-34% is found for the electrophoretic mobility of "Nejol" dispersed in water; the influence of added alkalines and long-chain colloidal electrolytes is examined.

- "Electrochemical analysis of peat for study of molecular structure of organic compounds," by R. A. Gostner (pp. 63-68).

- "The electrophoretic mobility of the aliphatic alcohols and acids, ethyl ethers of the aliphatic acids, acetone and the aliphatic alcohols, 8 benzene derivatives and CCl4 at a cellulosic-organic liquid and an Al(OH3)organic liquid interface have been studied.

- (B) Streaming Potentials and Surface Conductance.

- "Streaming Potentials and Surface Conductance," by A. J. T. Kruyt (pp. 69-89).

- Results obtained with old and new forms of apparatus are surveyed; anomalous behavior of the Ce curve for KCl solutions is attributed to surface conductance. The Helmholtz-Smoluchowski equation is derived and corrected.

- "Electrohydrodynamic effect in egg albumin solutions," by H. B. Bull (pp. 80-94).

- "The viscosity of dilute solution of egg-albumin (concentr. 0.111) has been studied at 30°C. Neither the Smoluchowski nor the Kraus-Rutgers equation gives the correct order of magnitude for the electrohydrodynamic effect.

- "Electrical conductivity and Other Methods.

- "Electrochemistry of simple interphases, with special reference to that between mercury and solutions of electrolytes," by S. A. Crawford (pp. 95-101).


- "The significance of L-potentials in determining ionic concentrations at interfaces is discussed in considerable detail.

PART II. THEORETICAL TREATMENT OF THE DOUBLE LAYER AND ITS IMPLICATIONS.


- A critical review of the mechanism of the double layer; a simple relation between electrophoretic mobility and colloidal stability does not exist.

- "Electrokinetic equations.

- "Study of double layer at metal-solution interface by electrokinetic and electrochemical methods," by A. Faustnik (pp. 117-127).

- "A critical review, more especially of the properties of Pt and Hg electrodes.

- "Observations on the double-layer capacity at Hg electrodes," by L. M. Barcley and J. A. V. Butler (pp. 128-133).

- "An oscillographic study of the negative polarisation of freshly made Hg surfaces shows that the behavior of double layer distortion for charged spherical particles moving in an external electric field is studied.

- "The Helmholtz," by E. A. Gohein (pp. 139-144).

- The measurement of the moment (r) of an electrical double layer in volts shows confusion of thought. A suitable unit for r is the Helmholtz, defined as 1 Deyke/1." The conversion of volts to Helmholtz is given by \[ V = \frac{D}{15} \text{Helmholtz}, \] where D is the dielectric constant.


- The Debye-Hückel theory in its classical form applies to dispense systems only when the ionic strength of the solution is very small; its extension to strong solutions necessitates the integration of additional terms other than the 1st Debye-Hückel equation and the consideration of surface processes such as adsorption and chemical reactions.


- "Electrokinetic equations, corrected to take account of surface conductance of capillary and colloidal systems, account for the maximum of \( \zeta \) the high dielectric constant of aqueous sols, etc., and can be used to obtain definite values of \( \zeta \).

- (B) Adsorption potentials.

- "Adsorption potentials of KCl solutions by T. B. Deam, O. Gatsy and E. K. Ridel (pp. 161-166).

- Thin layers of insoluble substances, permeable to at least one ionic species can only affect diffusion potential in some cases when they offer sufficient change in the resistance to passage of at least one ionic species. An expression for the diffusion potential through a thin permeable membrane is derived.
"Adsorption potentials. Part II. Oil-water potentials," by R. B. Dean (pp. 164-173).—A method for investigating the electrical properties of oil-water interfaces is described, and results supporting the conclusions of Part I (see above) are detailed.

"Adsorption potentials. Part III. Air water potentials," by R. B. Dean and O. Gatty (pp. 173-179).—The behaviour of air-molecular-water solution interfaces attracting ionized air particles is discussed.

(C) Colloid stability.

"Role of forces between particles in electro-deposition and other phenomena," by H. C. Hamaker and E. J. W. Verwey (pp. 180-186).—Electro-deposition is mainly a mechanical problem, the electric field merely moving the particles towards, and pressing them on to the electrode.

"Influence of particle size on physical behaviour of colloidal systems," by H. C. Hamaker (pp. 188-195).—The various forces concerned in the physical behaviour of colloidal systems and their dependence on particle size are discussed; the behaviour of colloidal systems under gravity and in a centrifuge is treated.

"Electrical double layer and stability of emulsions," by E. J. W. Verwey (pp. 195-209).—Discusses why a stable emulsion cannot be obtained without the presence of a special emulsifier.

"Repulsive forces between charged colloid particles, and theory of slow coagulation and stability of lyophobic sols," by B. Derjaguin (pp. 202-210).—A mathematical theory of the forces operative between particles and determining the stability of sols, suspensions and emulsions, with applications to thixotropy, etc., is developed. Agreement between theoretical and experimental determination of the force of repulsion between surfaces separated by liquid films is not satisfactory.

"Stability properties in hydrophobic sols: application of mutual energy of two particles," by S. Levins and G. P. Dube (pp. 211-228).—Applications of the expression, given by the authors, for the mutual energy of two colloidal hydrophobic spherical particles, are discussed.

"Significance of phenomenon of electrical charge in stability of hydrophobic dispersion," by H. Eibler and J. Kofy (pp. 229-241).—Data on which are based the relation between the E-potential and the stability of lyophobic colloidal systems, are critically reviewed, and a more satisfactory, approximate relation is established between electric boundary phenomena and the stability of the system.

"Electrical double layer in relation to stabilization of emulsions with electrolytes," by D. P. Creelman and A. King (pp. 241-247).—Generalizations, based on recent experimental work, relating to the stabilization of any alcohol/water emulsions with various electrolytes, are presented.

PART III. BIOLOGICAL AND TECHNICAL APPLICATIONS.

"Use of electrophoresis in the elucidation of biological problems," by L. S. Moyer (pp. 248-256).—A survey of recent work.

"Electrical double layer and virus stability," by A. S. McFarlane (pp. 257-264).—A survey of recent work.

"Consequences of electrical double layer in rubber technology," by D. P. Twiss, A. S. Carpenter and P. H. Anbry (pp. 265-277).—The subject is reviewed generally and new work relating to the coagulation of dialyzed Horse latex is presented.

"Anodic deposition of oleo-resinous lacquers," by C. G. Summer (pp. 278-287).—A method of lacquering metal surfaces by electro-deposition from an oleo-resinous emulsion, developed primarily for the internal coating of tinplate cans, is outlined.

"Formation of deposit by electrophoresis," by H. C. Hamaker (pp. 279-287).—The production of coatings by electrophoresis from suspensions of BaCO₃, BaSr(SO₄)₂, MgO, MgCO₃, Al₂O₃ and Fe₂O₃ in methanol, ethanol, acetone or mixtures of these fluids is discussed.

"Deposition of oxide coatings by cataphoresis," by M. Benjamin and A. B. Osborne (pp. 287-290).—Experimental work concerned with the production of non-colloidal cataphoretic suspensions of the alkaline earth carbonates and alumina, from which the particles may be deposited along with a cellulose binder is described.

"Wetting and rotation in connection with problem of transition layer," by P. Rehrlind (pp. 290-300).—A survey.

"Amphotic ion double layer and the double ionic exchange in soils," by S. Mattson and L. Wahlander (pp. 300-319).—The simultaneous exchange of anions and cations at the equi-ionic point of soils occurs according to the mass law expressed by the Donnan equilibrium. The double ionic exchange leads to the conception of an "amphotic" electrical double layer.

F-4. Fedosseev, V. A., B. A. Manakin, and Z. M. Domentiano


F-5. Felici, N. J.


This emphasis is on the practical development and application of electrostatic generators, rather than on theoretical considerations. The small cylindrical compressed-air generators with conducting segments proved very satisfactory for powers of the order of 30 W at voltages of 70 kV. In attempts to increase the output multiplate generators with conducting segments were evolved which reached 730 W at 225 kV, but beyond this range difficulties of mechanical construction proved formidable. After disproving the current view that charge slip was responsible for the low output of moving insulator machines, a cylindrical generator of this type was constructed with highly encouraging results. PA-57-3424

F-6. Fleming, A.

206. Electrification of powdered insulators. A. Fleming. Proc. Phys. Soc., Lond., 53, pp. 51-53, Jan., 1941. Experiments are described whereby the production of a negative charge, as a result of the fall of a dielectric powder from a metal or glass receptacle into a metal container, is demonstrated. It is necessary that a good insulator, such as powdered sulphur or silica, be employed and, in the case of the latter, it must be previously very well dried by heating. By means of a rotating cylinder a small quantity of powder may be utilized to give an unlimited supply of charge. It is concluded that, when dielectric particles strike a metal surface with some velocity, electrons tend to pass from the latter to the former. The negatively charged particles are capable of acting as condensation nuclei in steam. PA-64-236
F-7. Fleming, A.

2432. New Method of Creating Electric Fields. (Sir) Ambrose Fleming. Phys. Soc., Proc. 81, pp. 402-406, May, 1928.—When certain powdered insulating materials such as SiC are allowed to fall down a tube and strike a perforated metal plate or gauze of Zn, Zn, Ni or Fe, the metal plate becomes electrified positively and the powder negatively. The powder must have grains of nearly equal size and be perfectly dry. The electrification appears to be due to impact, not friction.

PA-62-2628

F-8. Fletcher, W. H.


F-9. Forrest, J. S.

2423. Methods of increasing the electrical conductivity of surfaces. J. S. Forrest. Brit. J. appl. Phys. Suppl. No. 2 [Static electricity] 2, 37-56 (1933). Diffluence due to electrostatic charge on insulating surfaces can be overcome by coating the surface with an electrically-conducting film. The paper describes conducting films of metallic oxides, metals, carbon, mixtures and casting agents. Information is also given on the application of these films to ceramic and plastic insulating materials.

PA-57-3423

F-10. Foster, W. W.

2304 DEPOSITION OF UNIPOLE CHARGED AEROSOLS. PARTICLES BY INITIAL IMPACT. W.W. Foster. Brit. J. appl. Phys., Vol. 10, No. 3, 338-345 (April, 1959). A simple theory is developed. The application obtains the average radius and the average charge of the particles to be determined from measurements of the area of the deposit on metal surfaces and the charge given by the particles. This work method offers a means of determining the rate of evaporation of complex charged aerosols. Data from experiments indicate that the simpler theory of evaporation is correct. The calculated energy radius of the initial charge particles obtained comparisons favourably with that determined from measurement of the optical density and mass concentration of the aerosol. The charge determined by the new method is consistent with that calculated on the basis of current charging theory.

PA-63-8324

F-11. Fraas, F.


F-12. Fraas, F.


F-13. Fraas, F., and O. C. Ralston


F-14. Franck, S.

2339. Dust Motion in Electric Fields. S. Franck. Phys. Zeit. 94, pp. 214-218, March 1, 1933.—Using hopocodium and sugar dust the author has examined the forms taken by the dust when subjected to homogeneous and inhomogeneous electric fields, and a series of photographs is reproduced.

PA-56-2288

F-15. Fraser, D. A.


F-16. Frenkel, Ya. I.

266. Mechanism of the electrification of solids and liquid by atomization. Frenkel, Ya. I. J. Exp. Theor. Phys. USSR, 18, 799-806 (Sept., 1948) In Russian.—The electrification of solid bodies (ionic dielectrics) by atomization may be explained by the selective effect in the formation of ionic holes of one of the two possible signs (whose formation requires less energy) on the surface of the crystal. Simultaneously the holes of the opposite sign form a space (diffuse) layer of electrification. The potential jump in this double layer balances the energy difference of hole formation of the ions of different signs. When a substance is atomized, the particles take a charge of the same sign as the original surface. With an increase of the dimensions of the particles their specific charge is correspondingly reduced, and under the influence of a supporting air current a separation of the lighter particles from the heavier ones takes place, which is also a separation of particles of
F-16. (Continued)
unequal charge. Thereby strong electric fields of the
order of 1000 V/cm are set up. The electrophoretic ef-
fect, i.e., the charging up of water droplets by
spraying, may be explained analogously.

PA 52-566

F-17. Frenkel, Ya. I.

Adsorption and discharge of ions on the surface of
coated particles and its effect on the limiation and elec-

CA 41-637g


Translation available from SLA (John Crerar Library),
Number RT-1545.
Electrical parameters of dispersive systems. Ya. I.
(1945).

CA 43-7776h

F-19. Frisch, H. L.

2233* The Diffusion-Controlled Growth of an Aerosol in
Mathematical analysis. Graph. 9 ref. BMI 4-2333

F-20. Frumkin, A., and A. Obrutschewa

the Surface of Separation between Gas and Solution. A. Frumkin
spraying of liquids leads to a separation of opposite electric charges, a
phenomenon named water-dropping or bubble electricity and, by
Christiansen, ballo-electricity. The present authors do not wish to develop a
complete theory of ballo-electricity, but wish merely to investigate and
consider solutions containing, side by side, capillary inactive electrolytes
and capillary active non-electrolytes. It is deduced with few exceptions
that the ballo-electrical capacity of different molecules is dependent on
the type of their orientation at the surface of separation. The different
compounds can be divided into two classes, (1a) hyperhatalalic and
hypernatalalic bodies of Christiansen) depending on whether the positive
end of the molecule in the surface of separation is directed towards the
gas phase or towards the liquid phase. Water must be considered as
belonging to the second class.

PA-34-1987

F-21. Fuchs, N. A.

Fuku, N. A.

PRECISION OF AEROSOLS ON VERTICAL SUR.
FACES (Osazadnoye Aerossoy na Vertical'nykh
Poverkhnostyakh). 4 Oct 60, 9p. (1 fig. omitted)
3 refs. Trans. V-1619.
Order from LC or SLA m$1.80, p$1.80 61-13803

Trans. of mono. Aerossol v Sel'k'om Khonysystve,
Moscow, 1956, p. 77-81.

The mechanism of aerossol precipitation on vertical
surfaces is analyzed in an attempt to improve insecti-
cidal wall spraying. Uniparioly infected (sic) aerossols
are recommended because they disseminate evenly in
all directions by their own priming and they sediment
evenly on the ceiling, walls, and bottom of the cham-
bers. A compact mobile device must be constructed
and mounted on an aerossol generator to obtain a uni-
lar corona discharge working 'from the light network.
A low capacity generator must be invented to produce
a mist of 5 to 10 micron particles.

T5 310

F-22. Fuchs, N. A.

FUCHS, N. A.

ASLIB GB-80. The magnitude of electric charges
caiyered by particles of atmospheric aerosols. invent.

TM 4-495

F-23. Fuchs, N. A.

Fuku, N. A.

THE MECHANICS OF AEROSOLS, tr. by
E. Lachowska. 1958 [67]p. 581 refs. CWL Special
Pub. 4-12.
Order from GTS $7.50 59-2109


Contents:
Classification of aerossols. Dimensions and shape of
particles in aerossols
Rectilinear, uniform motion of aerossol particles
Rectilinear irregular motion of aerossol particles
Curvilinear motion of aerossol particles
Brown's movement and diffusion in aerossols
Convective and turbulent diffusion in aerossols
Condensation of aerossols
Transformation of powdery substances into the
aerossol stage

T3-152
F-24. Fuchs, N. A.


Summary — By the limiting sphere method the combination coefficients for gaseous ions and aerosol particles were calculated, allowing for the jump in ion concentration at the surface of the particles. Hence the stationary charge distribution on aerosol particles in a symmetrical bipolar ionic atmosphere was determined. The use of the Boltzmann equation for this purpose proposed by some authors is theoretically wrong as this equation applies to equilibrium rather than to stationary states. In practice, the Boltzmann equation can be used for particles with radius $\geq 1 \times 10^{-4}$ cm (under atmospheric pressure). Within this range the image forces and the jump in ion concentration may be neglected. The conditions of the applicability of the steady diffusion equation to the theory of the stationary charge distribution in aerosols are discussed.

Author

F-25. Fuchs, N., and P. Lisowski


CA-50-6137h

F-26. Fuchs, N.; I. Petranyov, and B. Rotzeig


1. A method for the determination of the rate of charging of floating particles by an ionic current is described. It consists of passing a narrow charged jet parallel to the axis of a cylindrical electric precipitator and measuring the charges acquired by the particles in it.

2. The experiments were made with oil-droplets ranging from 0.5 to 0.5 cm in radius. The size and charge of the droplets were measured by the "oscillation" method. Current densities of about 5 to $10^{-2}$ A/cm$^2$ and times of charging of about 0.1 to 0.01 sec., were used.

3. A good agreement between the mean values of the measured charges and theoretical values calculated neglecting the effect due to diffusion of ions and to mirror-forces, was obtained for the whole range of sizes studied.

Author

F-27. Fukada, E., and J. F. Fowler


The different insulating materials have been tested for the polarity of electroweak when rotated against each other, and a sequence of increasing tendency towards negativity was established. A comparison with certain features of ionic electron trap distributions, as derived from measurements of X-ray-induced conductivity, indicates some correlation between these two properties of the materials.

Author

F-28. Furman, A. M.


CA-42-28h


With regard to the separation of particles in an a.c. field, the magnitude of charge of the particle obtained by conduction from the lower plate is one of the most important conditions affording the separation efficiency, yet this kind of charge has never been sufficiently discussed. With this in mind, the charge of a particle moving in the field was measured by means of a d.c. amplifying circuit of the type developed by L. A. Dubridge and H. Brown.

PA-58-4616
G-1. Gallilii, I., and G. Ailam


A general expression is derived for the vapor pressure of a charged drop suspended in the center of a spherical container with perfectly conducting walls. It is assumed that the liquid is conducting, the medium denser than the vapor, and that a sphere of large diameter is in equilibrium with the vapor. The vapor pressure in the case when the radius of the container is close to that of the drop is evaluated after solving the equation for the distribution of the charged molecules near the surface.

G-2. Gavis, J.


Alternate Electrochemical phenomena in these have usually been described mathematically in terms of the electrical potential differences within, and at the surfaces of the fluid. In this paper an alternate description of electrolytic phenomena in terms of the charge differences within the fluid is attempted, applicable when the discharge current of the fluid is low. This involves the formation of a linear potential difference between the charged plates; the addition of electric charge by diffusion, evaporation, and condensation to the fluid. The principle of symmetry is applied to the expression; i.e., the electrolytic phenomena is a potential dependent on the excess charge at the surface of the charged plates.

G-3. Geist, J. M.


The electronic spray analyzer incorporates a probe carrying a positive electrical potential, upon which the drops in the spray image. If the drops conduct electricity, pulses of negative potential occur in the probe. These pulses are amplified, scored according to size, and counted.

The relationship between the particle size and the size of the pulse obtained at the input to the amplifier is apparently independent of the material of the drop so long as the material is a conductor.

Metal spheres with diameters from 100 microns to 500 microns and water drops with diameters from 250 microns to 1000 microns followed the same calibration curve. For drops of material having relatively high conductivity the size of the pulse varied directly with the probe potential and approximately with the 1.6 power of the particle diameter, at least over a range from 1/2 to 6 times the diameter of the probe wire. The size of the pulse is also dependent upon the position of impact of the drop on the probe.

These characteristics of the probe are explained by considering the probe to act as a condenser with a fixed charge. The change in the capacitance of the probe due to the placement of a spherical conductor in contact with the probe creates a pulse of negative potential, dependent upon the electric field round the probe.


The strength of the applied electric field, the thickness of the slab being electrified, the time of electrification and the low temperature holding time before removing the slab were varied for carneya wax electrets. The approximately one hour discharge current varied inversely as a power of the time since turning off the electric field, the power being close to one. The magnitude of this current depended on both the forming field strength and on the thickness of the electret. A large discharge was obtained, when the test was stimulated and uncharged wax, not an initially solidified.

The experimental measurements were made at temperatures between 27°C and 86°C, frequencies between 50 cps and 11 kc, and with an applied electric field strength in the wax of zero, 2700 and 5500 volts per cm. The application of the field was found to raise the dielectric constant of the higher temperatures. The case for permanent dipole orientation and ion formation, capacitors, and the case of the dipole charge of the electret is examined, and it is shown that there are objections to such interpretations. An ultimate explanation is suggested.

G-5. Gilbert, H. W., and P. E. Shaw

2133. Electrical Charges at a Liquid-gas Interface. H. W. Gilbert and P. E. Shaw. (Phys. Soc., Proc. 37, pp. 155-233; Dec. 213-214, June, 1925.) This paper is a general review and discussion of the various methods of studying the potential differences and electric charges which arise at a liquid-gas interface. The authors divide the subject into the following main headings: (a) The determination of the p.d. at the surface liquid-gas when one or both of these is at rest. (b) Cathode spraying of gas bubbles. (c) Passage of gas over a liquid without rupture of the latter, or of a gas over a wet solid with the same proviso. (d) The fall of a liquid in an unbroken column through a gas. (e) Liquid jets. (f) Waterfall electricity. (g) Electrification produced by bubbling gases through liquids. (h) Electrification produced by shattering drops in air-stream. (i) Electrification produced by spraying a liquid. An attempt is made to coordinate the materials obtained from this vast area of research. Many of the results may be obtained in terms of the modern theory of orientation and polarisation of the liquid-gas interface, but there are other facts which do not appear to come within the scope of established principles. Suggestions are made as to possible developments in future research.

PA 28-2133
G-6. Gill, E. W. B.


The high potentials of the order of 100 V developed when ice is formed from dilute solutions were investigated to discover the mechanism. Contact potentials between solids and liquids are usually of the order of 1 V and some further fact must operate to achieve 100 V. The scheme suggested is that, whereas in the usual case the charges producing the potentials are adjacent to the boundary, in the case of freezing the charges extend to a small distance from this boundary.

PA-57-4332

G-7. Gill, E. W. B.


By means of a sample experiment it is shown that a fine fluff of dry sand produces a potential of measurable magnitude. It is concluded that the sand rubbing on itself produces positive charges on the smallest particles and negative charges on the larger ones. The observation is believed to explain the build-up of high potentials in dust storms.

PA-52-3975

G-8. Gill, E. W. B.


Observations relating to charges produced on sand insulating particles sliding down a metal funnel were given by Dobemon [Apart. 2594 (1946)] together with certain suggested explanations. It is now shown that the observed results admit of an alternative explanation in which the particles reach a sufficiently high potential to produce a discharge through the air around them. On this view the charge-particle curve would resemble the well-known curve of conduction potential against pressure. The observation that the charge has a min. value at about 1 mm. is then accounted for.

PA-52-3974


Charges on drops bouncing up in electric fields were investigated and it was found they could all be explained by the ordinary laws of electrostatic induction, with allowance for contact potentials. Electrification due to splashing was also studied and again the effects could be explained by contact potentials alone, so that theories of double layers put forward to explain previous experiments are unnecessary. A warning is given of the necessity of making due allowance for possible electrification by splashing in interpreting experimental results, and a critical examination of an experiment of Zehavy is reported. A few experiments of splashing water drops off ice gave results which may have a bearing on the production of electricity in thunderstorms.

PA-55-6323

G-10. Gill, E. W. B. and G. F. Alfrey


In contrast to earlier work [Abstr. 5802 (1950)] no considerable contact potentials are found to be developed at the water-ice interface during the freezing of dilute aqueous solutions. A tentative explanation is offered of the observed large potentials developed between water and ice. It is suggested that when a small water drop impinges on an ice particle a large negative charge is carried away by the rebounding water, a corresponding positive charge being left in the outer ice layers. If melting occurs the polarities may be reversed.

PA-55-3563


A jet of water falling vertically from an eroded metal reservoir was surrounded by an insulated metal cylinder which could be charged to various potentials $P$ between $\pm 1000 V$. The charge $Q$ per cm$^2$ acquired by the water on breaking up into drops was found to be $\propto V$. The small value of $Q$ remaining when $P = 0$ is attributed to contact potential difference between water and reservoir. In similar experiments with insulating liquids (CCL, transformer oil) an applied field had no effect.

PA-53-2437


6418. *Frictional electrification.* E. W. B. Gill and G. F. Alfrey. Letter in Nature, Lond., 163, 172 (June 29, 1949).—The frictional charges acquired by dust grains such as chaff, bricks and sand when sliding over an earth-connected inclined metal plate, are affected to a considerable extent when an external electric field is applied between the plate and another plate placed above and parallel to it. The charge, $Q$, is given by $Q = \frac{a}{2} \cdot a - Q_0$, where $a$ is the electric field (p.s. or v), according to the upper plate is $a$, or $-a$, and $a$ is a constant and $Q_0$ is the charge produced in air. With very of interest only to throwing light on the mechanism of frictional electrification, but may be useful in practical applications, since by applying an external field, the frictional charges may be so reduced that dangers resulting from frictional electrification may be avoidable.

PA-52-5418


G-11. Gillespie, T.

G-15. Gillespie, T.
"On the Adhesion of Drops and Particles on Impact at Solid Surfaces;"
I. T. Gillespie pp. 266-280
II. T. Gillespie and E. Rideal pp. 281-298
J. Coll. Sci., 10, 266-298 (June 1955)

G-16. Gillespie, T.
Smoke-chamber experiments have been carried out to determine the electric charge distributions and the constants descriptive of collision and surface loss of aerosol in presence of smoke, soot, and ammonium chloride. The data obtained were used to test the hypothesis that the rate of capture is affected by the electric charge distribution. Calculations have been made of the effect of electric charge on the capture of aerosol on impact on surfaces of various solids. The results are in terms of the contact constant K and the deposition constant D with the aid of equations known to be applicable to ammonium chloride aerosol over a wide range of conditions. Marked differences were found in the values of K for different aerosols and lesser differences in the values of D. An electron microscope study of the shape and structure of the particles led to the conclusion that differences in these characteristics are not predominantly responsible for the observed differences in behavior, although they may be a contributing factor. A few preliminary experiments in which silts powder were dispersed through an electrically charged screen indicated that the coagulation and deposition processes are influenced by changes in the electrical charge distribution.

G-17. Gillespie, T. and G. O. Langstroth
An instrument has been developed to permit measurement of the electric charge distribution in aerosols. The results of these experiments show that the charge on any particle in a deposition can be determined in a subsequent examination from the size of the particle itself. The results are given in the form of curves and results of tests are given to show that the instrument can be used to determine the charge on any particle in a deposition. The use of the instrument is illustrated by an account of a preliminary study of the charge distribution in a silica dust aerosol at various times after generation.

PA 56-2792

G-18. Gillespie, T. and G. O. Langstroth
COAGULATION AND DEPOSITION IN STILL AEROSOLS OF VARIOUS SOLIDS

Spectroscopic experiments have been made of the aging of magnesium oxide, zinc oxide, carbon, coal dust, and silica powder aerosols, under essentially uniform experimental conditions. The changes with time in the particulate number and in the number of particles lost from the system by deposition on chamber surfaces are well described in terms of the coagulation constant K and the deposition constant D with the aid of equations known to be applicable to ammonium chloride aerosol over a wide range of conditions. Marked differences were found in the values of K for different aerosols and lesser differences in the values of D. An electron microscope study of the shape and structure of the particles led to the conclusion that differences in these characteristics are not predominantly responsible for the observed differences in behavior, although they may be a contributing factor. A few preliminary experiments in which silica powder was dispersed through an electrically charged screen indicated that the coagulation and deposition processes are influenced by changes in the electrical charge distribution.

Author

G-19. Giosios, T.
2163. Formation of Condensation Nuclei under the Influence of Electric Charges. T. Giosios. Ann. d' Physik. 34, 55 pp. 445-446, March, 1939. It is shown that the theory of Tohmori and Volmer [see Abstract 6002 (1938)] with certain refinements is in agreement with experiment without supposing that there is a decrease in the dielectric constant of a liquid in the form of drops.

PA-42-2162

G-20. Godard, L. and C. Lafargue
The fine particles (raindrops, fog, snow crystals, and aerosols) are trapped in a fluid of known viscosity (usually a silicone oil) between the plates of a parallel plate condenser. Their movement under a known potential difference is observed with a microscope and the charge calculated by the application of Smoluchowski's law.

PA-54-1068
G-21. Göbel, H.


Plant protection of agricultural crops is mainly practised by deposition of electrical substances on the plant surfaces, these substances being bonded to solid or liquid carrier particles. Improved deposition effects can be achieved by applying electrostatic charges. Laboratory tests proved that charging results in a considerably better distribution of the particles and in a twofold to threefold increased precipitation. Further advantages consist in a reduced grade of dispersity of the deposed particles and in a stronger adhesion of dust particles to the plant surfaces. Extended experiments revealed the most efficient arrangement of the electrostatic charging implements and the relations between spray current, density of dust or liquid particles, and charge of particles.

Author


Thrust measurement and its correlation to the operational characteristics of an experimental collodial-particle thruster are discussed. Measurements were made on a previously designed condensation collodial-particle electrostatic thruster with mercury as the propellant. Thrust measurements of the order of 1 to 10 millinewtons were made with a modified electric microscope calibrated to a sensitivity of 10^{-4} to 10^{-5} gram. As anticipated from the classical liquid-drop theory of condensation, no thrust was observed until a viscous flow regime, and subsequently a critical nucleation rate had been obtained in the nozzle. This condition corresponds to a vaporizer temperature of 60^oC. With the assumption of a charged colloid, it was determined that a mean particle size of 0.01 sq. mm would be required to account for measured target deflections at a vaporizer temperature of 40^oC. From an electron photomicrograph of the colloid beam at similar operating conditions, a mean particle size of 0.1 sq. mm was indicated.

Author

G-23. Gordievskii, V. A.


Theoretical and experimental work on charged atmospheric particles and physiological effects on the body.

Author

G-24. Gotsch, G.


The author describes experiments with mixed cloud and expansion chambers for the examination of the activity of Aitken nuclei and compares them with the theory of H. Köhler and C. Jungreis. He states that supersaturation of about 30% is sufficient to activate most of the nuclei counted by means of an Aitken nucleus counter with an increase of volume of 25%. Since this theory required a considerably higher supersaturation for activating all nuclei, a correspondence between theory and results of measurements could not be found.

Further on it could be demonstrated that with adiabatic expansion the released water vapour combines with the nuclei in approximately 100 milliseconds to such an extent that possibly not yet condensed free vapour is not detectable. This reaction is in first approximation independent of the expansion speed; with very rapid expansion the cloud is already traceable after 1-3 millisecond.

The extremely high speed of the condensation makes it probable that the supersaturations of the free atmosphere do not exceed 1%, so that in the formation of natural clouds only that group is involved which is already saturated with such small supersaturations. The results of the experiments lead to the assumption that, contrary to the conception hitherto generally recognized, a very large quantity of the Aitken nuclei belongs to the highly active group of nuclei.

Author

G-25. Gott, J. P.

4118. Movement of Electrically Charged Cloud Particles. J. P. Gott. Cambridge Phil. Soc., Proc. 32, pp. 486-492, July, 1936—Experiments are described in which observations were made of the motion of electrically charged cloud particles past a sphere. The cloud particles were moving vertically in an air stream, and there was a vertical electric field. This gave conditions similar to those surrounding a falling rain drop in a thundercloud, and the observations are in accordance with the theory proposed by Wilson to account for the mechanism of thunderclouds.

Author

G-26. Gott, J. P.

4931. Charge on Water Drops Falling through a Cloud of Charged Particles in a Vertical Electric Field. J. P. Gott. Roy. Soc. Proc. B, 181A, pp. 688-696, Oct. 1, 1935—A preliminary part of the work consisted in developing methods for producing a cloud by cooling a measure of steam and air, of giving the cloud a charge by exposure to ionization in an electric field, and of producing a cloud containing equal numbers of + and — particles, by mixing two clouds carrying charges of opposite signs. This was followed by the measurement of the electric conductivity of the cloud, and of other quantities related to it. The mobility of an individual cloud particle in strong electric fields was found to be less than the velocity of a falling water drop. Measurements were made of the charge collected by a large water drop while falling through a jet of the cloud containing equal numbers of + and — particles in a vertical electric field between two horizontal plates. When the lower plate was — the drop collected a — charge; and when the upper plate was — the drop collected a + charge. This is in agreement with a theory proposed by Wilson in connection with the mechanism of thunderclouds. The quantitative agreement is as close as could be expected from the experimental arrangement. The experiments also afforded a test of the mechanism suggested by Eiater and Geitel; any charge thus collected was too small to be observed.

Author
0-27. Gott, J. P.
Cambridge Phil. Soc., Proc. 31, pp. 85-83, Jan., 1931.—A detailed account
is given of the appearance observed when drops of water 1-6-6 mm
radius, fall from various heights > 100 mm. into deep water under the
influence of a vertical electric field of varying strength > about
± 8898 V/cm. The smallest drops in the spray thrown up by a splash just
begin to rise to the upper plume at fields of about 200 V/cm, i.e.,
slightly > the field observed at the earth's surface in a thunderstorm. The
charge of such a drop is of the order 1000 e.s.u.; its radius about
4-4 mm.
PA-38-1257

0-28. Gott, J. P.
Electric Charge Collected by Water Drops falling through
Proc. 163, pp. 545-588, Oct. 2, 1923.—Three series of experiments have
been made to determine the charge collected by a water drop falling in a
vertical field through air ionized by a beam of X-rays. Different forms of
ionization being produced in the three cases. It was found that (1) in the
presence of ions of one sign only (i.e., to meet the falling drop, it
collects a charge for all values of the electric field; (2) when ions of one sign only
are moving in the same direction as the drop falls, the charge collected
depends on the velocities of the drops and the ions; and (3) if the descending ions have the greater velocity, so that they overtake the drop, then it collects a charge, but if the drop has the greater velocity,
so that the descending ions cannot overtake it, then it collects no charge.
The electric field which gives to the descending ions a velocity equal to
that of the drop is the critical field for the phenomenon. In the presence
of ions of both signs, carrying equal currents, the drop collects no net
charge in fields greater than the critical field. In fields less than the critical
field it collects more charge as the descending ions and as the drop's
velocity increases. This charge does not increase indefinitely, but tends to a limiting
value. Experiments have been made with water drops of various sizes
in fields greater than the critical field, the initial rate at which the drop
collects charge in the presence of ions of one sign only is equivalent to
collecting the ionization current from an area equal to three times the
area of cross section of the drop. This applies both for ascending and
descending ions. In fields less than the critical field, the initial rate at which
the drop collects charge from ascending ions appears, in the experiments, to be different from that value, but the difference may not be
true. In the experiments the drop was not distorted from its spherical shape. These experimental results are in accordance with the theory proposed by C. T. R. Wilson to account for the mechanism of
thunderstorms and the electric charge brought down by rain. [See
Abstract 298 (1929) respectively.]
PA-36-4837

0-29. Goudet, G. and P. Laurencetou
STUDY OF THE DIELECTRIC PROPERTIES
OF VARIOUS SYNTHETIC FABRICS.
G. Goudet and P. Laurencetou.
J. Phys. Colonne (France), Vol. 31, Suppl. No. 7, ETA-91A
A method of measuring charges due to friction caused by knitted
or twisted fibres is described, as well as the corresponding apparatus. The method chosen makes it possible to obtain fairly accurate and reproducible results. Two sets of experiments clarified its application, one electronic, comparatively the dielectric properties of knitted polyacrylonitrile and acrylic nitrile, the other comparing the behavior of twisted polyacrylonitrile and cotton wool with Cetex in different amounts. Charts indicate how the different treated materials might be classified, according to their frictional properties.
PA-54-17859

0-30. Goyet, G. G., R. Greun, V. K. LaMor
7528. Filtration of monodisperse electrically charged aerosols. G. G. Goyet, R. Greun and V. K. LaMor.
Uniform particle size liquid aerosols were charged electrically by passage through a win in a cylinder
and electrically charged droplets. The uncharged droplets carried a positive charge ranging from 25 to 150 electrons charge per droplet. The radius of the charged droplets was determined using a Milikan-type oil drop apparatus. The maximum theoretical charge was not obtained and a decrease of charge on uniform particle size particles was observed. Factors affecting the incompleteness and non-uniformity of charge are: electric wind, turbulent flow, non-uniform velocity of air and charging times, inhomogeneity of the field gradient. Although a completely uniform charge was not obtained, a sufficiently well defined charge was applied to the particle radii studied, to yield reproducible filtration at a given size as a function of the average particle charge. Filtration of charged droplets through a filter was studied at two linear velocities, 2-7 and 28 cm/sec. An appreciable decrease in penetration is observed upon charging. As would be expected, this decrease is larger at smaller linear velocities. The time of
transit of the charged particles through the filter layer is not an important factor. The effect of the charging on filter penetration is larger the smaller the droplet size.
PA-57-7828

0-31. Graf, P. E.

Atomization of organic liquids can be produced by electrical
charging. This results from the pressure developed by the mutual
repulsion of surface charges. When the electric pressure exceeds a
critical value determined by the drop's surface tension and radius, the
surface becomes unstable and a liquid jet is ejected. A dispersion of
fine droplets is obtained as the jet breaks up.

Electrical pressure, \( P_e \), can be calculated from

\[
P_e = \frac{F - V^2}{8\pi \sigma}
\]

where \( V \) is the applied voltage, \( r \) is the drop radius, and \( F \) is a charging
factor. The charging factor, which represents the fraction of the applied
potential attained on the drop surface, decreases with increasing liquid
conductivity and increasing electrode spacing. The electrical pressure
is largely independent of the attracting electrode's configuration
and polarity and the liquid's dielectric constant. A charging mechanism
is discussed in terms of ion migration in an electrical field. The rate
of charging determines the continuity of jet ejection and the quality of
atomization. High charging rates are obtained with (1) high liquid
conductivity, (2) large charging electrode surface, and (3) high potential
gradient.

Author
G-30. Green, H. A. and W. R. Lane

G-33. Grenet, G.

G-34. Griffin, C. W., et al

G-35. Gross, B. and R. J. de Novoas

The internal charge distribution of the ceramics own electret has been determined by a screening method: three probes and sealing samples are not two probes of different diameters. They are nothing and the sealing charge density is measured. The total electric charge, as determined by numerical integration of the corresponding current-time curve, gives the polarization of each section. A companion curve charge polarization would give charge values which, with increasing thickness of sections, go to zero; a millimeter volume polarization would give values which are independent of thickness. Measurements give constant values and therefore prove the existence of a uniform volume polarization of the electret.


In electrostatic spraying, drop size and velocity affect the quality of the paint coating while the spray angles provide an indication of the ability of the paint to reach all surfaces of the work presented to the spray. The Authors feel, therefore, that when the composition is known, measurements of the conductivity or dielectric constant of the paint can provide some indication of its probable behavior in electrostatic spraying.

G-37. Gubkin, A. N.

Adams' and Swann's phenomenological theories were developed for short-circuited electrets. It is shown that only when short-circuiting is allowed for can the phenomenological theory give results describing the experimental data for electrets made from Cernobis wax correctly. The theory developed here is also extended to new electrets made from inorganic insulators with electrical conductivities considerably higher than that of Cernobis wax. The analysis shows that the electret lifetime can be defined as 1/m4, where M mainly depends on the electret conductivity, the surrounding medium and the short-circuiting conditions, and on 1/n, where n is a parameter specifying the time rate of fall of the semiconstant polarisation. The values of 1/m4 and 1/n are calculated for several electrets, as are the basem- and homoecharge magnitudes. It is shown that in most cases the electret lifetime is determined by 1/m4.

G-38. Guest, P. G.

"The Response of Droplets and Particles to Electric Fields, in the presence of Ions."
to 21 August 1964.

A theoretical study of the motion of charged molecular clusters, droplets, and particles in a field is presented as an essential part of an investigation into electrical control of certain combustion processes. The information required is the charge and mobility of each such charge-carrier, in the presence of flame ions, under the influence of large fields. The study is subdivided by particle size and by whether the particles are charged to a constant level, or are free to continue acquiring charge along their trajectories in a field. Subdivision by size follows the response to molecular collisions. For the smallest, the target area for impact is greater than geometrical, because of dipolar induced in neighboring molecules. In the next size range, such forces of attraction are negligible, while interaction with neutral gas can still be treated as individual collisions. Larger particles experience such collisions only as a viscosity—leading into the Stokes regime. Lastly, particles of sufficiently large size are treated in terms of Newton's Law and it is shown that this regime includes the largest sizes likely to be encountered in practice. Particles carrying constant charge occur when, after a region of relatively plentiful space charge (or space-charge discharge, should their trajectory lie where no small charge carriers exist, or where the thermal equilibrium charge is too low than initial). The mechanisms and rates of change due to ion bombardment, diffusion, and thermionic emission are next examined and it is shown that in the most relevant case—the drifting of particles towards electrodes in the company of ions—the particles' charge, together with field intensity, tends to increase continually.

The equations are analytical expressions for charge, mobility, and range of applicability for each combination of regime. One notable result is that the largest particles, when free to acquire charge, attain a constant mobility >0.2 of that of H2O. Author

G-40. Gunn, R.


An apparatus for conveniently producing discrete and transportable free electrical charges of significant size and to 100 cm of either sign is described. A common electric field intensity is established between two horizontal metal plates by a battery and a volt-meter. Sheet-balls of radius are suspended from the mid level of the upper plate to an electrometer, allowed to fall freely through a hole in the bottom plate, and then into a Faraday cage. The mean charge Q induced on and carried by each is a constant from (Q = 2x 0.4 cm, where x is an adjustable constant closely approximating unity. Deviations due to contact potentials are always clearly evident in measuring the values by positive and opposite electron scales; one may approximately determine the net induced charge due to contact potentials. These may then be applied as a correction to the above equation. The present accuracy is capable of improvement by pole or chambers placing the metal parts to reduce contact electrometer fields.

G-41. Gunn, R.

1964. ELECTRIFICATION OF AEROSOLS BY IONIC DIFFUSION. R. Gunn.


The distribution of free electrical charges transferred to cloud droplets by ionic diffusion provides an example of a simple statistical process. Tables are constructed from first principles, shown to agree with successive terms of the binomial point equation of statistics, and applied to the initial stages of droplet electrification. The final equilibrium distribution, described by the basic electrification equation for aerosols, corresponds to an equilibrium state between the electromotive energy of the droplets and their thermal kinetic energy.

PA-61-3968

G-42. Gunn, R.

J. Colloid Sci. 11, 691-6 (1956).

THE RATIO OF THE POSITIVE AND NEGATIVE LIGHT ION CONDUCTIVITIES WITHIN A NEUTRAL AEROSOL SPACE

The diffusion of atmospheric ions onto an aerosol establishes a distribution of particle charges that depends on the ratio of the positive and negative light ion conductivities. When the aerosol space is electrically neutral, it is shown that this important ratio may be expressed in terms of the number of particles per unit volume, their size, the rate of ion pair formation, the light ion mobilities, and recombination coefficients. The derived relation is useful in defining the properties of an aerosol in terms of known and measurable atomic and electrical parameters. Author

G-43. Gunn, R.

9116. RAINDROP ELECTRIFICATION BY THE ASSOCIATION OF RANDOMLY CHARGED CLOUD DROPLETS.

R. Gunn.


Light ions generated in the atmosphere by cosmic rays and radiativity normally diffuse on to cloud droplets and establish a nearly symmetrical Gaussian distribution of positively and negatively charged droplets. When the cloud becomes unstable, these cloud elements grow by association and the charges accumulate to establish a new equilibrium consisting of nearly equal numbers of larger and highly charged positive and negative cloud droplets. Growing raindrops or graupel falling through such a cloud are accordingly bombarded by both positive and negative droplets, and this establishes a statistical accumulated charge on the various drops. The distribution of the number of drops in relation to the sign and magnitude of the free charge is worked out from basic principles and shown to agree remarkably well with the magnitude and distribution of charge measured inside precipitating clouds. The mean drop charge, irrespective of sign, depends on the square root of the drop size and kinetic energy of the small droplets relative to the larger moving drops. An equipartition is established between the electrical potential energy carried by the larger drops and the relative kinetic energy of the smaller drops. The estimated drop charges on warm rain or graupel are sufficiently large to account for thunderstorm phenomena, provided only that some unspecified process systematically separates the positively and negatively charged droplets. The charges produced at the rain forming level commonly approximate 50 electrostatic units per gram. The observed electrification of quietly falling rain is primarily a manifestation of the ionization produced in the atmosphere by radiactivity and cosmic rays. PA-59-9116
G-44. Gunn, R.

5222. DROPLET-ELECTRIFICATION PROCESSES AND COAGULATION IN STABLE AND UNSTABLE CLOUDS.


The fundamental electromechanisms of droplet electrification and coagulation within stable and unstable clouds is investigated. The analysis shows that atmospheric ions formed by cosmic rays or other means normally diffuse onto droplets and thereby increase the electrical charge. When droplets collide and are electrified by an aerosol, a nearly Gaussian distribution is established which shows that half of the droplets in any selected volume of a stable cloud acquire a positive charge and the other half a negative one. The distribution of the droplets of a typical cloud is shown in the figure. The diffusion of charged droplets produces a net accumulation and a statistical distribution of highly charged droplets is established. Equations are derived for the distribution and for the mean statistical charge on the associated droplets. Equal numbers of positive and negative droplets are normally produced, but the number of positive droplets increases due to unequal ion conductivities sometimes results in marked electrification of a single sign. The influence of droplet electrification upon cloud stability is considered. The droplet charges normally have a detecable but not important, direct effect upon the condensation rate of the cloud. The indirect effects, however, may be large. Electric fields of appreciable magnitude always accompany precipitation as a result of droplet charge separation. Expressions are derived for the electrical field of a cloud, the electrical field of a cloud that is not in equilibrium with the atmosphere, and the electrical field of a cloud that is in equilibrium with the atmosphere. It is shown that electrical precipitation may exceed that due to gravitational effects.

G-46. Gunn, R.

1401. Diffusion charging of atmospheric droplets by ions, and the resulting electrification coefficients.


The role of ionic diffusion in electrically charging droplets in the atmosphere is investigated. Space charge effects are neglected; exact equilibrium is obtained for the charging rate and the average distribution of charge acquired by a drop in an ionized atmosphere. The augmentation of the charge by an appreciable relative motion is determined. The calculation coefficients for neutral and charged droplets are calculated and found to agree with direct measurements. It is concluded that ionic diffusion plays a vital role in determining the electrical equilibrium in the atmosphere.

G-47. Gunn, R.

"Measurements of the Electricity Carried by Precipitation Particles."

Byers, H. R. (Ed.)


G-48. Gunn, R.


The free electrical charge carried on individual precipitation particles was measured in an electrically active thundercloud at various altitudes up to 20,000 ft. Using an aircraft and an improved induction method of measurement that avoided touching the particles, data were given for the free electrical charge carried on the droplets and the free space-charge density at 7 different levels. Positive and negative charges were observed at all levels but it was only a single sign was observed in a specific area. With the frozen level at 14,000 ft, the maximum electrification occurred near 7,000 ft and at a temperature of -10°C. Here both the positive and negative charges had values of 0-2-2 e.s.u. per drop. The charge per drop at 5,000 and 20,000 ft was less than one-fourth of this value. The electric field at the surface of the observed highly-charged droplets is large compared to the dielectric strength of air, showing that powerful electrifying agencies exist. The distribution of free charge inside an electrically active thundercloud is relatively complicated.
G-49. Gunn, R. 6617. The free electrical charge on thunderstorm rain and its relation to thunderclouds. Gunn, R. J. Geophys. Res., 54, 57-63 (March, 1949).—By means of a novel piece of apparatus, which is briefly described, simultaneous measurements are made of the free electrical charge and the mass of individual large raindrops falling from thunderclouds. Values obtained in V storms are plotted and a definite tendency is found to exist for the charge to increase with the size of the drop. The average free charge is found to be 0-015 e.m.u. for a positive drop and 0-019 e.m.u. for a negative drop. Frequent charges are found to occur in the polarity of falling drops such that after 7 drops of one polarity have fallen there exists a high probability for the next drop to have opposite polarity.

PA-52-6617

G-50. Gunn, R. 6618. The electrical charge on precipitation at various altitudes and its relation to thunderstorms. Gunn, R. Phys. Rev., 71, 181-5 (Feb. 1, 1947).—The free electrical charges on individual precipitation particles were measured by an induction method that avoided touching them. In a weak cold front exhibiting no thunderstorm activity, positive charges averaging 0-03 e.m.u. were observed from 10,000 to 20,000 ft. Negative charges averaging 0-04 e.m.u. were measured from the surface up to 30,000 ft. The electric field at the surface of many of the particles was an appreciable fraction of the breakdown field for air, showing that powerful charging agencies exist even under apparently quiet frontal conditions. Electric field measurements showed that the particle charge was nearly neutralized by nearby charges, so that removal of this will immediately produce thunderstorm electric fields and potentials.

PA-50-1079

G-51. Gunn, R. 6591. Electricity of Rain and Thunderstorms. R. Gunn. Terr. Mag. 46, pp. 78-108, March, 1931.—Following an introduction dealing with the factors which influence the distribution of free charge the author discusses first the electricity of rain. There is shown that if each water droplet and the moisture laden atmospheric air surrounding it be assumed to constitute an electric concentration cell then the observed properties of raindrops having different life histories can easily be described. The charges so calculated are found to be in agreement with observation. The next section dealing with a theory of thunderstorm electricity, shows that with a rapidly rising air current and with the formation of rain drops above a critical size separation of charge takes place. The charge distribution arising from the separation is calculated and agreement obtained with observations as regards potential difference, electric field, etc. The author proceeds to show that special thunderstorm conditions in mountainous regions would maintain the earth's charge by bringing down sufficient negative charge on rain and transferring positive charge upwards. It is further considered that forced vertical convection over mountain barriers in fair weather may also contribute towards this end.

PA-38-2951

G-52. Gunn, R. and C. Devin, Jr. 6592. Raindrop charge and electric field in active thunderstorms. R. Gunn and C. Devin, Jr. J. Meteorol., 10, 279-94 (Aug., 1953).—The electrical characteristics of two active spring thunderstorms are reported. Simultaneous surface measurements of the sign and magnitude of the free charge on individual raindrops, the electric field, and precipitation rate have been made. More than 7000 drops, representing a continuous sample of the drops falling in the storms, show no important systematic dependence on the sign or magnitude of the instantaneous electric field. The measurements show that the convected current to the earth frequently exceeds the conduction currents by a large factor, and, therefore, the charged rain may determine the electric field at the surface. The average measured free charge brought down by positively charged rain was 0-022 e.m.u., and by negatively charged rain was 0-031 e.m.u. per drop. The ratio of the negative free charge to the positive free charge brought down by rain was 1-2, while the ratio of the number of negative drops to the number of positive drops was 0-88.

PA-57-6180

G-53. Gunn, R. and R. H. Woesener 6593. "Measurements of the Systematic Electrification of Aerosols." J. Colloid Sci 11, 254-9 (1956).—The distribution of the fractional numbers of aerosol particles carrying assigned charges was measured for the case where the positive and negative light ion conductivities in the environment were equal. The maximum of the distribution is displaced toward the sign of the charge that corresponds to the ion having the predominant conductivity. With a measured ratio of -0.7/0.8 the charge distribution was nearly neutralized. The magnitude of both the observed mean charge and the distribution corresponds closely to the aerosol electrification equation recently worked out by the senior author. The investigations show that ion diffusion is responsible for the equilibrium electrification of perhaps most aerosols.

Author

G-54. Güntherschulze, A. 1633. A Reply to the Paper by Busch: The Potential Gradient in the Vicinity of a Thin Wire. A. Güntherschulze, (Zeits. f. Physik, 36, 1928, p. 193, 1928).—The author commences his reply by admitting the correctness of Busch's standpoint, and then states that his previous work on electron orbits has for objective the derivation of a simple formula which would permit a judgment of the phenomena discovered by Katsch [see Abstract 2140 (1925)]. He points out that his formula, obtained by certain simplifications, is not a rough approximation as stated by Busch, but that while strictly valid only for an infinitely thin cathode wire, its deviations for finite wires increase with their thickness as compared with the dimensions of the apparatus.

PA-29-1633

H-1. Heise, H. and B. H. Hartke

H-2. Hall, W. C.

H-3. Harrwell, G. P.

H-4. Harper, W. R.
22150 ELECTRIFICATION FOLLOWING THE CONTACT OF SOLIDS. W.R.Harper.
Contemporary Physics (CB), Vol. 3, No. 5, 345-50 (June, 1941).
The charge formed on solids after they have been rubbed together can only be a direct consequence of friction when the rubbing is vigorous; more usually, the charging is the result of contact, rubbing, and interaction of the medium. Opinions differ regarding the origin of contact charging, but certain experiments suggest that the origin of this phenomenon, according to which the charging is due to electron transfer between materials, either semiconductors or metals, lies in the nature of the materials and the nature of the contact. Electron transfer is associated with the setting up of a contact potential, and transfer can be caused either by a potential difference across the material, or it can be caused by forces that are not electrical in nature, in which case the current flows against the potential difference generated by the "mechanical transfer" of charge.
PA-65-22150

H-5. Harper, W. R.
Experiments and theories on the electrostatic charging produced by (i) the boiling of a gas through a liquid, and the spraying and atomizing of drops, (ii) a liquid when frozen in contact with a solid, (iii) the contact between solids, are dealt with at some length. Reference is also made to the separation of charge which occurs when water freezes and to the generation of charge in a thunderstorm.
PA-61-3057

H-6. Harper, W. R.
Very large charges are obtained from the light contact of two crystal faces of quartz with each other, an X-ray face being positive with respect to a Z cut. The effect is not permanent in origin, since it does not reverse when an X face is used instead of a Z face. The net immeasurable charges obtained using vitreous silica may be due to patches of insulating crystallization. The tendency of well-cleaned quartz and silica surfaces to adhere seems not to affect the charging, and the adhesion is not electrical in origin. It is unlikely that electrostatic forces ever contribute appreciably to the force of friction. Author

An experimental investigation of the static electrification of metals/metal surfaces shows that the mechanism normally obtained is due to the following phenomena, and that the complete elimination of rubbing leaves an effect that is measurable to quantitative measurements. This "surface changing" is shown to be related to the contact potential, and to have the characteristics to be expected if the Volta-Hahn hypothesis is correct. The importance of this mechanism in the Volta effect has long been debated. The assumption that the hypothesis predicts negligible charging of conductor/conductor surfaces is shown to be based on an inadequate understanding of the significance of surface topography at the points of contact. By paying proper attention to this, and revising the hypotheses to allow for the transfer of electrons by tunnel effect, a precise theory of expansion changing is derived. When applied to the experiments, agreement within the limits of experimental error is obtained, without the introduction of adjustable constants. Author

An experimental investigation of the static electrification of insulating surfaces after light contact with metals shows that hydrophilic surfaces such as glass acquire a conductive charge, whereas hydrophobic surfaces such as mica show negligible charging by comparison. The theoretical significance of this is discussed. Author

The contention of Gill and Alfrey that electrification by splashing is due to electrostatic induction in the field of a contact potential is discussed in the light of other published work, and it is concluded that this contention cannot be upheld. The orthodoxy view that electrification of this kind arises from the existence of a double layer in the vicinity of the liquid surface suggests that there should be no charging with a non-conducting liquid, contrary to what has been found by previous works. Experiments using the method of boiling have shown that the electrification does disappear, even with much more sensitive apparatus than previously used, if the purification of a liquid has been carried far enough to reduce its conductivity to below 10^-12-10^-14 cm^-1. The liquids used were hexane, octane, decane, benzene, benzene, naphthalene, carbon tetrachloride, and a mixture of xylene and carbon tetrachloride. The non-conducting liquids still produce considerable quantities of neutral centres. PA-57-3420


PA-54-4633

H-11. Heinrich, D. O.

"Process of Electroprecipitation" 


CHARGED DROPLET EXPERIMENTS.
11340 C.D.Hendricks, Jr.

The velocity and charge of individual charged droplets of oil accelerated through 12 and 13 kV have been measured. From these measurements, the oil density, and the accelerating potential, computations were made of the charge-to-mass ratio, the mass, and the radius of the droplets. The charge-to-mass ratios were 0.1 to 2 coulomb per gram and the droplet radii were 1 to 10 microns. The charged oil droplets were produced at the point of a hollow stainless steel needle maintained at a high (12-13 kV) positive potential. Rayleigh's theory on the instability of charged liquid drops predicts a minimum limit of charge-to-mass ratio as a function of radius above which the drops become unstable. The minimum observed charge-to-mass ratios of the oil droplets at any radius were found to lie very close to the theoretical curve predicted by Rayleigh's theory. This limit was about a factor 10 below the field emission limit predicted on the basis of Muller's work (Abstr. 518 of 1956) on field emission. PA 65-11346


Experimental techniques for the measurement of charge-to-mass ratios and drop size of electrostatically charged droplets discussed. High potential hollow needles produced electrostatic atomization of octane. Distribution of radii and charge-mass ratio given, as well as distribution of droplet charge. Size was concentrated in 1 to 4 micron range.


Preliminary analysis of space flight trajectories has shown (1,2,3) that electrostatic thrust devices using particles with charge-to-mass ratios in the range of 10^2 to 10^5 coulomb/kilogram would permit achievement of payload optimization quite readily. In addition, beam neutralisation problems would be minimized.

The research discussed in this paper is presently aimed at furthering the general knowledge of charged droplet production and behavior by studying the effects of such physical properties as density, viscosity, conductivity, and surface tension, on the charge-to-mass ratio distribution. In this paper, high speed photomicrographs of surface instabilities are presented and discussed and Rayleigh's theory on the instability of charged(4) droplets is extended to include droplet emission.

Author

H-15. Hendricks, C. D., Jr., and J. M. Schneider


The boundary equations of motion are written in generalized coordinates which describe small departures from the spherical equilibrium configuration of a conducting liquid droplet. It is initially assumed that the actual shape differs only slightly from the equilibrium sphere. The equation representing the surface is, then, written as a series of surface normal harmonics in which the coefficients are shown to be the normal coordinates of the droplet. The frequency of oscillation of the normal coordinates is shown to depend on the total charge on the droplet in such a manner that for all values of charge below a certain limit, the frequency is real. For all values of charge above a certain limit, the frequency is imaginary, and, thus, the droplet is unstable. This paper presents a detailed derivation of a result communicated by Rayleigh in 1882. The results of Rayleigh's communication have been widely quoted but, until now, this particular derivation has not appeared in the literature.

PA-66-14503

H-16. Henriquez, P. C.

A new formula for molecular polarization and molecular refraction. P. Cohen Henriquez. Rev. trac. chim. 54, 674-89 (1955)

CA-29-6117
H-17. Henry, P. S. H.
The occurrence of static electricity in the textile industry, and the ways in which it interferes with production, are briefly described. The general principles of its dissipation are discussed, with special emphasis on the time factor. Brief descriptions are given of the various types of electrostatic eliminators, both of electric and radioactive, used in the textile industry, with references to the commercial apparatus.
PA-57-3436

Two independent types of contact electrification are discussed; the one requiring different surfaces, but not needing friction; the other requiring asymmetric rubbing, but not a difference in the surfaces. It is suggested that the combination of these two effects which occurs when different surfaces are rubbed together (usually asymmetrically) is a contributory factor to the notorious uncertainty of such experiments. It is shown that almost all rubbing processes involve local asymmetry, with the result that like surfaces rubbed together, though such neutral as a whole, are covered with a pattern of opposite charges. A similar effect accounts for the different triboelectric behaviour of surfaces of the same material but different degrees of roughness, and occurs as a complication in the rubbing together of different materials. The part played by asymmetric rubbing between two solids in observed transference of charges to the air is discussed. Experiments are described in which all possible pairs of ten different materials are brought into contact by a method involving the minimum of rubbing. It is shown that the results, with very minor exceptions, are in accordance with the existence of a self-consistent electrostatic series. The separation of charge by the asymmetric rubbing of like surfaces is discussed, and the hypothesis suggested that it is also due to the thermal gradient across the surface, and that it is analogous to thermal diffusion and to the Thompson triboelectric effect in metals. As yet little experimental evidence exists to test this hypothesis, but suggestions are made as to how it might be obtained.
PA-57-3426

A general account is given of the principles used in measuring contact electrification, and of the difficulties due to discharges in air and to unknown contact areas. The nature is discussed of the information which might be obtained from work on this subject, and a list is made of the various mechanisms which have been proposed in the past, together with one new hypothesis. The suggestion is made that these are by no means mutually exclusive, and a simple form of theory is worked out to illustrate how several of them might be expected to operate together.
PA-57-3417

H-20. Henry, P. S. H.
A review. Points discussed include the polarities and magnitudes of the charges generated and the theories advanced to account for the phenomena. The effects of "static" in industry and methods of overcoming it are described.
PA-57-1280

H-21. Hermans, J. J.

H-22. Hewitt, G. W.

H-23. Hinkle, B. L. and C. Orr, Jr.
Describes experiments to determine the effect of aerosol on the aggregation of an aerosol by varying the method of vapor production and by ionizing the air and vapor.
BMI-1-7829
H-24. Hinkle, B. L. et al


Because of the importance of the electrification associated with aerosol particles, an electric field analysis apparatus permitting rapid evaluation of the amount of negatively and positively charged particles in an aerosol by measurement of the lateral deflection of the aerosol stream in an electrical field has been developed. Results obtained thus far have been in excellent agreement with expectation and with the published data of other investigators. The principal advantage of the method presented here is the speediness and ease of obtaining data and the elimination of the need for numerous samples to give statistically accurate results. An equation is presented for the calculation of the average electron charge carried by particles.

PA-57-6089

H-25. Hogan, J. J.

PARAMETERS INFLUENCING THE CHARGE-TO-MASS RATIO OF ELECTRICALLY SPRAYED LIQUID PARTICLES


The problem in this study was to investigate the parameters influencing and the mechanisms involved in the electrical atomization process, i.e., the process by which liquid surfaces are broken up into small charged particles as a result of electrostatic forces. Electrical atomization was studied primarily by measuring the charges, masses, velocities, and charge-to-mass ratios (specific charge) of the particles in the beam thus generated. A theoretical study of the electrical dispersion process is presented. The study includes surface energy measurements of the dispersed system of particles, solution of Poisson's equation and the influence of static charge on the specific charge of the emitted particles, and the influence of the conductivity and temperature of the liquid on the generation of charged particles.

N6-20822, 14-23

H-26. Hopper, V. D.


Movements of oil drops in Millikan's apparatus were photographed at 1 sec. intervals by synchronized sparks. Measurements of the ratio (charge/viscosity) at 3° were made, and the results were compared with Millikan's data. A tabulation giving values of viscosity of air and oil obtained from the results of other workers shows that this is still a major source of error in Millikan's experiment.

PA-52-5415

H-27. Hopper, V. D.

5414. The electronic charge and the oil drop method. V. D. Hopper, D. V. Aust. J. Sci. Res. A, 1, 160-99 (Dec., 1948).—A study has been made of Millikan's oil drop method for determining the electronic charge. Owing to the inaccuracy in the value of the viscosity of air, the value of the ratio e/U has been determined and quoted rather than the electronic charge. Some of the factors which have been found to influence this determination are: (1) the purity of the air; (2) the influence of the field of the hole in the top plate and the layer of oil which collects in the lower plate of the condenser; (3) corrections to Stokes' equation due to the influence of the walls of the apparatus; (4) evaporation of the oil; and (5) impurities in the oil. Data from a study of 47 drops of butyl sebacate, and using Stokes' analysis for the resistance to a sphere moving in a viscous medium, the value

\[ e^2/U = (335 + 0.01) \times 10^{-10} \text{ (e.s.u., } \text{c.g.s.)} \]

has been obtained. This will be increased slightly if Lewis' explanation in Stokes' analysis is applied, but the increase will be \( < + 0.004 \% \).

PA-52-5414


H-29. Hurd, R. M., G. M. Schmid and E. S. Snavely, Jr.

11347. ELECTROSTATIC FIELDS: THEIR EFFECT ON THE SURFACE TENSION OF AQUEOUS SALT SOLUTIONS.

R. M. Hurd, G. M. Schmid and E. S. Snavely, Jr.


Electrostatic fields of up to 7000 V cm\(^{-1}\) were applied across moving interfaces by means of parallel-plate electrodes, and the resulting surface tension changes were obtained by measuring, through a balance linkage, the deflection of mica plates floating on the surface. Surface tension changes (always negative) of up to 0.5 dyn cm\(^{-1}\) were observed in both distilled water and dilute sodium chloride solutions.

PA-63-11347
I-1. Imyanitov, I. M. and A. T. Starovoitov

2166a. THEORY OF ELECTROSTATIC CHARGING OF BODIES
IN AIR CURRENTS. I. M. Ilyanitov and A. T. Starovoitov.
In Russian, English translation in Soviet Physics—Technical Physics
A study is made of the mechanism of electrostatic charging of
bodies in air currents, taking into account the conductivity of the
medium and the corona discharge current. It is shown that the
charging mechanism, in which allowance is made for the contact
potential difference between the body and the particles of the air
stream, is adequate to explain the high potential bound. The values
of the potentials calculated from the parameters of the current
occurring in the atmosphere are in agreement with those acquired
by airplanes in flight.

PA-66-21668

I-2. Ingraham, J. C. and S. F. Philip

13010. EFFECT OF SURFACE CHARGE IN ELECTRIFICATION
MEASUREMENTS. J. C. Ingraham and S. F. Philip.
Although the volume charge distribution in a homogeneous
substance decay exponentially with time, in general this will
not be true at the electric field above a free surface of the substance,
due to the formation of surface charge. This must be taken into
account when the electric field on the sample is selected as a
measure of the electrification, or the decrease of these quantities
as a measure of the time constant of a charged sample. The forma-
tion of surface charge during charge relaxation is considered in a
simple one-dimensional case. The contribution made by surface
charge to the surface potential and electric field above the surface
may be large for grounded objects, such as a probe or field meter,
if not the surface.

PA-64-13010

I-3. (The) Institute of Physics, London

This contains the papers read at a conference held in
London in March, 1953. They are arranged
under four headings: General principles; Useful
applications; Electrostatic machines; Harmful static
electrification. For abstracts, see Abstr. 3415-16,
3420-1 (1954).

PA-57-3413

I-4. Irani, R. R., C. F. Callis and I. Liu


I-5. Israel, H.

"Messgerate und Arbeitsmethoden bei lüftelektrischen
untersuchungen Übersicht." Arch. für Tech. Messen.

I-6. Israel, H.

3274. Dust Electrification. H. Israel. Zeits. f. tech. Phys. 9, 8,
The theory of charging on dust electrification [see Abstract 410 (1928)]
is discussed, and experiments with numerous substances are described
which extend its scope and show that it is applicable, not only to material
of one kind, but to different substances when brought into contact with
each other.

PA-31-3274
J-1. Jacobi, W.
—Unipolar charged aerosols of high dispersity (particle diam. 0.1-3.0 μm) are forced by emission of lead lamps. Bin distribution and clump formation are analyzed by means of the electron microscope and electron diffraction. Especially the unipolar aerosols used by Drummond, et al. (10 Jahre Forschung auf dem physikalisch-medizinischen Grund-gebiet) 1951 (C.A. 35, 2771) are discussed.

Author

Operating apparatus for the formation of an electrically charged aerosol. Walter Jaeger and Louis F. Weber (In Hydro-Zone S.A.). Brit. Pat. 278,330, May 1, 1951 (Cl. 84). A potential difference of at least 100 v. is maintained between a jet of conducting material and a spark electrode situated near the jet. The stable electrically charged aerosol is produced by blowing fluid through the jet at an air stream.
CA-46-1896c

ELECTRIFICATION OF THE DUST OF NaCl AND KCl
WHEATERS.
The dust of NaCl and KCl ordinary monocrystals shows greater charge per particle surface area than the dust of whiskers of these materials. The main reason is a greater cleavage surface of monocrystals than the cleavage surface of whiskers. The electrostatic properties of the dust are also influenced by the presence of contaminations in the crystal.
PA-65-14615

"Charging and Removal of Surface-Condensed Particles for Colloid Propulsion."
Since the report on a "Heavy Particle Source" was given last year, the work at this laboratory has been concentrated on the charging and removal of particles so formed, (i.e. by condensing metal vapors on surfaces in vacuum). The necessary apparatus has been designed and constructed for charging, accelerating and measuring the electrical properties of charged particles having any charge to mass ratio. The apparatus is based on the measurement of the time of flight of charged particles, where the flight is initiated by the application of a high voltage pulse and completed at a charge detecting device. Maximum detector sensitivity has been obtained with an electron multiplier structure as the target.
Author

J-5. Johnson, C.
23837 PRODUCTION OF LIQUID DROPS.
C. Johnson
A photographic study of drop formation from a hypodermic steel needle when the needle is at a smooth potential of 4 kV. The application of this potential decreased the size of drops to such an extent that to the naked eye they appeared as a continuous jet, the frequency of drops being increased from 3-4/sec to 300/sec. Qualitative explanation of photographs suggests that electrostatic forces opposing surface tension at surfaces of high radii of curvature weaken the area, causing increased flow, thus creating a sharp nosed filament, necking and subsequent small drop formation.
PA-66-23857

J-6. Johnson, V. A.
"Electrets, Part I. A State-of-the-Art Survey."

J-7. Johnstone, H. F.
CA-52-15282d

J-8. Jones, J. H.

1974. Influence of Surrounding Medium on Frictional Electricity. J. H. Jones. (Phil. Mag. 80, pp. 1160–1177, Nov., 1925)—The rubber was mounted on a disc carried by the shaft of a motor and the specimen held in contact. Both disc and specimen were encased in an air-tight vessel so that the effect of various gases and liquids could be observed. A modified quadrant electrometer with slate needle was used to measure the potential. Better results were obtained with a conducting disc than with an insulator. If a metal is rubbed in air the potential is low; the introduction of coal-gas, H_{2}, or CO gives rise to rise, and rise again. The introduction of SO_{2} causes the potential to rise, whether it is high or low in air. The potential of the metal is increased by the presence of a liquid of appreciable conductivity. The effect of a liquid insulator increases with rise of temperature up to a certain point, when the insulation appears to break down. The temperature of the rubbed metal rises almost in proportion to its potential. PA-29–574

J-10. Jones, W. H.


An important factor in the handling of dust is the fact that the particles will adhere to each other and to solid surfaces. The mechanism by which this takes place is discussed and some quantitative results are given. It is shown that the intermolecular forces between the surfaces in contact is large enough to account for this phenomenon of adsorption, although in some cases electrical forces and other processes may operate giving considerably greater attraction. An application to dust sampling problems is also mentioned. PA-56–1283

J-12. Junge, Ch.

"The Size Distribution and Aging of Natural Aerosols as Determined from Electrical and Optical Data on the Atmosphere." J. Meteorology 12, No. 1, 13 (1953).

A first attempt at surveying the complete size distribution of natural aerosol particles is made. The size range covers more than three orders of magnitude in radius, with approximate limits of 10^{-10} and 5 \times 10^{-2} cm. Previous only parts of this spectrum had been carefully investigated due to the cost involved in the various experimental methods used. Particle spectra show, for instance, below 10^{-10} cm are well known, having been obtained by direct count under the microscope, but above 10^{-10} cm are counted in the dust counter, but their size distribution can only be determined from mobility measurements on these particles which are charged. However, to deduce nuclei spectra from ion spectra, the fraction of charged particles must be known. Previous determinations of this fraction are small and are shown to contain considerable errors. The expression derived here is based completely on the ion spectra into nuclei spectra. The particle size range between 10^{-10} and 10^{-2} cm has been investigated by direct measurements, because of the experimental difficulties encountered. Valuable informations can be gained here from the dependence of the scattering on wavelength.

The available data seem to indicate that the maximum nuclei concentration is located in the size range between 10^{-4} and 10^{-1} cm radius, and that the number concentration drops to zero between 10^{-2} cm and 10^{-1} cm radius. The size range greater than 10^{-1} cm can be well approximated by a power law which seems to hold for large parts of the world. It can be shown further, where some nuclei counts or other electrical data are available from a large number of stations all over the world, that the average radius of all particles decreases when the total number decreases. This can be explained by coalescence processes.

It should be emphasized that the results obtained in this article are to be considered as rough but approximate, valid only for average conditions in time and space. More detailed information is needed to improve our knowledge of this field.

Author

J-13. Jutzi, Werner


Researches on electric charge, determining magnitude and sign. Quantity, turbidity, titanium dioxide, and ammonium chloride-air systems. Tables, graphs, diagrams, photographs, micrographs. 63 ref. BM 3–15530
K-1. Kachurin, L. G. and V. I. Bekryayev

AN INVESTIGATION OF THE PROCESS OF ELECTRIFICATION OF CRYSTALLIZING WATER.


In Rassian.

The charge division that occurs near the boundaries of a phase transformation in a substance is an important factor in problems of atmospheric electricity such as lightning protection of transmission lines, radio noise elimination etc. Experiments are described in which a drop of water is held on a wire loop and lowered into a central shaft b. a thermostat whilst remaining at the focus of a microscope, the microscope being connected with a cine camera. The other end of the wire is joined either to an electron micro or, via an amplifier, to an oscilloscope. Photographs show the stages of crystallization and bursting of a drop. Some drops burst on crystallization and produce a significant charge, others do not. A table gives the charge of 70 bursting drops of 0.2 to 2 mm diameter at -3 to +10. The results are of the same order as obtained for thunder clouds.

PA-63-10858

K-2. Kay, K.


CA-61-1186c


COMBINATION COEFFICIENTS OF IONS AND NUCLEI.


Values of the ion-nucleus combination coefficients $a_{ij}$ are calculated for various values of the nuclear radius and are compared with experiment. It is shown that the use of the coefficient $b$ in the equation $q = bN$ when equilibrium is absent, does not entail serious error. Values of the coefficient $b$ are deduced by obtaining the curve $W_{pp}$ from the application of the Boltzmann law. The combination coefficients of charged and uncharged nuclei to the size range, radius $> 3 \times 10^{-8}$ cm, are obtained in two ways with satisfactory agreement.

PA-65-22164


CHARGE EQUILIBRIUM IN AEROSOLS ACCORDING TO THE BOLTZMANN LAW.


The consequences are examined of treating charged aerosol particles as having an excess energy due to their charge and applying the Boltzmann distribution law to their equilibrium with small ions. The results are found to be in agreement with the available experimental determinations in the range $4 \times 10^{12} < r < 14 \times 10^{12}$ cm. For radii greater than $3 \times 10^{12}$ cm a simple formula is established: $2N_{r} = rV_{r}$, where $V_{r} = (2\pi kT/r)^{3/2}$. For large particles, it is found that the average number of elementary charges per particle is $\approx (2\pi kT/r)^{3/2}$ and that the average charge per particle is $2\pi kT/r^{2}$. It is shown that the average electrical energy per particle is $1 \times 10^{-5}$ and that equipartition exists between the electrical and mechanical degrees of freedom. Simple formulae are deduced for the ratio of the various combination coefficients of particles and ions. These are found to agree for large particles with formulae for combination coefficients established by Harper, Purvis, Brice and Gunn. For large particles a difference formula of the Whipple type is found to hold approximately, but the difference is one-half that proposed by Whipple for smaller particles. A new way of arriving at combination coefficient ratios by a consideration of the distortion of ionic trajectories is described and found to give satisfactory results for large particles when the effect of image charges is taken into account. For particles and combination nuclei less than about $10^{-8}$ cm in radius, difficulties arise in solving the equation for coefficient ratios. The implications of the apparent inapplicability of the Boltzmann Law to very small particles are discussed.

PA-63-7073

K-5. Kitaev, A. V.


A method has been proposed for the calculation of the vibrational partition function, based on the use of special functions set up in a similar way to the usual exponential functions. Assuming a finite limit to the sets of vibrational and rotational quantum numbers the proposed method has been used to calculate the partition function of a non-linear polyatomic molecule without degenerate vibrations and internal rotations.

Author

K-6. Kitaev, A. V.

KITAEV, A. V.

R-4212. Unipolar electrification of aerosols in the field of the corona discharge. Vremeh Sver’el’, Akh., 2, no. 9, p.127-131, September, 1957. (139p.)

TM 4-252
Ion and electromagnetic spectrometry. A. V. Kitaev and L. N.
CA 61-1365h

K-8. Kita, S.
211. THE GENERATION OF STATIC CHARGE ON HIGH
POLYMER. S. Kita.
The generation of static electricity by the contact and separation
between high polymer substances and metals was studied. The
combinations: polyethylene-Pt, polyvinyl acetate-Pt, and
polyethylene-Pt were examined. It was observed that the surronding
conditions have serious effects on the quantity and sign of the static
charge generated. A mechanism of generation of the electrostatic charge
has been proposed assuming the energy levels of the localized electrons
on the surface of high polymer substances and the charge of these energy
levels on the absorption of different gases. It was estimated that work
functions for Pt, polyethylene, and polyvinyl acetate are 4.0, 5.6, and
5.0 eV, respectively.
PA-62-12199

Induction of electric charge with poorly conducting liquids
CA 61-319e

Electrodynamics in the petroleum industry. Edited by A.
KLINKENBERG and J. L. VAN DER MINNE. (Amsterdam:
This, so far as the reviewer is aware, is one of the first full-
length books on the subject of "static" that has appeared in
the English language. It deals, however, exclusively with
one branch of the subject—that concerned with the separation
of charge when a liquid of low electrical conductivity is dis-
turbed in contact with other material; and its relation to safety
in the oil industry. This it does extremely well, with a
precision and clarity that contrast strongly with that of most
literature on "static" to be found in industry's journals.
Indeed, the reviewer finds this book hard to fault.
After an introductory section of four chapters which, in effect,
summarize the whole book (a novel scheme, but
admirable where appropriate), and a further chapter ex-

K-11. Kluge, W.
1618. Excitation of Frictional Electricity between Metals and
Non-Conductors in Relation to the Pressure of the Surrounding
An apparatus is described by means of which the electrical properties
of platinum, gold, and palladium foil were measured in a high vacuum
chamber. A high vacuum was obtained by means of a pump, and the gas
pressure was measured by means of a manometer. The electrical
properties of the metal were measured by means of a high vacuum,
the resulting voltage of the foil, and the electrical state of the foil. In
a high vacuum the polarity of the foil is always reproducible, and the
normal polarity of these metals is negative in the conditions mentioned.
The amount of the charge due to the foil's mutual repulsion
depends on the surface condition of the metal, it is very small at
atmospheric pressure, increases in a vacuum, and is further increased
when the foil is heated to redness. When air is again allowed to
surround the metal, the latter returns to its previous condition. A temporary
positive polarity of the platinum is ascribed to the presence of a
Gaseous State.
PA-32-1518

K-12. Knapp, K.
Collective paramagnetism and volume of magnetic susceptibilities. K.
Knapp. (Universität Tübingen, Tübingen, Ger.) Z.
Elektrochem. 54, 225-246 (1954):
Das Verfahren der magnetischen Teilchengrösstenmessung mit Hilfe der Langmuir-Chemie. Theor />
kollektivparamagnetische Paritäten. K. Knapp. (Universität Tübingen, Ger.) Z.
Elektrochem. 54, 225-246 (1954):
Elektrochem. 54, 225-246 (1954):
Elektrochem. 54, 225-246 (1954):
Elektrochem. 54, 225-246 (1954):
K-13. Knoblauch, O.
"Versuche über die Berührungselektrozität"
("Experiments on Contact Electricity")

K-14. Kolbe, F.
"Try Lurgi Dust Precipitator for L. D. Process"

K-15. Kolm, A.
Shows that electric conductivity of irregular bodies and microsphere particles may be measured by finding conductivity of a solution in which they experience an electromagnetic force.
Diagram.
MB-2-3633

"Negative Wire Corons at High Temperature and Pressure."

K-17. Končar-Djurdjerić, S; L. Caso; D. Vukovic
"Influence of Certain Factors of Fluidization on the Electrification of Particles."
Le phénomène d'électrisation des corpuscules pendant la fluidisation par le gaz est étudié en mesurant la différence de potentiel entre l'électrode métallique immergée dans le lit fluidisé et la grille au fond de la colonne.
On étudie l'effet du débit de l'air, des constantes électrique et de la composition du mélange des corpuscules. Malgré la grande complexité apparente du phénomène, on a trouvé des relations simples entre les facteurs en jeux.

K-18. Konorski, B.
601. CERTAIN PROPERTIES OF THE ELECTROSTATIC FIELD OF TWO SPHERES. B. Konorski.
Arch. Elektrotech. (Berlin), Vol. 43, No. 4, 225-49 (1957).
In German.
A detailed mathematical analysis of the classical problem of the spatial field determined by two charged spheres at a finite distance apart. The method is worked out fully and values for the field strength and induced charge are tabulated for a range of values of all the relevant parameters.
P-61-601

K-19. Konorski, B.
1344. LIMIT ANGLES IN THE ELECTROSTATIC FIELD OF TWO SPHERES BEARING CHARGES OF OPPOSITE POLARITY.
B. Konorski.
In Polish.
On the sphere bearing larger charge a circle determines the limit between field lines ending at the other sphere and those going to infinity. The solid angle corresponding to the circle is calculated first for a simple case of a point and a sphere, then equations for the general case are established and applied to numerical examples.
P-60-1244

K-20. Koszman, I and J. Gavis
"Development of Change in Low-conductivity Liquids Flowing Past Surfaces."
Abstract—A theory, developed earlier by the authors, which describes change generation in the turbulent flow of low-conductivity (hydrocarbon) liquids in tubes, is recapitulated. The theory is extended, by use of well known correlations of turbulent mass transfer, into a form which may be easily tested experimentally, and from which engineering predictions may be made. The charging current is shown to be a universal function of a dimensionless group—four times the square of the tube radius divided by the product of the kinematic viscosity of the hydrocarbon, its relaxation time and the seven-fourths power of the Reynolds number—which turns out to be related to the ratio of the laminar sublayer thickness to the diffuse double-layer thickness in the liquid. If small enough values of this group the current can be predicted by the theory, for larger values of the group the theory is unable to predict the current. The highest value of the dimensionless group where the theory can predict the current must be obtained experimentally.

See Also, Univ. of Illinois, Kraeser, H. F., AT 11-1 276 (AEC).
CA-49-3443f

"Collection of Aerosol Particles in Presence of Electro-Static Fields."

K-23. Krajewski, J. and S. Herszderfer

Krajewski, J. and Herszderfer, Szemom.

THE ELECTROSTATIC ENRICHMENT OF COALS, PT. II (Wyzagaczanie Elektrostaticzne Węgla, cz. II) tr. by Igancy Chmucki. 1954 [30p.], 12 refs. [PL-600].
Order from OTS 80, 50.
60-21280

Tran. of Glowny Instytut Gornictwa. [Kowalskii] (Poland) 1952, no. 121, p. 3-21.

DESCRIPTIONS: *Coal, Poland, Particles, Separation, Electric potential, Electrostatic fields, intensity.

To test the suitability of the electrostatic method for the enrichment of coals from Upper and Lower Silesia, investigations of the conditions of enrichment were made with an electrostatic separator of the author's design. The investigations were aimed at determining the influence of parameters of field intensity, humidity, and grade sizes. Coals from fourteen collieries were tested. Graphs were drawn of enrichment as a function of electric potential. Comparison was made between the results of enrichment and of enrichment in heavy liquids. A diagram was constructed of coal yields as a function of the concentration of the raw coals. The relationship was determined between the results of enrichment and the grade of concentration of the raw coals, of coal humility, of grade above and of the immunity of the electrostatic fields. 76-684

K-24. Krajewski, J. and S. Herszderfer

Krajewski, J. and Herszderfer, Szemom.

ELECTROSTATIC SEPARATION OF COALS (Wyzagaczanie Elektrostaticzne Węgla) tr. by Jerry Grzeszkowski. 1960 [70p.], 2 refs. [PL-460].
Order from OTS 80, 50.
60-21280


DESCRIPTIONS: *Coal, Poland, Particles, Separation *Electrostatics, Minerals, Electrical properties, Conductivity, Hydrogen

Tests on electrical conductivity of petrographic types of coals and associated mineral matter were made with a view to obtaining some data for electrostatic separation of coal dusts. The tests were carried out on polished prisms of individual petrographic types of coals and mineral matter as well as on granules of the same samples of bright coals. Differences have been found in electrical conductivity of individual petrographic types of coals and of contaminating mineral constituents; the differences being particularly great for fusain, as compared with vitrain, clarain and durain. Considerable differences were also found in electrical conductivity of coals with low and high hydrogen content.

78-684

K-25. Kunkel, W. B.


See Abstr. 7223 (1950). Attention is drawn to earlier work [Whiting, Phy. Rev., 28, 127 (1926)] which is in agreement. Kunkel gives added explanation.

PA-54-2656

K-26. Kunkel, W. B.


The interaction of small particles suspended in air with the ions normally produced in the air is discussed. The neutralization of highly charged dust particles, if suspended in air, is treated in detail. The result is found to be in qualitative agreement with experiment. The special case of fast equilibrium is investigated. It is found that multiply-charged particles should be present in an appreciable number in coarse aerosols at all times. This is confirmed by experiments both for normally charged quartz dust and for naturally neutral ammonium chloride smoke. The general nature of the equilibrium charge distribution is presented. Charges up to ten electron units are found to be not uncommon.

PA-53-7224

K-27. Kunkel, W. B.


An extensive study of the charge and size distribution of particles from 0-5 to 50 microns radius in dust clouds of various types dispersed in air under a variety of conditions ranging from blowing with minimum of turbulence to conditions of violent and maximum impact with various types of surfaces was made using adaptations of the Hopper and Laby modification of the oil drop experiment. It was observed that all dusts, including homogeneous dusts with no impacts on solid surfaces, were charged. In homogeneous systems the charges of opposite sign were equal, no net charge resulting, the number of particles of similar size with opposite charges being about the same. The magnitude of charges increased somewhat less rapidly than the surface of the particle. There was no correlation between size and sign of charge. In aerosols there is strong evidence that charging occurs on separation of the contacts between particles in the dispersion of the cloupl. Humidity did not affect the charging. Studies of heterogeneous systems make contact with solid walls of different composition from the powder gave consistent asymmetry of charge of varying degrees depending on the proportion of particular striking the surfaces relative to that just separated.

PA-53-7223
K-28. Kunkel, W. B.

Growth of charged particles in clouds.

In order to calculate the average growth of a charged particle in a dust cloud caused by electrostatic attraction, the following assumptions were made: the particles obey Stokes' law of motion, their velocities are small so that their motion can be considered to be in constant equilibrium with the forces acting, and the forces are effective at short ranges only if the cloud density is small enough so that not more than two particles have to be considered interacting at a time. In addition to the Coulomb force, there will appear an attraction between particles resulting from induced dipoles, but it was found that in general the effect of this force can be neglected. Straightforward integration of the equation of relative motion of two charged dust particles yields their effective cross-section for aggregation from which in turn can be determined the rate of growth if the particle size and charge distribution in the cloud are known. Assuming a highly simplified distribution, one arrives at the result that aggregation is negligible if the cloud density is 

K-29. Kunkel, W. B. and J. W. Hansen


An apparatus is described by means of which the size and the charge of large numbers of electrostatic particles can be simultaneously determined. The method is based on Hopper and Lany's work on the determination of the electric charge, i.e., horizontal deflection of particles settling under gravity recorded photographically. The procedure is relatively simple and the nature and limitations of the general results are discussed. Simplicity of operation and design are emphasized to render the instrument a workable tool in industrial research.

K-30. Kuz'min, D. V.


Dielectric moments of dielectric and semiconducting particles are considered. The plane difference between the alternating field and the dipole moment is calculated.

PA-52-1021

PA-53-6488

PA-60-1253
L-1. Ladenberg, R.

L-2. Ladenberg, R.

L-3. Lagarias, J. S.
"Discharge Electrodes and Electrostatic Precipitators." Air Pollution Control Association No. 59-51 (1959).

L-4. Lakey, J. R. A. and W. Bostock

L-5. Lam, S. H.
4529 A General Theory for the Flow of Weakly Ionized Gas. A general theory is developed for the flow of a weakly ionized gas about an arbitrary solid body with discharging surfaces. The method adopted is the prediction of the electrical properties of the body as a function of the pertinent properties of the flow. The theory is based on continuum formulation. Discharge models and results are obtained for the discharging potentials and the current-voltage characteristics. - S. H. Lam, AIAA journal, v. 2, Feb. 1964, p. 256-262.

L-6. Landolt, P. E.

L-7. Landolt, P. E.

L-8. Langer, G. and J. L. Radnik

L-9. Large, M. I. and E. T. Pierce

Since Franklin's experiment meteorologists have known that in1 atmospheres the electric field near the earth's surface can be intense enough for point-discharge currents to flow from raised points. C. T. R. Wilson (1928) was the first to suggest that these point-discharge currents might be extremely important in the exchange of electricity between the earth and the upper atmosphere, and this suggestion has been investigated and confirmed by subsequent workers in atmospheric electricity. Point-discharge is also a familiar phenomenon to electrical engineers, who usually call it corona discharge. Both and his associates have done a great deal of work on discharge in a point-to-plane gap in air at atmospheric pressure. While meteorologists have been mainly concerned with the magnitudes of point-discharge currents, electrical engineers have investigated in more detail the mechanisms of the discharge, and they have shown that the current is often made up of a series of pulses.

It is the purpose of this paper to show that many of the effects observed in nature and experiments on corona discharge are apparent in natural point-discharge at elevated voltages, and that much of the information gained by electrical engineers may be applied directly by meteorologists to the natural point-discharge.
L-10. Latham, J.
1958 ELECTRIFICATION PRODUCED BY THE ASYMMETRIC RUBBING OF ICE ON ICE. J. Latham.
Experiments showed that when an ice specimen is allowed to slide over an ice surface the specimen became hotter than the surface and acquired negative charge; the charge separation was proportional to the temperature difference created. The magnitude of the electrification is independent in terms of the Latham-Mason theory of charge transfer associated with temperature gradients in ice.
PA 66-19158

L-11. Latham, J. and B. J. Mason
GENERATION BY ELECTRIC CHARGE ASSOCIATED WITH THE FORMATION OF SOFT HA' LIN THUNDERCLOUDS. J. Latham and B. J. Mason.
The electrical charging which results from collisions between ice crystals and a suspended halite in measured as a function of their temperature difference, and of the size and impact velocity of the crystals. It is found that the sign of the charging is governed by that of the temperature difference, the halite becoming negatively charged if it is warmer than the rebounding crystals. The magnitude of the charging is proportional to the temperature difference but radii insensitive to the size and impact velocity of the crystals. With a temperature difference of 5 deg C., a rebounding crystal of diameter about 12, produces, on average, a charge of 5 × 10^-9 e.s.u. The electrification of 20 articulate, pelleted of soft had growing by the accretion of supercooled water droplets (fuming) is also investigated. Freezing of the droplets on the halite as accompanied by the ejection of positively charged ice splinters, the halite acquiring a negative charge. The manner in which the size of charging and splinter production vary with the air temperature, drop diameter and impact velocity has been established. In a typical experiment, with the air temperature at -12 °C and droplets of diameter 80 µm impacting at 10 m/sec to produce, on average, 12 splinters and a charge of 4 × 10^-9 e.s.u. per drop. Droplets of diameter less than 10 µm produce few splinters and little charging. The results of both sets of experiments are interpreted in terms of the author's theory of charge separation in ice under the influence of a temperature gradient, and are used to calculate probable rates of charge generation in thunderclouds. It appears that the electrification which accompanies the growth of pellets of soft hail through the freezing and splintering of supercooled droplets is capable of generating and separating charge at the required rate of about 1 C/km² sec-1 but, while rebounding ice crystals will usually charge the halite in the same negative sense, this mechanism will contribute only slightly to thunderstorm electrification.
PA 64-20835

L-12. Latham, J. and B. J. Mason
ELECTRIC CHARGE TRANSFER ASSOCIATED WITH TEMPERATURE GRADIENTS IN ICE.
J. Latham and B. J. Mason.
The development of electrical potentials in ice crystals under the influence of temperature gradients is investigated both theoretically and experimentally. The maintenance of a steady temperature gradient across a piece of ice is accompanied by concentration gradients of H⁺ and OH⁻ ions; because of the much greater mobility of H⁺ ions, these diffuse more rapidly into the ice. As the temperature at the tip of the crystal increases, there is a potential difference between the two sides of the ice crystal. This effect predicts a surface density of charge on the ends of the ice of 1 × 10^-13 C/cm² s.e.u. and a potential difference across a uniform specimen of about 2.3 mV, where 2.3 is the temperature difference across the ends. These values are quite well confirmed by a series of experiments on specimens of highly purified ice. When two pieces of ice of initially different temperatures are brought into temporary contact and separated, the warmer acquires a negative charge and the colder an equal positive charge. The theory indicates that a maximum charge transfer of 3 × 10^-13 C. s.e.u. cm² should occur with a contact time of about 0.01 s and that it should thereafter decline as the two pieces of ice become more nearly equal in temperature. The theoretical value for the charge developed for a contact time of 5 × 10^-1 s is well confirmed by experiments which show that very little charge separation occurs if the contact period exceeds 1 s. Experiments in which the ice was contaminated with carbon dioxide, hydrochloric acid, and sodium chloride in concentrations of up to 50 times that normally present in rain water, showed that the electrification was not greatly influenced by these impurities. These phenomena are thought to be of basic importance in the generation of electric charge in thunderstorms. This aspect is developed in the following paper.
PA 64-26834

L-13. Lebedev, N. N. and I. P. Skal'skaya
1964 FORCE ACTING ON A CONDUCTING SPHERE IN THE FIELD OF A PARALLEL-PLATE CAPACITOR.
N.N. Lebedev and I.P. Skal'skaya.
The electrostatic problem of determining the charge and force on a conducting sphere in contact with one of the plates of a parallel-plate capacitor is treated mathematically and solved.
PA 66-19144

L-14. Lenard, P.
LENARD, Philipp.
Order from SLA $5.60 63-1856.
Trans. of [Annalen der Physik] (Germany) 1899, v. 46 [p. 564-568].
DESCRIPTORS: Atmospheric electricity, Water, Hydrodynamics, Air.
T1-1470

L-15. Lever, R. C.
ELECTRICAL ANALYSIS OF PAINTS FOR ELECTROSTATIC DEPOSITION.
CA 61-4591d

L-16. Levich, V. G.
B ref. BM 1-6500
L-17. Levin, L. M.

Order from LC or SLA suppl. 80, subj. 80, 59-129081


Reasons are presented for believing that the results obtained by E. Gans (1. Metrolog. 1: 562, 1955) for cloud drops with radius greater than 20µ are erroneous.

TM 4-413

L-18. Levin, L. M.

2570. THE COAGULATION OF CHARGED CLOUD-DROPS.
L. M. Levin.

The logarithm and statistical theories of the formation of precipitations are reviewed. The author discusses two oppositely charged drops, and a large charged drop with a smaller uncharged one. It is concluded that for the charged droplets with differences of 4 to 20µ, the capture coefficient is quite large which ensures coagulation of the droplets. With one droplet very large, compared with another, the effect of these electric charges upon coagulation may be negligible. In rain-drop traps the precipitation on a receiver plate is almost independent of the charges on droplets and on the trap.

TM 4-450

L-19. Levin, L. M.

LEV1N, L. M.
R-2738. The coagulation of charged cloud-drops and size distribution for cloud-droplets and rain-drops.

TM 4-156

L-20. Levin, L. M.

LEVIN, L. M.
A28-FIXED. Precipitation of particles from an aerosol stream on obstacles.

TM 4-518

L-21. Levine, S.

5146. The free energy of the double layer of a colloidal particle and the charging process. S. Levine.

A detailed analysis is given of the alternative charging processes used by Verwey and Overbeek and the author to determine the free energy associated with the electric double layer of a colloidal particle. A general statistical proof of the equivalence of these methods is obtained. It is shown that the sum of the different charging processes is equivalent to assuming an additional, hypothetical, thermodynamic variable to describe the colloidal system; this can be simply interpreted as an arbitrary "chemical" potential of the ions adsorbed on the particle surface. The expression for the free energy derived by Verwey and Overbeek is extended to apply to more general cases, and the treatment by these authors of the so-called chemical energy is clarified.

PA 56-5161


3415. RELATION OF CHANGE TO FRICTIONAL WORK IN THE STATIC ELECTRIFICATION OF FILAMENTS.

A study of the generation of electrical charge on fibrous materials was carried out using the apparatus of Hether and Montgomery, in which a fibre is held fixed in an insulating lower yoke while a second fibre in a grounded upper yoke is rubbed across it under controlled ambient and mechanical conditions. The original apparatus was modified to permit measurement of the frictional work of rubbing as well as the charge. Precautions were taken to discharge both fibres with a radioactive source after each measurement. It was found that, at any one velocity, several thousand rubs were required before steady values of charge transferred and frictional work of rubbing were obtained. It was also found that the velocity of rubbing affected strongly both the charge transferred and the frictional work of rubbing, the former being found to decrease and the latter to increase with increasing velocity. This has been explained in terms of local heating, plastic deformations, and material transfer which occur during rubbing. An empirical relationship relating the velocity of rub, the frictional work of rubbing, and the charge transferred was found to hold in the great majority of the cases examined. From the experimental data obtained it was possible to calculate the mechanical energy expended in any one rub and to estimate the resulting electrical energy. Thus, for any pair of fibres under a given set of conditions it was possible to calculate the efficiency of the process of converting mechanical energy to triboelectrical energy. At 25°C and 37% R.H., measured efficiencies were very low (0.00-0.42%); at a very low humidity, efficiencies as high as 0.5% were found. The presence of a lubricant on the fibre surfaces during rubbing was found in most cases to cause a decrease in both the charge and frictional work of rubbing.

PA-6-3116

L-23. Lewandowski, H. G.

L-24. Lewis, O. C. M.

4471. Electric Charge on an Oil Droplet in an Emulsion. W. C. M. Lewis. Faraday Soc., Trans. 28, pp. 697-701, July, 1932.—The total electric charge density on an oil droplet in an emulsion is calculated on the basis of a balance between the inwardly directed capillary pressure and the outwardly directed dielectrophoretic pressure. On the basis of the existence of an electrical double layer of constant dielectric capacity, expressions are obtained, essentially the same as those derived by Knapp (see Abstract 1438 (1923)). The charge density is shown to be independent of the size of the e-p., i.e., a polycrystalline system is therefore possible as an equilibrated system. Comparison of the total charge with the mobile charge responsible for electrophoresis shows the latter to be only a very small fraction of the former even under the most favorable conditions for electrophoretic movement. In view of the mechanism postulated in the above treatment for the attainment of charge, etc., by the adsorption of ions from the continuous medium, it is concluded that the treatment does not apply to those cases, e.g., colloidal electrolytes, in which the charge has its origin in surface ionization of the colloidal material itself. An examination of the electric bubble case indicates that the surface conditions are very different from those at an oil-water interface, the electrophoretic or electrophoretic charge apparently accounts for the total charge in the case of the suspended air bubble. An Appendix deals with the pressure inside a liquid droplet suspended in a liquid or gaseous medium.

PA-35-4471


8066. SEPARATION OF AN AEROSOL CLOSED IN A PLASTIC CHAMBER. A. Lieberman and J. Rosinski. J. Colloid Sci. (USA), Vol. 17, No. 8, 816-23 (Dec., 1962).—A series of preliminary experiments were performed to determine the effect of a charged air stream on the surface of a plastic chamber containing an aerosol. The aerosol was tested in a circular plastic chamber at a temperature of 30°C. It was concluded that the wall-to-wall constant for the suspended plastic changes very rapidly at the beginning of the experiment but later as a result of changes in the electric-charge distribution on the surface of the suspended plastic. The possibility of error due to random charge distribution on the surface of the plastic is discussed.

PA-66-8986

L-26. Livensos, A. R.

THE USE OF ULTRASOUND IN AEROSOL THERAPY 17 June 59, 16 p. (8 figs. omitted) 9 refs. PERS L-805-N. Order from OTS $0.50 50-13580


The feasibility of using an ultrasonic atomizer for inhalation apparatus is discussed, after a background review of the mechanisms of ultrasonic fog formation. The experimental atomizer used has an ultrasonic atomizer functioning at a frequency of 800 Kc/sec with a power of 45 w. The ultrasonic atomizer is roughly 10 times as efficient as the jet atomizer tested for comparison in terms of aerosol density and homogeneity. The aerosol charge is always negative. Reference is made to the use of a concave disk of ceramic barium titanate as a focusing device; this emitter must have an angle of open.
L-31. Loeb, L. B.

STATIC ELECTRIFICATION. L. B. Loeb.
A detailed and often critical account of the phenomena with a
comprehensive discussion of recent theoretical interpretations of
electrostatic effects. The following principal subjects are
treated in chapters or groups of chapters: electrostatic charge,
electrostatic processes, contact potential differences, spray electro-
static, electrostatic on solid—solid contact and the generation
of static charges by processes involving ionization of gases etc.
135 references.

PA-61-3415

L-32. Loeb, L. B.

"Experimental Contributions to the Knowledge of
Charge Generation," in Byers, H. R. (Ed.)
"Thunderstorm Electricity." Univ. of Chicago

L-33. Loeb, L. B.

"Recent Developments in the Mechanisms of Positive
and Negative Coronas in Air."

L-34. Loeb, L. B.

The basic mechanisms of static electrification.
An examination of the literature shows that the
theoretical interpretations put forward to explain
static phenomena are, generally inadequate. Five
basic mechanisms are discussed, namely, electrolytic
effects, contact potential mechanisms, spray electro-
static, friction or tribo phenomena, and the segregation
of ions and electrons in gases and flames. It is likely
that these basic mechanisms operate together in any
particular case, but their separate consideration should
help to clarify past results and to guide future work.

PA-49-1075

L-35. Loeb, L. B.

597. Absolute Mobilities of Negative Ions in Air. L. B. Loeb. (Frank.
Inst., J. 196, pp. 557-566, Oct., 1923.)—Although it appears as if the
Rutherford alternating-current method of measuring the mobilities
of negative ions was capable of yielding the greatest accuracy of any
of the methods used, the values of the mobilities thus far obtained by
this means show variations which are greater than are to be expected
from the errors entering into the measurement. Thus in some very careful
measurements made in 1916 Kovarick found a mobility of negative ions
of 2.06 cm fsec. volt/cm.; while the value obtained by Frank and Pohl,
and since then by other workers generally lay close to 1.8 cm fsec. More
recently the writer found that the mobilities of the negative ions measured
directly on photo-electrically generated ions was 2.18 cm fsec., while the
mobilities of the negative ions generated by polonium in an auxiliary
chamber lay close to 1.84 cm fsec., the conditions being otherwise the
same. Investigation showed that the difference in mobility lay in the
use of the gauge and auxiliary field and not in the nature of the ionizing
agent. Various methods are discussed, and it is agreed that the Ruther-
ford method with photoelectric ions is free from many uncertainties
prevalent with the others. The experimental arrangement used is de-
scribed. Its chief defect appears to be the difficulty of obtaining strict
parallelism of the plates. The value of the mobility now obtained in
fields varying from 12 to 50 volts/cm., in frequencies varying from
14 cycles per sec. to 75 cycles per sec., and with plate distance lying between
1.4 and 2 cm., at 760 mm. pressure is 2.18 cm fsec. volt/cm. The greatest
uncertainties lie in the evaluation of the plate distance where the plates
are not quite parallel. This introduces an uncertainty of ± 3 per cent. The
estimation of the voltage intercept is not certain to an accuracy greater
than ± 3 volt. Errors of ± 1 per cent due to timing, of from 0 to ± 2 per
cent on account of the distance gone as an electron and perhaps of ± 2 per
cent. in the conversion and correction of the potentials between the plates
must also be considered. Taking into account the variety of conditions
under which these results are obtained, the mobility of the negative ion
may be stated as 2.18 ± 0.04 cm fsec. volt/cm. in place of the value of
1.8 cm fsec. usually assigned to it. Other work is in progress.

PA-27-597

L-36. Lorenz, P. J.

AIR-ION DENSITIES IN A SMOKE-FILLED ROOM.
P. J. Lorenz.
This study was concerned with the differentiation and
measurement of small, intermediate, and large ion densities in a
sealed room. It was found that the background density of large
negative ions exceeded that of any other class. Under conditions of
tobacco smoke pollution, large ions of both positive and negative
charge were the major components of the air-ion population. This
was accompanied by a persistent attraction of high mobility ions both
during and after smoking.

PA-65-11619
L-37. Lovers, G.
2222. Electrification of drugs. G. Lovera. N. Cimento, 15, pp. 409–414, Dec., 1938.—A review is given of observations since 1885 (see Abstract 1484 (1928)) on the electrification produced in the air surrounding waterfalls and on that noticed when the surface of various liquids is broken. Lovers's theory of the double layer is referred to (see Abstract 1446 (1918)) but the author of the summary regards the subject as a thorny and difficult one which requires further cautious experiment and observation.
PA-42-3223

L-38. Lovers, G. and A. Pochettino
685. Frictional electricity from polar solutions. G. Lovera and A. Pochettino. N. Cimento, 15, pp. 327–341, July, 1938.—An extension of previous work by the same authors (see Abstract 1317 (1928)). A mixture of liquid suspended in an atmosphere of N₂ at 60 mm. Hg is circulated so that it passes between plates connected to an electrometer. The frictional charge is measured by the rate of increase of voltage. The liquid used was dioxane, benzene, xylene, and toluene, and solutions in them of hydrocarbons of appreciable dipole moment. Tables and curves of results are given in detail. The charges were found to depend on the dipole moment. In every case an increase of dipole moment caused an increase of charge. Positive and negative charges were unequal, and the ratio of positive to negative charge was inverse proportional to the dipole moment. Lovers's hypothesis of frictional charges arising from a double layer is held to be disproved, for the present liquids. Instead it is suggested that the liquids have superficially a crystalline structure, and that frictional charges are generated when the crystals are fractured.
PA-43-553

L-39. Lovers, G. and A. Pochettino
1317. Electrification of Liquid Droplets. G. Lovera and A. Pochettino. N. Cimento, 14, pp. 393–410, Nov., 1937.—When a stream of N₂ was blown through a solution of an organic salt, the droplets of liquid passed between two electrodes connected to a Lindeman electrometer, were found to be charged both positively and negatively. The magnitude of the charge varied with the rate of flow of the gas and with the concentration of the solution. The form of the curve of charge against concentration is different for positive and negative charges, and has a number of points, characteristic of the salt, at which the positive and negative charges are equal. For metahydrinic blue and quinine sulphate there are two such points, and for uranin there is one.
PA-41-1317

L-40. Lowe, H. J. and D. H. Lucas
Summarizes the existing theories of the behaviour of particles in an electric field with special reference to the electrostatic precipitation of fly dust in power stations burning pulverized coal. The theoretical relation between particle size and precipitation efficiency is not borne out in practice and an attempt is made to resolve the discrepancy by considering the properties of the particles after they have been deposited on the collecting electrodes.
PA-57-3435

L-41. Luchak, G.
Equations describing the changes with time of the electric charge distribution of coagulating aerosols are solved for lightly charged systems. The solutions are compared with experimental data from the literature on the electric charge distribution of initially uncharged ammonium chloride aerosols and good agreement is obtained. The theory is used to describe qualitatively the change in electric charge distribution of silica dusts previously studied experimentally by Gillespie.

L-42. Lunde, K. E. and C. E. Laplace

L-43. Lundgren, D. A.

L-44. Lundgren, D. A. and K. T. Whitby
CA 61-320f
L-45. Luther, F. E.


An electrostatic atomizer for No. 2 fuel oil developed. As micron MD end up reported, where MD is directly proportional to flow rate. A cone and ring electrode configuration used. Effect of using IC voltage, AC voltage and a combination of these examined.

Author

L-46. Lyubimov, G. A.

Lyubimov, G. A.

BOUNDARY CONDITIONS ON IONIZED GAS-SOLID CONTACT SURFACE. 23 Mar 64 [13p] 7 refs FTD-TT-64-126.

Order from OTS, SLA, or ETC $1.00 TT-64-15338

Unedited rough draft trans. of [Zhelezny] Pril. 1 Matematiki i Tekhniennicheski Plodit (USSR) 1963, no. 4, p. 70-82.

T12-43
M-1. Mackown, S. S., and V. Yough

M-2. Macky, W. A.
1218. Deformation and Breaking of Water Droplets in Strong Electric Fields. W. A. Macky, Roy. Soc. Proc. 133. pp. 565-587, Oct. 1, 1921. Drops of water of radius (r) 0.065-0.28 cm, exposed to an increasing electric field, horizontal or vertical, first become elongated (for this in the case of the largest drops, a field of at least 6000 V/cm is required), and when the field strength rises to 297(V/r) V/cm, unstable. A filament then forms at each end, much larger at the positive, and a discharge passes, a glow or spark being visible in the dark, the luminous effects being such as are characteristic of positive or negative point discharges; the current first passing is of the order of 20 microamperes. When the discharge passes small drops pass away free; the filament, thus reducing the size of the drops. In this way the maximum size of drops in a thunderstorm would be limited, e.g., no drop of r > 0.15 cm can persist in a field of 9000 V/cm. Reduction of pressure, unless near such as causes a spark to pass in absence of a drop, has no effect. [See Abstract 4070 (1920).]

M-3. Macky, W. A.
The method is similar to that used by C. T. H. Wilson and C. J. Taylor (see Abstract 2331 (1924)), save that both plates are connected to the poles of a Wimshurst machine, the potential being adjusted by varying the distance of a point on the negative plate, and that instead of the bubble being placed directly on the wetted plate a shallow cavity was made in the lower plate and the bubble placed on soap solution contained therein. The phenomena are similar to those previously observed, except that the field is sufficient to cause vibrations, the strength for which is the same for a positive or negative bubble, varying inversely as its radius. Thereafter the positive bubble always bursts quickly, but the negative bubble does not usually do so until some protrusion (e.g., splashed soap solution) on the positive plate causes a spark to pass. Photographs of bubbles in various stages are given. Preliminary experiments with water drops indicate that these are distorted in a very similar manner, and that a drop of radius 0.18 cm is disrupted by a field of about 9000 volts/cm.

M-4. Macky, W. A.
Two substances are rubbed together under definite conditions, and the resulting charge is measured. Only minute charges are obtained as the result of simple contact. For given specimens the charge increases with the amount of rubbing, up to a fairly definite maximum. The dielectric strength of the medium in which the experiment is performed is shown to be a very important factor. The experiments do not support the Heimholtz contact theory or Cohen's relation between charge and dielectric constant. References are given to a great deal of recent work on frictional electricity. [See also Abstract 1671 (1928)].

M-5. MacLeod, G. F., and L. M. Smith

M-6. Magarvey, R. H., and B. L. Blackford
Charges induced on drops formed by dispersing small masses of water in a region of an electric field were measured. The induced charge was found to be proportional to the voltage applied to a ring electrode positioned coaxially with the liquid jet from which the drops were formed. The measured values were in good agreement with theoretical predictions. Charges induced on drops in a regular procession were calculated from the current measurements and the drop production frequency. The charge transported by the drops was read directly from a calibrated meter.

M-7. Magarvey, R. H., and L. E. Outhouse
The disintegration of a charged liquid jet is examined, and the breakup mechanism inferred from photographic evidence. Gravitational, molecular and electrical forces all contribute to the segmentation of the jet and determine the drop size distribution. The disintegration process is investigated from the point of view of drop generation. The segmentation of the charged jet differs from the known cases in which an uncharged jet is broken into drops.

M-8. Magono, C., and T. Takahashi
It was found that droplets produced artificially on a thin wire was electrified negatively when the water temperature of the reservoir for supplying water vapour was lower than about 80°C, and positively when the water temperature was higher than about 85°C. The electrification phenomena of the condensate were considered to be originated from the electric charge on individual water droplets, because it was observed that the droplets were electrified when they rose from the water surface of the reservoir, and the sign of charge on the individual droplets agreed well with that of the condensate.

PA-60-15877
PA-35-1318
PA-33-4070
PA-31-2162
PA-61-6865
M-9. Mainstone, P. A.


The investigations of other observers are summarised. The apparatus used was of two types designed to obtain reasonably constant conditions in measuring the results due to very small amounts of mechanical work, and is fully described and illustrated. The materials used were brass, steel and silver, in each case on rubbing contact with glass, and experiments were conducted in air, hydrogen, nitrogen, and in the case of silver in oxygen, at pressures varying from 0.001 mm to a mosterious pressure. The results (a number of which are demonstrated graphically) appear to show that: (1) Where a glass surface is rubbed on metal the charge shows marked variation with pressure, being a minimum over a range of about 1 to 10 mm. (2) At higher pressures the charge varies with the gas. (3) Variation of charge with pressure is independent of the capacity of the system.

PA-33-1539

M-10. Makhotkin, L. G.

Order from ATS 94. 25


TS-410


M-12. Malarski, T.

1899. Influence of Electrolytes on Electrification of Water by Abnormalities. T. Malarski. Acta Physica Polonica, 2, pp. 45-74, 1899. In German.—The influence of thorium nitrate, thorium sulphate, aluminium chloride, aluminium sulphate, b. an chloride and potassium chloride on the electrification of water by abomination, was investigated. The water and solutions were atomised by means of compressed air, the atomised water was allowed to impinge on a platinum plate which was connected with a quadradot electrometer. The results showed that the potential to which the plate connected to the electrometer was charged, depended to a very large extent on the method of preparation and storage of the water. Water distilled from a vessel of Jena glass and a silver condenser gave a much lower deflection of the electrometer than water distilled in an apparatus made of quartz. Curves were given, showing the effects of the various electrolytes on the atomisation potential of water.

PA-38-1850

M-13. Mason, B. J.


CA-58-4335c

M-14. Mason, B. J.


M-15. Mason, B. J., and J. Maybank


The freezing of water drops is often accompanied by shattering of the ice shell and the production of small ice splinters. These phenomena have been studied in relation to the drop diameter in the range 50 μ to 1 mm, the nucleation temperature of the drop, the air content and purity of the water. The number of splinters produced is largely governed by the nucleation temperature (the degree of supercooling) which controls the quantity of air released during freezing and is not very dependent on drop size. Slightly supercooled drops of 1/10 to 1 mm diameter produced, on average, 20 to 50 splinters. The mechanism of drop fragmentation is discussed and the potential importance of splintering in the ice-worner economy of clouds is assessed. Fragmentation of freezing drops is accompanied by electrical charging, usually with the splinters positively charged and the drop residue carrying a negative charge. The magnitude of the residual charge which, on average, is observed to be about 10⁻¹° ε.s.u. for a 4 millimetre drop, is related to the same factors which control splinter production. Charging by this mechanism would not appear to be of major importance in the electrification of thunderstorms.

PA-64-20832

M-16. Masters, J.


Described is a simple device for measuring the total mass and total charge of a powder cloud. The instrument consists of a sensitive electrometer circuit and a metallic collection chamber. The powder is collected on a filter paper sealed between two aluminium tubes which, if their lengths are three times greater than their diameter, provides sufficient shielding of the charge collected on the filter paper to justify assumption of an "ice Fall." The shielding error is less than 0.5%. A null-reading circuit is used with a Cenco electrometer. The necessary counter voltage for the null-reading circuit is supplied by a potential-meter circuit, and a vacuum-tube voltmeter is used to measure the voltage. Because it is desired to obtain
explicitly the mass and charge of a given cloud of particles rather than the ratio of charge to mass, enough mass must be collected for weighing and, in addition, the total charge measured. This is to be accomplished without disturbing appreciably the normal flow rate of powder from the second generator.

PA-56-8744

M-17. McTaggart, H. A.

114. Electrification at the Boundary between a Liquid and a Gas. H. A. McTaggart. (Phil. Mag. 44, pp. 366-366, Aug., 1922.)—In continuation of previous work (see Abs. 1910 (1911)) the author has investigated the electric charges on small spheres of air immersed in an aqueous solution of thorium nitrate. The spheres become positively charged in solutions of the salt as dilute as $8 \times 10^{-8}$ normal. For concentrations in the neighborhood of $8 \times 10^{-8}$ normal, a sphere initially negatively charged becomes gradually positively charged as the sphere decreases in size. A sphere of air immersed in colloidal thorium hydroxide becomes likewise positively charged, and the same reversal of sign of the charge is shown as the bubble decreases in size. It is suggested that the reversal of sign affords evidence of a relation between the curvature of the surface and its adsorptive power.

PA-26-114

M-18. Medley, J. A.


A method is described by which very high charge densities may be measured after separation. The influence of externally applied fields on the apparent electriification is described, and also the electromotive contribution to hysteresis of contact angle.

PA-57-3421

M-19. Medley, J. A.


It is shown that over a range of roller pressures, gaseous discharge imposes an upper limit to the charge density of class, poorly conducting wood cloth or roofing; this can be further reduced by conductors axially to the rollers and designed to concentrate locally the lines of force. Dissipation by conduction back through the material to the point of contact is dissipated from discharge through surface contamination, which behaves as a leaky dielectric in the region of contact. It is confirmed experimentally that electrification rapidly dissipates as the bulk conductivity of the surface agent attains a calculable critical value in practice of the order of $10^{-9}$ cm$^{-1}$ or, when the material itself conducts, as a percentage of the distance which is occupied by the material in the surface. It is suggested that the bulk conductivity of the surface agent should be used as a measure of the electrical characteristics of the material in terms of speed, external dimensions and a direct measurable parameter.

PA-57-3418

M-20. Mercer, T. T.


Sodium chloride particles of sub-micron dimensions, moving in a unipolar ion field, in a region in which there was an externally applied electric field of about $3 \times 10^5$ volts/cm, for a period of time such that the product of ion density and time was about $3 \times 10^5$ sec/cm$^3$, were found to acquire charges that were much greater than those calculated according to the theories of field charging and diffusion charging. The discrepancies between theoretical and experimental values were apparently due in part to the fact that present equations based on diffusion theory are not applicable to initially high charging rates.

The relationship between charge and particle size, for the foregoing charging conditions, was found to be such that the velocities acquired by charged sodium chloride particles due to a homogeneous electric field were at a minimum for particles of about 0.2 micron on a side. Furthermore, for the limited range of sizes studied (few sodium chloride particles greater than 1 micron on a side were encountered) there was only a slow increase in the electrical velocity as the particle size increased beyond 0.2 micron.

It was concluded that the separation of sub-micron particles into discrete size groups by electrostatic means is not generally feasible.

Author


Apparatus for electrostatic charging of particles suspended in an air stream by means of a radioactive cartridge, Firma G. A. Messen-Jaschin, Swiss 343,686, Feb. 15, 1960 (Cl. 12). CA-54-19236b


NAS-14232 Institute for Advanced Studies. School of Cosmic Physics, Dulles (Va).

TABLES AND GRAPHS IN AEROSOL PHYSICS. PART II. NUMBER OF UNCHARGED PARTICLES IN PERCENT OF TOTAL NUMBER OF PARTICLES V. RADIUS AND VELOCITY. Technical (Scientific) Notes no. 15.


(Re Geophysical Bulletin no. 20, ACR-17-514)

For comparative simplicity of measuring the uncharged fraction of an aerosol, the tables give for temperatures of $0^\circ$, $15^\circ$, $25^\circ$, and $32^\circ$, the number of uncharged particles, P, in percent of the total number of particles for the radii: $5 \times 10^{-8}$ to $109.0 \times 10^{-8}$, $0.1 \times 10^{-8}$, and $1.0 \times 10^{-8}$ respectively and the radii as a function of P for each tenth of a percent.

N 62-14252
M-23. Meyer, K. A. G.
Bases of several research in science and engineering.
1931-1942, L. Meyer, K. A. G. Kolbenheuser, NE.
pp. 293-295, March, 1943. - A progress review of
scientific research on aerodynamics with an extensive
bibliography.
PA-48-1102

M-24. Mierdel, G.
"Migration of Dust Particles in Electric Filters." G. Mierdel.
824, No. 1, 1932. - Studies the behavior of ions, particularly in "tube
filters." They are metallic tubes about 28 cm. in dia. and several meters
in length, along the axis of which a wire charged to some 200 volts is fixed,
while the tube itself is earthed. The air to be cleaned is made to stream
along the tube with a speed of 1 to 3 m/sec. The author determines the
migration velocity for models of various sizes, and finds them to range from
40 cm/sec for particles of 60 to 70 μ to 4 - 9 cm/sec for particles of 0 - 0 μ.
These velocities correspond so closely to theory that it is unnecessary to
assume any action beyond the ordinary electrostatic action in calculating
the efficiency of the apparatus.
PA-36-762

M-25. Mierdel, G., and R. Seeliger

M-26. Miesse, C. C.

M-27. Milhoud, A.
Comptes Rendus, 198. pp. 1866-1868, April 30, 1934. - Experiments are
described to find the e.m.f. produced when water vapour is driven through
tubes of glass or other material under pressure. With tubes of uniform
cross-section, it was found that the e.m.f. developed was proportional to
the initial pressure. Using tubes of insulating material converging to a
neck and then diverging again it was found that no e.m.f. was produced
until the pressure was sufficient to produce turbulent flow. Above this
critical pressure the voltage rose rapidly and reached some thousands
of volts. The voltage was found to be proportional to the difference
between the inlet and outlet pressures. The presence of droplets of
water in the vapour appears to be essential, as it was found that super-
heating to 120° C. completely eliminated the electri
PA-37-2644

M-28. Miller, J. G.; H. Heinemann, and W. S. W. McCarter
The static electrification of dust clouds. John G. Miller,
Heinz Heinemann, and W. S. W. McCarter (Atta-
palooza Clay Co., Philadelphia, Pa.). Science 107, 144
(1948).
CA-42-51571

M-29. Millikan, J. A.
"Coefficients of Slip in Gases and the Law of Re-
flexion of Molecules from the Surfaces of Solids

M-30. Min, K; B. T. Chao; M. E. Wyman
"Measurement of Electrostatic Charge on Solid Particles
in Solid-Gas Suspension Flow," Rev. Sci. Instr., 34,
No. 5, 529-531 (May, 1963).
A method for measuring the charge spectrum of particles in a solid-gas suspension flow is described. The probe, fabricated of hypoallergic metals, gives minimal disturbance to the flow stream. The charge spectrum is obtained by a probe counting technique. Typical results are presented for glass particles of 20 μ diameter in air stream flowing at 4 m/sec inside an aluminum container. The charge distribution follows essentially an exponential law and the average charge per particle has been found to be 1.0 x 10^-5 C. Practically all particles carried a measurable charge.

M-31. Moiseyev, Yo. V.
"Charging Solid Particles and Drops in an Electric
Translation available: AD 402 469.
The electric charge on solid particles or
drops of liquid in contact charging is achieved
as a result of raising the voltage of the power
source, of using material with high electrical
capacitance, of sharp rounding of the electrointer,
and of decreasing the thickness of the layer
of material on the edge of the electrode. Since
certain variables simultaneously influence the
size of the charge it is necessary strictly to
maintain the technological regime according to
the voltage, point flow rate, and electrical
parameters of the material.

Author
M-32. Moll, W. L. H.,

"Recent Work on Aersols (Dust, Smoke, Fog)." W. L. H. Moll.
Kollid Zentral. 81. pp. 235-246, Nov. 1937.—The author gives a
very complete survey of work dealing with aersols during 1934-36, and
first colletects together the most important scientific results under the
following sections: General properties of aersols; preparation methods,
analysis (particle-number, concentration, -magnitude, electrical and optical
properties); coagulation (in the gravitational, electrical, acoustical and
thermal fields); absorption of aersols in liquids; meteorology: dust in
industry (survey of various industries, fine gases, dust explosions, gas
purification); fog removing agents; filters. A very complete Bibliogra-
phy of 250 references contains publications on aersols exclusive of
dissertations, patents, and popular articles, and is arranged alphabetically
according to the authors’ names.
PA-41-22

M-33. Moncrieff, R. W.

"Can Smell Be Detected Other than by the Nose?"
American Perfumer, 47, No. 5, 41-43 (May 1945).

M-34. Montgomery, D. J. et al.

STATIC ELECTRIFICATION OF FILAMENTS:
EFFECT OF FILAMENT DIAMETER.
D.J. Montgomery, A.E. Smith and E.H. Wainwright.
A study was made of the effect of filament diameter on the
charge transferred between filaments rubbed together under con-
trolled ambient and mechanical conditions. Filaments of various
diameters and of medium resistivity (vulcan, ~ 10^15 ohm cm) and
one of high resistivity (polyethylene, ~ 10^19 ohm cm) at differ-
ent normal forces between the filaments. For nylon against vucan,
the charge transferred was found to be proportional to the square
root of the product of the diameter and the normal force between the
filaments. For nylon against polyethylene, the charge transferred
was found to be proportional to the square root of the normal force,
not nearly independent of the diameter. These findings are consist-
ent with the hypothesis that the charge transferred is proportional to
the true area of contact (that is, the area over which the interpretation
of surface conductivity occurs) swept out on the object of low
conductivity.
PA 64-4549

M-35. Moore, C. B., and Vonnegut

"Estimates of Raindrop Collection Efficiencies in
Electrified Clouds," Physics of Precipitation,
( book) Geophysical Monograph No. 5, American Geophysical
Union (1960).

M-36. Morikawa, M.

2931 CALCULATION OF AXIALLY SYMMETRIC
ELECTROSTATIC FIELDS FOR TWO COAXIAL
EQUIDIAMETER CYLINDERS. M. Morikawa.
A method is given for calculating the potential distribution of a
system consisting of two coaxial cylinders, each of unit radius,
separated by a distance of 2a along the axis. The potentials of the left-
and right-hand cylinders are taken as -1 and +1, respectively.
The problem can be solved if the potential c_{1,0} or r + 1 or its
inverse Fourier sine transform (A) is obtained. The dual integral
equations for (A) are derived from the boundary conditions on the
aersors and the continuity condition of the potential and of its
normal derivative on the gap (r = 1, s = a) between the cylinders.
The solution (A) is expressed by the following series:
\begin{align}
A_{0,0} & = \sum_{n=1}^{\infty} \frac{\sin n \pi a}{n \pi a} \cdot \frac{\sin n \pi s}{n \pi s} \\
& \quad \times \left( \sin n \pi r - \sin n \pi s \right)
\end{align}
The coefficients a, in this series satisfy an infinite set of linear
equations. The values of a, for several values of the half-gap
length are calculated by successive approximations and are shown
in a table.
PA-67-2931

M-37. Morris, G.

3428 The ignition of explosives by condenser dis-
S 97-5 100 (1953).
To investigate the mechanism of ignition of explosive by capaci-
tance sparks, the critical ignition energy of lead trinitroresorcinate was examined for a
wide range of capacitance and series resistance. The experimental data do not completely conform to the
same energiztime relation as for ignition by hot
wires. A useful empirical relation is, however, found.
The use of added resistance ... earth lines is shown to
decrease plant safety.
PA-57-3428

M-38. Morris, G.

powder due to free fall has been examined quantitatively. For a given
powder the quantity of electricity generated is found to be proportional to the
square root of the product of the height of fall and the weight of powder.
It is independent of the nature of the surface of the receiving vessel, and of the
capacitance of the measuring system. Under given conditions of fall
the quantity of electricity generated increases rapidly as the fineness of
the powder is increased.
PA-43-249

M-39. Morton, W. B.

1616 Electrification of Two Intersecting Planes. W. B. Morton.
(Phil. Mag. 1. pp. 337-345, Feb., 1928.—The two-dimensional problem of
finite breadth, but of infinite length in the direction of their intersection,
is solved by Schwarz's method of conformal representation. The differen-
tial equation expressing the transformation is found to be integrable, so
that the coordinates of a point in the electric field can be simply expressed
in terms of the logarithmic potential and the line of force function.
With reference to the distribution of the charge, it is shown that half of the
entire charge is borne on the outer side of one plane together with the
inner side of the other. When the two planes have equal breadths and
are inclined at angle (μ - γ) the charge on the convex side is to that on
the concave side in the ratio of (μ + σ - 1)(μ - 1)σ to (μ - sin^-1(μ)/σ).
When the planes are equal and at right angles the outer charge is
double the inner.
PA-29-1416
M-40. Moureau-Hanot, M.

Transport of Electric Charges by Droplets. M. Moureau-Hanot. Comptes Rendus, 207, p. 1422-1424, May 8, 1938. Advantages of replacing the solid particles in an electrostatic generator working with a current of gas (see abstract 2355 [1937]); by liquid droplets are summarized, and experiments are carried out with an apparatus using droplets of a mixture of CO₂ and gasoline. In an apparatus of four ionizers properly arranged, each drop could be charged or discharged 18 times on an average before striking the walls. To obtain 500 μA, 100 cm² must be atomized per min., the drops being 1 μm in radius. The process is thus capable of supplying a reasonable current.

PA-42-3021

M-41. Muchnik, V. M.


Order: from LC or SLA or $1.80, ps $1.80


When drops of water break up, a division of the charge induced on the drops occurs. Droplets have a positive charge, while water drops have a negative charge. The positively charged droplets of the liquid-drop region instantly the original field, while the negatively charged water spray is carried upward by air currents. Very high charges are formed which when transported to a liquid-drop region, instantly the charge and the field under it. This process of accumulation of charges in a cloud proceeds with constantly increasing speed and continues itself in a chain process. The accumulation of charges and the consequent increase in the potential of the Earth in thunderclouds does not take place linear but at a constantly increasing rate in accordance with an exponential law. A thundercloud may be considered to be a self-exciting generator in which a chain process of the accumulation of charges occurs.

T1-97

M-42. Muchnik, V. M.


An experimental study of water drops of 0.6 cm diameter in a vertical stream of air in a field of the order of 170 V/cm. On breaking-up ions were formed and were registered as light and heavy ions by an electrometer. For the break-up of one drop 10⁵ light ions and 2·10⁶ heavy ions were formed; the corresponding total charges were -5·10⁻⁶ and +1.5·10⁻⁶. Experiments were also performed on the variation of the charge produced as a function of the field, and it was shown to be directly proportional to the applied field.

PA-57-8379

M-43. Mühleisen, R.


Experimental results show that when the water vapour content of the air in a large hall of volume 400 m³ was increased, there existed a negative space charge of about 1000 elementary charges per cm². Heating the air caused the space charge to become a positive one of about the same magnitude. These results and their relation to meteorological observations, such as the morning increase in the fine-weather field, are briefly discussed.

PA-61-2712

M-44. Mühleisen, R., and W. Holl


A waterdrop, falling from an earthed injection-needle within an earthed screening-cage is influenced by the electric space charge of the surrounding air. The drop therefore leaves the point with a true electric charge proportional to the space charge of the air. A method for measuring electric charge on water drops is described. Recording of the space charge is possible to a sensitivity of about ±10 elementary charges/cm². Volta potentials cause a zero uncertainty of ±25 electronic charges/cm². Three measurements can be made in a second.

PA-56-4516

M-45. Müller, A.

M-40. Müller-Hillebrand, D.

When ice crystals impinge on the lower surface of a particle of hail or soft hail part of the charge induced by the electric field is transmitted to the ice-cryatal. The relaxation time for the exchange of charge varies from a few milliseconds to about 10^-2 seconds and is sufficiently short to enable this gain of charge. In a positive field the soft hail will therefore get a negative and the ice-crystal a positive charge. In an electric field E the final charge of a sphere with a radius R is q = -0.12ER. At temperatures between -18 and -36° the number of ice crystals is sufficient to allow a time constant of about 5 minutes for the charging process. The charge per droplet and per g. of water derived from this process are in good agreement with measurements of Ross Gunn. The growth of precipitate and the formation of strong electric fields can be brought into correspondence with the timing and development of thunderstorms.
PA-58-5799

M-47. Müller-Hillebrand, D.

A critical investigation is presented of the charging mechanism of thunderclouds first suggested by C. T. R. Wilson. The relative magnitudes are determined of the charges accumulated by droplets or particles in a weak electric field and of the simultaneous diffusion process. It is argued that the Wilson process can only operate during a limited period of the life cycle of a thundercloud. It is furthermore shown that the rate of change generation according to the Wilson mechanism is too slow and the magnitude of the charge generated too small to account for the charges involved in the mature stage of a thundercloud. See also preceding abstract.
PA-58-1408

M-49. Murphy, A. T. et al.

Recent measurements of charge imparted to fine particles by unipolar ions in a strong electric field have shown that this charge is appreciably higher than that predicted by previous theoretical analyses. The charge acquired by fine particles is due primarily to ions which strike the particle by virtue of their random heat motion. Previous analyses have assumed that the only field existing was that due to the charge on the particles, thus neglecting any external field which would be present in a corona discharge. Two effects of an external field which influence charging are crucially examined: (1) ions or electrons which travel in the direction of the external field toward the particle will acquire energy in addition to their heat energy; their increase in energy will allow these elementary particles to overcome more readily the potential field of the charged particle: this effect is shown to be small for molecular ions at atmospheric pressure except for only the very smallest particles but, for charging by free electrons, which have a much longer mean free path, the effect could cause a large increase in charge; (2) the presence of an external field will alter the density distribution of ions around the charged particle since this field opposes the particle field on one side of the particle and aids it on the other side. The general equation for the ion density distribution was not able to be solved. However, approximate finite difference methods using computing machinery show that this effect is important and may almost completely account for the higher charge found with molecular ion charging.
PA-63-241

M-50. Murphy, P. V. et al.

The electron state was produced in Teflon and camphor was by simultaneous action of penetrating radiation and an electric field. Polyesiathene, polyvinyl, polystyrene, polyethylene, polychloroprene, polycarbostyrene, and nylon did not form electrets under these conditions. The change of isothermal decay curves and thermal desorption "flow curves" were used to calcute activation energies for the depolarization process in Teflon. The average activation energy as calculated from the "initial rise" of the desorption curve was 0.054 e V. The persistent heterogeneous of camphor was attributed to order polynuclears by the orientation of dipole units composed of a positive molecular ion and a partially valent electron.

Author
H-1. Nakaya, U., and T. Terada

Electrostatic charge of dust particles blown by air blast. U. Nakaya and T. Terada. Phil. Mag. 18, pp. 115-123, Jan., 1914. The movement of dust particles by the use of air blast was studied. By means of a charged metal plate, the charge on the dust particles was measured. The results showed that the charge was proportional to the square of the velocity of the air blast.

PA-38-891

H-2. Natanson, G. L.

TOWARDS A THEORY OF THE CHARGING OF NON-IONIC MOLECULAR PARTICLES AS A RESULT OF THE CAPTURE OF GASEOUS IONS. G. L. Natanson. J. Phys. Chem. 30, pp. 51-101, May, 1963. The problem of charging non-ionic molecular particles by the capture of gaseous ions is analyzed. The results show that the charging process can be described by a simple mathematical model.

PA-63-14976

H-3. Natanson, G. L.

Deposition of aerosol particles from a gas stream flowing around a cylinder. G. L. Natanson. J. Aerosol Sci. 29, pp. 1-10, 1968. The deposition of aerosol particles on a cylinder in a gas stream is studied. The results show that the deposition rate increases with the gas velocity and decreases with the particle size.

CA 51-16006

H-4. Natanson, G. L.


CA 51-10179d

H-5. Natanson, G. L.


CA 49-2150b

H-6. Natanson, G. L.


For aqueous solutions of all substances, at low ion concentrations the sign of the balloelectrical effect agrees with the sign of the charge of the capillary-activated ion present, and at high ion concentrations it is opposite to the sign of the jump in potential on the surface. The balloelectrical effect depends on the application of two factors: the effect of the discontinuity of the water-solid layer and the effect of the contact charging. At a low ion concentration, due to the large thickness of the ion diffuse double layer and the low electrical conductivity of the liquid, the first factor predominates, and at a high concentration the second factor predominates.

For concentrations of purely aqueous solutions of inorganic electrolytes the value of the balloelectrical effect is considerably lower than in the presence of capillary-active additives and is virtually independent of the ion jump in potential. This is due, probably, to the fact that the time of relaxation for the ion double layer on the surface is considerably less than for a dipole layer of the absorbed additive.

T7-627
N-7. Natanson, G. L.

THE SYMMETRIC ELECTRIZATION OF DROPS WITH MECHANICAL ATOIZATION OF LIQUIDS.
15 Nov 61, 2 ref. MCL-1326. AD-676 790
Order from OTS or SLA $2.00 62-15160


Density, Boiling, Measurement, Ions, Distribution.
Electrical effects, Mathematical analysis.

We investigate experimentally the electrization of
drops for the radius region 0.5 to 2 µ when liquids
are atomized which have an ion concentration from
2 x 10^-4 to 0.8 mole/liter. The results obtained are
discussed from the point of view of the fluctuation
mechanism of the phenomenon.

T7-627

N-8. Natanson, G. L.

MECHANICAL ATOIZATION OF LIQUIDS AS A RESULT OF
FLUCTUATIONS IN THE ION DISTRIBUTION.
27 Oct 61, 19 ref. MCL-1326.
Order from OTS or SLA $2.00 62-13581

Unedited rough draft trans. of Zhurnal Fizikheeskoi

Density, Boiling, Measurement, Ions, Distribution.
Electrolytes, Conductivity, Fatty acid esters.
Ethylenediamine, Electrical conductance.

A calculation of the magnitude of the fluctuation
charges in liquids containing ions is given. The elec-
trization of drops during atomization of liquid in
the region of ion concentration from 1 x 10^-7 to
3 x 10^-3 mole/liter for drops with radii from 0.5 to
3 µ is studied. It is shown that the results obtained
agree with the fluctuation theory of the origin of the
drops as atomized drops. On the basis of the re-


THE FLATTENING OF DIELECTRIC LIQUID DROP IN
A UNIFORM ELECTRIC FIELD.
12 Sept 59, 1 ref. MCL-1326.
Order from OTS or SLA $2.00 62-13581

The flattening of a dielectric liquid spherical drop in
the presence of uniform external electric field is studied. It is shown
that the drop becomes spherical under the influence of both electric
field and surface tension.

PA-64-132

N-10. Neubauer, R. L., and B. Vonneg"{u}t

Production of monodispersed liquid particles by electrical
atomization. Raymond L. Neubauer and Bernard Vonnegut

CA-48-425c

N-11. Nieboj, H. P.

"Aerosol Spectrometer for Measuring Size, Electrical
Charge, and Density of Dust Particles," Kolloid Z.,
160, 58 (September 1958).

CA-48-425c

N-12. Nikliborc, J., and A. Szynok

INFLUENCE OF F-CENTER CONCENTRATION ON THE
8255 ELECTRIFICATION OF THE DUST OF KCl MONO-
CRYSTALS IRRADIATED WITH B RAYS. J. Nikliborc and A. Szynok.

The electrification of a dust of KCl single crystals irradiated
with B-rays is influenced by three factors: absorption of electron
in the crystal, creation of F-centres, and secondary emission. The
F-centre concentration in crystals irradiated with B-rays for
various irradiation times was measured spectrophotometrically.
Based on the F-centre model and with the help of statistical
calculations, the relationship between the F-centre concentration
in the crystal and the surface charge due to F-centres was found.

T7-269


N-14. Nolan, J. J.

2155. Breaking of Water Drops by Electric Fields. J. J. Nolan, (Roy. Irish Acad., Proc. 37, pp. 29-39, May, 1926).—Tests were applied experimentally to examine conclusions of Wilson and Taylor [Abstract 2351 (1925)] regarding the maximum size of a water drop which can exist in an electric field in the atmosphere. Illuminated uncharged drops of distilled water of different sizes fell at a slow rate between a pair of almost flat plates connected to a Wimshurst machine and having Leyden jars in parallel with it. The drops were observed visually to undergo (1) explosive bursting whatever the size of the drops for values of the field given by $FV^2 = 3500$, where $F$ is the field intensity in volts/cm, and $V$ the radius of the drop in cm, this agreeing approximately with Wilson and Taylor's results; and (2) a type of disintegration for drops larger than 0.2 cm. radius for field strengths given approximately by $FV^2 = 600$. Measurements of the charge carried by the broken drops were unsuccessful, but it was found that a sudden increase in the charging of the collecting vessel occurs for results agreeing with the above observed on the explosive bursting of drops. The application of the results to the behaviour of rains, in atmospheric electric fields is considered.

PA-29-2155


996. Experiments on Large Ions in Air. J. J. Nolan and J. Enwright, (Roy. Irish Acad., Proc. 38, pp. 93-114, July, 1923).—In this paper are recorded experimental results on the origin, constitution, and behaviour of the large ion in air. The work deals principally with the effect on the large ions of certain substances such as SO$_2$ and N$_2$O, with the effect of temperature, with the decay of large ions by combination with small ions, and with the occurrence of multiple charges. The ions dealt with in the experiments are almost exclusively those produced by ordinary Bunsen flames, Ammos, as also found in the case of the hydrogen flame, cannot act as a starting-point for nucleation. SO$_2$ and N$_2$O, if supplied to the flame or subsequently to the flame-gas, cause the ions to grow beyond their normal size and the transition is not gradual but abrupt. When the alteration is produced by the action of the gases on the ions already formed, there is a reduction in the number of ions. With NaCl the number of ions is increased, but whether due to the NaCl supplying extra nuclei or extra ions to the flame, is not clear, although the unsymmetric character of the increase suggests the latter alternative. The idea of the large ion as a rather loose group, originally suggested by de Broglie, is adopted to explain certain mobilities observed, is practically compelled by the observations of recombination between large and small ions. The units out of which the ions have been assumed to be built, the various homogeneous groups of ions which in so many cases accompany the final more stable body, reappear when the ion breaks up under the action of high temperature. The further complex stages observed in the case of phosphorus ionisation appear when the ions are affected by the presence of SO$_2$, N$_2$O, or NaCl. The large ions present in the atmosphere are possibly in great part produced by the action of ultra-violet light on the moist gas. They carry single electronic charges, and their constant of combination with small ions is between 5 and $10 \times 10^{-8}$.

PA-27-596


127. Electrification Produced by the Pulsatization of Aqueous Solutions. J. J. Nolan and H. V. Gill, (Phil. Mag. 44, pp. 225-244, Aug., 1923).—The method of working is as described in a previous paper [see Abstract 2458 (1922)] devoted to the study of the effects obtained with mixtures of distilled water and tap water. In the present work special attention is given to the effects of substances occurring in rain water. It is found that, with the exception of NaCl, such substances do not appreciably diminish the charge produced when a rain-drop is broken in air. Non-electrolytes do not affect the development of charge. A group of substances shown by Lewis to give abnormal adsorption effects includes sodium oleate, methylkiesel, blue, cupro red, and methyl orange, whose behaviour differs remarkably from that of the ordinary inorganic salts. In the case of metylvic base, 0.5 gramme per 100 c.c. of water is sufficient to reduce the positive charge to zero. The negative charge has a sharp maximum at 2 g. per 100 c.c., and the charge again decreases, being at about 1 g. per 100 c.c. It is suggested that certain results on inorganic salts obtained by other observers are due to the presence of impurities.

PA-27-127


2301. Multiply Charged Large Ions. J. J. Nolan and J. G. O'Keefe, Roy. Irish Acad., Proc. 41, pp. 26-40, Jan., 1933.—Continued on previous paper [see Abstract 2336 (1933)]. Ion-counting observations made with an Alkkin's nuclear counter show that the atmospheric micro- or nuclei produced by flames can be charged up so as to carry several thousand electronic charges. The mobilities of these bodies do not seem to be affected by the gaseous medium. Spray-ions have charges of the order of a hundred electrons. In contradiction to the assertions of Blackwood and of Bosse, the existence of definite mobility groups is again demonstrated.

PA-36-2301


2524. Electric Discharge from Water Drops. J. J. Nolan and J. G. O'Keefe, Roy. Irish Acad., Proc. 49, pp. 86-96, Feb., 1935.—An electric field is applied between a hemispherical drop supported on a glass tube and a brass disc, 5 cm. in diameter, having its centre 1 cm. above the drop. For all drops the negative discharge begins at a lower potential difference than the positive, and the negative current always exceeds the positive. When rapid discharge sets in the uniform field $F$ is connected with the radius $r$ of the drop by the formula $F/r^2 = 3 \times 10^8$. The ions produced in the discharge from a water surface always remain small in pure air; there is no disintegration of the liquid surface of such a kind as to produce nuclei which could become larger ions by picking up the small ones which are present in large quantities.

PA-35-2524

In English. It is shown that the discharge from a water-drop, even when it is of such magnitude that the drop is being dissipated as fine spray, is carried only by small ions. No production of condensation nuclei or large ions occurs. The bearing of this result on C. T. R. Wilson's theory of the thunderstorm is pointed out. [See Abstract 290 (1930).]

PA-37-1950

N-20. Norgren, C. T.

N63-20236 National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio

ON-SHEET COLLOIDAL PARTICLE GENERATOR FOR ELECTROSTATIC ENGINES


A method of colloidal particle generation, based on the expansion and condensation of a material in a nozzle, has been investigated, and is shown to be capable of supplying particles suitable for acceleration in an electrostatic engine. The material is heated and is heated in a small vaporizer which supplies a homogeneous vapor to a convergent-divergent two-dimensional nozzle. 15.5 cm long with a convergent throat 0.273 by 4.48 cm. Flow rate and subsequent particle growth are controlled by regulating temperature and hence, vapor pressure of the material in the vaporizer. The experimental particle-size determination was obtained by visual inspection of photographs taken in an electron microscope. It is demonstrated that particle size can be controlled from 0.005 to 0.01 and maximum and minimum range distributions suitable for engine application. The colloid generator was incorporated into a small experimental electrostatic engine. A negative corona discharge was used to charge the colloidal particles and a Pierce accelerator was used to accelerate these particles. A calculated threshold density of 5.8 X 10^14 charges/m^2 at a specific impulse of 420 sec was obtained on engine operation.

N63 20216, 20-27

N-21. Norinder, H.

6184. Experiments concerning electrification of snow. H. Norinder and R. Skiena. Ark. Geofys., 2, Paper 1, 59-89 (1954) in shorter form in Tellus, 4, 360-3 (Aug., 1953). Electrification of snow and related phenomena were investigated by measuring: (1) the charge of snow when pouring it from a vessel into a funnel, (2) the charging of an insulated target when leaving show hit it as well as the charge of the scattered snow, and (3) the charge in air from blowing snow. Specific basic phenomena were separated. The charge of larger snow particles collected was dependent on the temperature and on the material of the target. The properties of the surfaces seem to be important in these phenomena. Enhanced charges of both polarities were measured in air by ion-counters. It seems that these charges are not due to ions, but may be attributed to very small snow particles suspended in air. A complete insight into the whole problem of electrification of snow might be obtained by a systematic consideration of all these specific phenomena.

PA-57-6184

N-22. Nueckel, H.


Zu dem 8. Thema, das gleichzeitig das Arbeitsgebiet der: gen und medizinischen und biologischen Aerosolforschung ausmacht, sind 3 Beiträge:
Das Aerosol im biologischen Gedachtnis
1. als Abgrenzung des wissenschaftlichen und praktischen Arbeitsbereiches des Deutschen Keramikers für Aerosolforschung
2. als Faktor von hoher wissenschaftlicher und wissenschaftlicher Bedeutung
3. als Beispiel für den Durchbruch der in der wissenschaftlichen Weltanschauung in die Biologie.

Author

N-23. Nukiyama, D.


The author applies the results obtained in an earlier paper (see preceding Abstract) to the cases of drops which slowly divide, drops splitting into others of different sizes, rain drops forming in an electrically neutral space, and the subdivision of large drops to explain the different charges acquired by rain drops. These results are applied to the formation of charges in the thundercloud, the effects of induction in increasing the charge, the predominance of negatively charged clouds of this type and the means by which positively charged clouds could result. Lastly, a means of measuring the real volume charge of rain drops is taken.

PA-32-252


A series of measurements was made with water flowing from a reservoir through an adjustable nozzle into an experimental chamber and falling through an electrical field maintained between two charged plates. Values of the ratio equilibrium potential (V), theoretical potential were plotted against the distance (h) of the nozzle from the upper plate for different potentials differences (D) between the charged plates. It was found that V was greater than the calculated value for weak fields, but the ratio decreased as B increased. For B > 20 volts, the ratio is less than unity. When the field is reversed, the ratio is less as B increases and finally is even negative. The capacity effect of the falling drop, the removal of charge by the drop and a space charge effect are examined and also the use of different liquids. The authors' results confirm those obtained by Maclean and Goto on the space charges produced by the interaction of water and air and also the waterfall effect, and this effect as well as induction must be considered in the theory of the water dropper.

PA-32-251

N-25. Nutting, A.

O-1. O'Connor, T. C.


The computer coefficient, also and charge distribution of condensation nuclei from room air when stored in a 3000 liter rubber balloon gasometer were studied. The results indicate that the acquisition of water vapour contributes to the growth of stored nuclei. A preliminary trial was made to see if Young's approximate rule that the number of nuclei in an aerosol varies inversely as the third power of their radius, also holds for Aitken nuclei. Further confirmation of the relationship between the percentage of stored nuclei electrically charged and their average radius was obtained. The measurements were carried out by means of the Folkard-Murphy improved version of the photoplastic nuclei counter. A statistical analysis based on over ten thousand comparisons of two theoretical models shows that the agreement of individual readings is better than 50% of nuclei concentration in 20% of all cases. Unexplained differences have now been eliminated.

PA-60-960


CA-50-4585f

O-3. O'Konski, C. T., and H. C. Thacher


An equation has been derived for the distortion of a liquid aerosol droplet under the influence of a parallel electric field. The equation, valid for static fields in insulating media, can be reduced to a simple form for many cases of interest. Numerical values of the distortion are computed for water and diesel oil droplets. The droplet becomes larger in the direction of the field, whether its dielectric constant is greater or less than that of the surrounding medium, because of the decrease in total electrostatic free energy of the system which accompanies this distortion in both cases. This effect is of interest in connection with size studies of aerosol droplets. It leads to predictions of an electric birefringence and of effects involving the scattering of electromagnetic radiation by liquid aerosol systems. A new method is proposed for studies of size distribution in aerosol systems containing large liquid droplets. It would employ the above effect to induce, by means of a periodic electric field, the natural resonant vibrations of the liquid droplets, which could be observed by the resulting modulation of the birefringence or of the light scattered by the aerosol. The distortion is also of interest for the study of dynamic surface tension by means of potentially very accurate measurements of the resonant frequencies of airborne or hanging drops.

PA-57-7404

O-4. Osamu, I. G.


CA-51-2305c

O-5. Ouang, T. T.

Electroization of particles suspended in a gas by ions produced by X-rays or radioactive substances. Ouang, T. T. Ann. Phys. Paris, 16, 47-144 (July-Sept., 1941). In French.—The equilibrium between large and small ions in a gas, the large ions being produced on smoke particles and the small ions by means of Po or X-rays, has been investigated. When equilibrium is established between the two types in the presence of neutral particles, a definite fraction of the neutral particles is converted into large ions of each sign. This fraction depends on the size of the particles, but is independent of the concentration of small ions if this is large. The number of large negative ions is always greater than the number of large positive ones, however large the particles may be, and the number of large ions is independent of the pressure in the gas of particles previously charged. An application of the theory of Langevin gives the coefficient of formation of large ions. The different results obtained by various workers on large ions in the atmosphere can be explained on the basis of the theory. There appears to be a favoured radius for ions produced on smoke particles or in the atmosphere.

PA-49-2323
P-1. Pannetier, P.

10666 STUDY OF THE EM ISSION OF ELECTRICALLY CHARGED PARTICLES PRODUCED BY THE PULVERIZATION OF ELECTROLYTIC SOLUTIONS. P.Pannetier.


The pulverization of a water surface by bubbling devices produces droplets negatively charged, and this appears to be an inherent effect and not due to secondary causes it still occurs when the surface is exposed to either a positive or a negative field. The negative charge is reduced in the case of electrolytes, and decreases as the concentration increases; it is due to the ions and to the undissociated molecules. Data are given for HCl, NaCl, KNO, LiNO, KNO, Ca(N03)2, Ba(N03)2, AgNO3, LiF, LiOH, CaCO3 and phenol. Electrolytes of the same conductivity have similar effects, and it is found that the acids and bases do not act by the signs of their charges but by their mobilities. Phenol and aqueous solutions of phenol give negative charges comparable with those of water, whereas the presence of CO diminishes the negative charge. In addition to the effect of rupture of the surface double layer, a part of the charge is thought to be due to the rupture of the links between the water molecules resulting in the liberation of electrons. The influence of concentration and ionic mobility on the phenomena are discussed.

There are 34 references.

PA-63-10666

P-2. Passoth, G.

8158. ON THE ATTEMPT TO DETERMINE EXPERIMENTALLY THE POTENTIAL DIFFERENCE AT THE SURFACE OF WATER. G.Passoth.

Z. Elektrochem., Vol. 60, No. 4, 420-3 (1956). In German.

On the assumption that within the surface layer the dielectric constant is smaller than in the interior of the water the potential difference at the surface is assessed at 0.2 to 0.3 volt. It is shown experimentally that the value determined by Chalmers and Passoth (Phil. Mag., Vol. 33, 68, 1937) must be explained by contamination of the water surface by organic impurities.

PA-59-8158

P-3. Patterson, H. S., and R. Whytlaw-Gray


P-4. Patterson, H. S. et al.


The experiments have brought to light no marked difference in the coagulation rates of comparable smokes of MgO and ammonium chloride indicate that electrification exercises little, if any, effect. Moreover, the authors have as yet detected no appreciable difference in the coagulation of ammonium chloride smokes of the same weight concentration, dispersed either normally or in the presence of X-rays.

PA-33-376

P-5. Patterson, H. S. et al.


The authors carry out further experiments on smokes and study the possible influence of the degree of heterogeneity and of electrification, as well as the effect of size on the rate of coagulation. Before embarking on this programme, the process of counting was scrutinised, errors eliminated and the method improved.

PA-33-375


P-7. Pauthenier, M.


A continuation of previous work [see Abstr. 6121 (1955)]. The charge acquired by a particle (± 10^-10 cm^2) as a function of the time spent in the field is calculated and indicates a logarithmic growth of charge with time. Further considerations suggest that there is a minimum speed of precipitation for submicronic particles.

PA-58-7945

P-8. Pauthenier, M.


It is stated that thermal agitation of ions is the chief factor contributing to the charge on particles of submicron dimensions. Boltzmann's distribution law is used to derive an equation giving the number of ions captured by these particles as a function of time.

PA-58-6121

P-9. Pauthenier, M.


A summary of work shows that to precipitate a normal fog by seeding with neutral water droplets of radius 10^-4 cm, 660 kg of water/10^4 m^2 must be used. For charged droplets 6 kg of water/10^4 m^2 is required. Such an application is possible because of the very large disruptive electrical field of small droplets, but otherwise there would be a discharge between the charged spherical particle and the neutral fog or cloud droplet with the very strong charges used. For a thick fog account must be taken of the increase of the radius of the charged droplet as it falls through the fog.

PA-54-4941
P-10. Pauthenier, M.


P-11. Pauthenier, M.

2296. Production of H.V. by Currents of Electrified Particles. M. Pauthenier, Soc. Frang. Elect., Bull. s, p. 328-408, Aug. 13, 1930; in French. An outline of recent progress. A brief description is given of generators which have been constructed and others in process of construction which may add additional insulation to the current system. It is expected to obtain 5 mA at 3 MV from a single pole of one such generator.

Abstract No. 2296 in Science Abstracts, Section B, 1939

P-12. Pauthenier, M., and L. Agostini

5235. Law of Charge of a Spherical Particle in an Ionised Field. M. Pauthenier and L. Agostini. Comptes Rendus, 199, pp. 705-708, Oct. 18, 1934.—When a small sphere falls for a time in a constant electric field, the fraction of the charge which could be gained by the ball (see Abstract 4468 (1932)) is $\eta = \eta_1 + \eta_2$, where $\eta = J/\eta$, $\eta_2$ is the mobility of the sphere and $\eta$ is the density of the space charge. The field is produced by a wire carrying a negative potential stretched along the centre of an earthed cylinder of 40 cm. dia. A steel ball falls through a tube of insulating material placed at a constant distance from the centre. The law is found to be correct to within 5 % when the velocity of the sphere is half that of the ions.

PA-37-225

P-13. Pauthenier, M., and R. Cochet


In French. Consideration of a vertical cylindrical precipitation with the means of a previously developed formula (Cochet and Refay, Abstr. 7152 of 1956) indicates how the efficiency of an electro-therm output depends on both the amount of dust deposited and the consequent counter-electrical field developed.

PA-64-15209

P-14. Pauthenier, M., and R. Cochet

7365. Development of a charged water droplet in a cloud above freezing level. M. Pauthenier and R. Cochet. Rev. Gen. Elect., 62, 215-22 (May, 1953). In French. A theoretical examination is given of the coefficient of capture by an electrified water droplet. The rate of its growth and the min. charge required by the droplet are determined. The effects are examined which the results obtained may have on the problem of natural precipitation as well as the artificial seeding process of clouds.

PA-56-7365


3129. GENERAL PROBLEM OF THE CHARGE ACCUMULATED IN A SPHERICAL PARTICLE IN AN ELECTRIC FIELD WITH NEGATIVE AND POSITIVE IONS. M. Pauthenier, H. Cochet and J. Dupuy. C.R. Acad. Sci. (Paris), Vol. 254, No. 21, 1696-8 (Nov. 15, 1962). In French. Mathematical derivation of the formulae and investigation of the electrostatic conditions, with generalized assumptions, in a field containing positive and negative ions. A short reference to industrial applications (electric filters and electric precipitators) is made.

PA-60-3229

P-16. Pauthenier, M., and R. Guillien

4463. Direct Electron Multiplier Measurement of the Limiting Charge of a Conducting Sphere in an Ionised Electric Field. M. Pauthenier and R. Guillien. Comptes Rendus, 196, pp. 118-121, July 10, 1933.—It is found that, when spheres of steel of 0.6 to 3.5 mm. radius are allowed to fall freely in an ionised cylindrical electric field of 30 cm. dia. and 2 m. height, and their charge is given up to a string electrometer of 5 cm. capacity, the spheres have received a maximum charge. This charge (see Abstract 1329 (1932)) is given by the equation $Q_0 = 3E_0\rho^3$, where $E_0$ is the field and $\rho$ the radius of the sphere, and is verified experimentally.

PA-35-4463

P-17. Pauthenier, M., and L. Loufoullah

1544. The electric scavenging of clouds. M. Pauthenier and L. Loufoullah. C.R. Acad. Sci. (Paris), Vol. 231, 533-4 (Nov. 6, 1950). In French. The possibility of a large charged water drop attracting smaller uncharged drops in a cloud is investigated. It is shown that particles will be attracted which are not directly in the path of the falling sphere and so the effective radius for collision is increased. Numerical calculations show that the release of charged water drops above a cloud or fog would be a very uneconomical method of precipitating the water drops.

PA-54-1544

P-18. Pauthenier, M., and C. Martin

1360. Limiting Electric Charge of Very Fine Particles. M. Pauthenier and C. Martin. Comptes Rendus, 204, pp. 239-240, Jan. 21, 1937.—The theory already shown experimentally to be valid for particles of sizes 20-30μ and 1-7 mm. is now shown to be equally valid for particles 2-20μ. [See Abstract 4483 (1932)].

PA-40-1360

P-19. Pauthenier, M., and M. Moreau-Hanot

413. Quenching of Corona Discharge by Suspended Particles. M. Pauthenier and Marguerite Moreau-Hanot. Comptes Rendus, 199, pp. 1193-1194, Nov. 28, 1934.—In a previous paper (see Abstract 2805 (1934)) the theory of the influence of an atmosphere of suspended particles on the corona discharge from a wire surrounded by a cylinder, has been developed. The present work is an attempt to confirm the results experimentally. So long as the drop in corona current is less than 30 %, theory and experiment appear to be in good agreement. The theory developed explains the progressive quenching of the corona discharge as the concentration of dust in the surrounding atmosphere is increased; the space-charge opposing more and more the emission of new charges from the central electrodes.

PA-38-413
P-20. Pauthenier, M., and M. Moreau-Hanot

2464, Electrified Space Containing Material Particles, M. Pauthenier and Marguerite Moreau-Hanot, *Comptes Rendus*, 199, pp. 199-200, July 16, 1934.—Previous calculations of the electric field in a cylindrical ionization chamber, have been modified by the assumption of the presence of a stream of air containing dust particles. An additional term, corresponding to the space-charge due to the particles, is introduced into the Poisson equation. It is shown that the passage of a stream of air containing material particles results in a drop in the current $\Delta i$; an increase of the potential on the electrodes $\Delta V_p$ is required to restore the original current. $\Delta i$ and $\Delta V_p$ are calculable. If potential distribution curves are drawn for the cases with and without dust, it can be shown that, in spite of the decrease of the current, the field near the wall increases.

PA-37-3862


1636, Spherical Particles in an Ionized Field, M. Pauthenier and Marguerite Moreau-Hanot, *J. de Physique et la Rad. H.*, pp. 200-201, Dec., 1929.—The systematic study of an anisotrope, a metallic tube with a central wire at a high potential, with special reference to the maximum charge which can be carried by conducting or non-conducting particles across the tube. Among the particles the behavior of which was examined were spheres of Rosé's fusible alloy projected by compressed air from an orifice in a tube, and measuring from a few microns to 100 in diameter. They followed the appropriate path until they were embedded in a film of moist gelatin. The charge acquired by a conducting particle is $E_p \times a^a$, where $E_p$ is the field and $a$ is the diameter of the particle. For insulating particles, 3 must be replaced by a more complex factor.

PA-36-1636


4464, Charge on Small Dielectric Spheres in an Ionized Electrical Field, M. Pauthenier, (Mme.) M. Moreau-Hanot and R. Guillien, *Comptes Rendus*, 196, pp. 213-216, July 18, 1926.—The calculation of the charge now submitted for small dielectric spheres is analogous to that already made for conducting spheres (see Abstract 1234 (1925)), wherein it suffices to replace the induced charges upon the conducting particle by the polarization charges of the dielectric. For particles of radius beyond a few microns, the limiting charge $Q_0$ is expressed by the relation $Q_0 = \rho_0 a^a$, where $\rho = 1 + (e - 1)/e + 1/e$ is the specific inductive capacity, $E$ the intensity of the ionized field and $a^a$ the particle radius. This result has been verified by two different methods, viz., an electrometric process adapted to spheres of radii around 1 mm, and one limited to small spheres of radii 10 to 200 $\mu$ based upon trajectories. The particles investigated were of gum lac, ebonite, paraffin and naphthalene.

PA-35-4464

P-23. Peace, A. G.


It is shown that finely divided dry Hexamine powder when dispersed in a dust cloud can be ignited by electric sparks of energy less than 0.003 J and that certain previously established principles of spark ignition apply also to this substance. No ignition of

heated powder by similar means could be produced. The powder is shown to be readily electrified in various mechanical operations similar to those used in manufacturing processes, charges of the order of 10$^4$ C/g being produced.

PA-57-3427


P-25. Penney, G. W.


P-26. Penn-y, G. W., and R. D. Lynch


Studies are applied to electrostatic precipitation.

BMI 6-16913

P-27. Penning, F. M.

P-28. Penning, F. M.

"Concerning the Probability of Ionization on Collisions Between Electrons and Atoms," Physica 5, 290-7 (1926).

P-29. Penning, F. M., and C. F. Veemanns


P-30. Pennsylvania State Univ.


P-31. Perucca, E.


A previous paper (see Abstract 143 (1926)) gave an account of a series of researches the results of which were interpreted as an instance of electrification by friction between solids and gases. Geisserhuescher's criticisms, and especially his objection that the observed phenomena is due to a simple volcanic effect caused by minute drops of mercury, inclined the author to repeat his investigations with an apparatus differing only slightly from that previously used, but so modified as to exclude the formation of such drops. The results of these renewed experiments is, briefly, a confirmation of his previous conclusions. An illustration of the modified apparatus is given.

P-32. Perucca, E.


An investigation was carried out which maintained the view of the existence of the Volta effect of the first kind, i.e., the existence of an electrostatic field in the dielectric around two insulators brought into contact. The favourable outcome of the research applies to the contact between a solid and a liquid insulator, but there is no ground for supposing that there should be any such relation in ferroelectric behaviour in the case of two solids in contact. The result obtained affords an argument in favour of the contact theory of frictional electricity.

P-33. Perucca, E.


Describes a case of frictional electrification of a solid by a gas in a high vacuum. The gas is mercuric vapour from a drop of mercury kept at about 100°C. The electrification is measured by a Van de Graaf collector in contact with an electrometer. The collector can be heated electrically to about 200°C. A comparison made between this electrification and electrification produced by small mercury drops in the same vessel and with the same collector shows that the action of a jet of vapour is not a Volta effect, but a true effect of frictional electrification.

P-34. Perucca, E.

143. Electrification by Friction between Solid Bodies and Gases. E. Perucca. (Zeits. f. Phys. 34, 3-4, pp. 120-139, 1926).—Experiments carried out with a Volmer mercury-vapour pump, a stream of mercury-vapour being made to impinge on a metallic wall. The electrification resulting from the contact of liquid mercury and metal is reduced to the simple Volta-effect, and therefore negligible. Wetting of the metal by the mercury was avoided. The metals employed were iron, nickel and platinum. A discussion, partly mathematical, of the observed results leads to the conclusion that the existence of a new form of electrification has been established, though the phenomena cannot be considered as fully elucidated. An illustration of the apparatus is given.

P-35. Perucca, E.

349. A New Case of Tribo-electricity. E. Perucca. (Phys. Math. Soc. Japan, Proc. 7, pp. 115-133, June, 1926. In English).—This is a somewhat elaborated account of work described in the preceding Abstract. The apparatus used is here more fully described by means of a diagram, and the following conclusions are drawn. A few indications of the fact that the metal oxides must be considered strongly electro-negative are found; it is observed that a newly nicked surface acts in a sensibly different manner from the same surface some days old. But even in this case characteristic uncertainties and difficulties of seeking a voltaic or a tribo-electric series are met with. It is not found possible to arrange the metals in a series analogous to the voltaic one. There is not a decisive experiment showing the identity of electrification described by Dö and friction-electricity, but all the observed facts may be interpreted as tribo-electric phenomena (including Stromungerstrom). It is therefore considered that any other hypothesis about the origin of this electrification is superfluous.

PA-29-143

PA-29-349
P-36. Perucca, E.

"4A New Case of Contact Electricity." E. Perucca. (Accad. Sci. Torino, Atti, 60, 2 and 3, pp. 88-92, 1924-1925.)—An interesting method of electrification has recently been noted by U. Doi when introducing a hot metallic ball into an insulating vessel. If the temperature of the ball is high enough to produce a violent evaporation of the liquid, the metal and liquid assume a separate charge, the potential of the ball surpassing 1000 volts in such a case. Doi attributes the phenomenon to the separation of the charge constituting the double layer at the liquid-metal surface during the violent boiling of the liquid. In the present paper the author endeavors to show that this result can be explained merely as another example of contact electricity. He, however, concludes that he has not been able to show definitely that this is the case, but that the facts observed can be easily interpreted as contact-electricity phenomena. [See also Abstract 104 (1925).]

PA-29-348

P-37. Peterson, John W.


An investigation has been made of the charging of fused quartz and borosilicate glass spheres rolling on a clean nickel surface. Positive or negative charges have been applied to the spheres while rolling over or sliding on the nickel surface. The data indicate that the process of charging depends only on the nature and condition of the material in contact and is independent of the pressure or the presence of extraneous objects. The results also indicate that the charging of the spheres is not dependent on the presence of extraneous objects or on the temperature of the nickel surface. The charging of the spheres is dependent on the nature and condition of the material in contact and is independent of the pressure or the presence of extraneous objects.

P-38. Peterson, J. W.


The charging of borosilicate glass spheres rolling on a clean nickel surface has been studied under controlled conditions of contact, humidity, and gas pressure. The results indicate that the charging of the spheres is not dependent on the nature and condition of the material in contact and is independent of the pressure or the presence of extraneous objects. The charging of the spheres is dependent on the nature and condition of the material in contact and is independent of the pressure or the presence of extraneous objects.


Experimental measurements permit determination of the functional dependence of the charge magnitude and rate of accumulation upon the ventilation velocity. Graphs, diagram. 4 ref.

BMT 4-2358


1912. Measurements of the size and electrification of droplets in cumuliform storms.


The size and the free electric charge of more than 6000 individual natural cloud droplets were measured. The measurements were made in stratocumulus clouds and in thunder-clouds associated with cumuliform storm clouds. The stratocumulus clouds with fair-weather electric fields were found to have approximately Gaussian distributions symmetric about zero charge. The magnitude and distribution of charge observed on these non-storm clouds approach values described recently by Gunn (1956) in his theory of aerosol electrification by the diffusion of environmental light ions. Thundercloud droplets were highly electrified and within given cloud volumes the droplets were charged entirely positive, entirely negative, or fractionally positive and negative.

PA-62-3012

P-41. Pitch, J.


CA 56-13573n

P-42. Pierce, E. T.

8790. Effects of high electric field on dielectric liquids. E. T. Pierce.


The effect of high electric field on dielectric liquids is determined by the relaxation time (permittivity/ conductivity) of the liquid and by the magnitude of the stress applied. Electroabsorptive effects are observed to occur in liquid containing ion impurities, whereas dielectrophoretic effects are dominant in highly pure liquids (Abstr. 285/1959).

PA-61-8079

P-43. Pike, E. W.


The Charging of Aerosols in a Corona Discharge. EMERSON W. PIKE, Raytheon Manufacturing Company—Quantitative calculation of the rate at which aerosol particles would be expected to gain charge, in passing through a corona discharge in air, as a result of the various expected processes, indicates that the present conventional explanations cannot account for the observed facts. Specifically, neither loss of charge nor the induced dipole in the aerosol matrix can account for the observed charges on mutes smaller than 10 microns. It seems probable, from present knowledge, that photoelectric effect is responsible for the charging of particles in the positive corona, and that electron diffusion may dominate in the negative corona. Some evidence is found for an expected limitation, by cold, emission, on the negative charge a note may carry.

Author
P-44. Pluvinage, P.


P-45. Pollak, L. W., and A. L. Metniks

MLO-14342 Dublin Inst. for Advanced Studies. School of Cosmic Physics (Ireland).

THE APPROACH TO CHARGE EQUILIBRIUM IN A STORED AEROSOL DURING AGING. Technical (Scientific) Note No. 14.


(Carswell AF 4/1963-36)

The approach during natural aging to charge equilibrium of an aerosol produced by charged aerosol versus the aerol. The number of charged aerosol nuclei at any instant is related to the number of charged aerosol present in the same moment in electrical equilibrium produced by charging-up the aerosol. It is shown that a stored aerosol consisting of small nuclei of negative concentration occurs not later than 15 minutes after their birth in electrical equilibrium. With increasing size and concentration of the nuclei it takes longer and longer until the stored aerosol attains charge equilibrium. Stored large nuclei appear not to reach even charge equilibrium after several days.

The reason for replacing the rubber balloon generator, used previously, by the rubber balloon generator for this investigation is given. In connection with the limiting condition required for producing charge equilibrium, the formation of condensation nuclei by electrical-attachment processes, and moving moisture-free air has been investigated. It has been found that no condensation nuclei are being produced in the aerol. The collected-aerol nuclei for the 8.1 and 20 thousand at the rate of 4.3 cm diameter by the alpha-rays of Potassium 210 of about 120 μC.


P-46. Pollermann, M.


The diffusion of a thin column of ionization (from a biased X-ray discharge) in an electronegative field, applied for varying intervals during the increase of supersaturation at expansion, is used to study the variation of size of the embryo nuclei as a function of supersaturation. The results are in agreement with the treatment of Volmer.

PA-53-5566

P-47. Power, A. D.

132. Recombination of the Natural Ions in Air; Weich Atmospheres Ionisation. A. D. Power. (Frank. Inst. J. 196, pp. 327-320, Sept., 1923.)—The coefficient of recombination of ions in air was determined for "natural" ionisation as opposed to the strong "artificial" ionisation usually used. McClung's method was replaced by a new method requiring the measurement of the growth with time of the number of ions per cm. 3. The diffusion correction is based on a solution obtained for Ω/Ω = D/ΩΩ/ΩΩ - βα + q. Results substantiate von Schweidler, that for natural ionisation it is more appropriate to use a βα than an αq term; this is here extended to confined air under a- and b-conditions. The value of β is on the average 6 x 10^-3, even when the dust content is very low. Its use cannot, therefore, depend upon the presence of dust; but in any event a very small quantity of dust would explain it. Under natural ionisation the distribution of ions appears to be non-uniform, confined to non-overlapping columns. For low potentials, the capacity of an air-condenser with plates, say, 20 cm. apart may be increased by the factor 2-7 by natural ionisation. The plates of a closed condenser be momentarily eared they will in the final state be short potential, no matter what the original distribution of ions may be.

PA-27-132

P-48. Power, G.


Some general solutions are obtained concerning the mathematical factors concerning certain two-dimensional electric fields of dielectric cylinders, assumed homogeneous and isotropic, with various boundary shapes. By taking particular values for the dielectric constants, these formulas lead to results of interest for particular electrodes.

PA-58-7934

P-49. Prati, A.

530. Charge on Non-Conducting Plates by Rubbing. A. Prati.

(Accad. Lincei, Atti. 31, ii. pp. 478-481, Nov. 19, 1923.)—The arrangement adopted by Cardini [see Abs. 2125 (1922)] when investigating the electric charge by means of the phenomena of ionisation and, reciprocally, that phenomena by means of the charge, has suggested the experiments here described. A qualitative and quantitative study is now made, with a ballistic galvanometer, of the charge which accumulates on a non-conducting plate by stroking one face, say with wool, and holding the other in contact, or not, with an armature in communication with earth. The substances experimented with include sulphur, cellulose and sealing-wax. The results given show that at first the quantity of electricity increases almost proportionately to the number of strokes, then a true state of electrical saturation of the plates is rather rapidly approached. These results, are in accord with those obtained by Cardini and also with those of Morris Owen.

PA-26-530
R-1. Rajagopal, E. S.
GRNNO.
Department of Chemical Engineering, R. S. Rajagopal.
The same were studied and were shown to be of the same order (8.0) as those obtained in colloid units. The effect of continued
irradiation to decrease the mean size of the particles and to broaden
the size distribution. The results are quantitatively and quantitatively in
terms of the lognormal particle size distribution.

PA 64-1493

R-2. Ralston, O. C.

Electrostatic Separation of Mixed Granular Solids,

R-3. Ralston, O. C.

"Practical Applications of Electrostatic Phenomena
to Particulate Matter," Paper presented AIIE Winter
General Meeting, New York, N.Y. (January 30-February
3, 1956).


"The Atomization of Liquids by High Voltage Electrical
Energy," Presented at A.I.Ch.E. Meeting at Las Vegas,
Nevada (September 22, 1964).

R-5. Rankine, A. O.

Proc. 36, p. 430. Aug., 1824.)—It can not be denied that a similar polished rod always becomes
negatively charged when rubbed with flannel, but a similar polished rod
can be got into such a state by prolonging its contact with the specially prepared
flannel that it becomes positively charged. Yet when the
polished and the unpolished rods are rubbed together it is the unpolished
that becomes positive. No explanation is offered.

PA-28-178

R-6. Rayleigh, Lord

"The Influence of Electricity on Colliding Water

R-7. Rayleigh, Lord

Soc. 34, 130-145 (1882).

R-8. Reiss, M.

533. Mobility of Liquid Particles of Radius 10^-5 Cm., and their
Electrical Charges. M. Reiss. (Zeits. f. Physik, 39, 6, pp. 623-630,
1925.)—Following the procedure similar to that described by H.
Trebitz (see preceding Abstract), observations were made with particles
of saturated barium mercury iodide (BaHgI3) of density 5-6 in nitrogen.
The constancy of the levitating voltage at different gas pressures indicates
constancy of the mass of the particles. With the above substance the normal law of resistance holds for particles of sizes down to 10^-5 cm.
radius. These particles had electrical charges of from 4.7 X 10^-18 to
3.7 x 10^-18 e.s.u., i.e., less than the electronic charge.

PA-30-533

R-9. Remy, H.

(In German.) H. Remy, Steub, Dec. 15, 1931, p. 428-442.
Combines review of literature with discussion of experimental
and theoretical factors that affect behavior and properties of
aerosols. Graphs, tables, and diagrams. 28 ref.

BMI 1-4434
R-10. Reshetov, V. D.

"Unipolar Charges of Aerosols"

The observed electrophoresis of aerosols is due to the
generation of net charges on the aerosol particles.
The sign of the charge depends on the acidity or alkalinity
of the aerosol particles. If the pH of the drops or
particles is less than 5 they appear negative with respect to
the air, and if the pH is greater than 5 they appear
positive.
The phenomena may be explained by selective adsorption
of hydrogen ions.

Author

R-11. Reshetov, V. D.

Unipolar charges in aerosols. V. D. Reshetov. Tr.

CA-57-14452h

R-12. Reynolds, S. I.

1966. Surface Charges Produced on Insulators by
Short- and Long-Time Irradiation. S.I. Reynolds.

A rotating-probe electrometer (Abstr. 3227/59) was used to
study the distribution of surface charge on polyethylene and polyvinyl
resin surfaces after x-ray. electrical discharge treatments.

PA-61-7038

R-13. Rice, O. K.

752. Surface Tension of Charged Surfaces. O. K. Rice. (J. P.),
Chem. 20, pp. 1348-1355, Oct., (1926)
A paper deals with the theory
of charged surfaces and the accompanying phenomena. The electro-
statics of the surface is treated mathematically and compared with
the thermodynamic expressions. The kinetics of the adsorbed ions
is developed by aid of the Boltzmann probability principle.

PA-30-752

R-14. Richardson, E. G. (Ed.)

"Aerodynamic Capture of Particles," Pergamon Press,


"Operating Experiences with cottrell Precipitators
on Sulfate Recovery Furnace Gases," Paper Trade J.
127, No. 18, 45-46 (October 28, 1948).

R-16. Robinson, M.

"A Miniature Electrostatic Precipitator for Sampling
(1961).

R-17. Roy, L.

449. Electric Forces in a System of Isotropic Bodies. L. Roy.
Expressions are developed for the resultant forces and moments on rigid
and deformable dielectrics due to electric forces on the free charge and
dielectric polarisation.

PA-42-449

R-18. Rüder, H. B.

"Entwicklung der Elektrischen. Gichtgasreinigung und
Neue Betriebsergebnisse," Z. VDI-Beihdr, 2,
89-98 (1943).

R-19. Ruff, O.; G. Nieße, and F. Thomas

2116. Behaviour of Drops in Electric Fields. O. Ruff, G. Nieße and
The behaviour of drops of various organic and inorganic liquids in electric
fields of high tension was investigated, especially as to the extent of the
possibility of their electrostatic charge and as to illumination phenomena
in their charged condition. Liquids were allowed to flow from a positively
charged electrode at tensions up to 40,000 volts, and it was determined
approximately up to what potential liquid drops, jets, or only mist were
to be obtained, whether from them whilst still in contact with the electrode
brush discharges took place, and whether after their separation from
the electrode illumination was shown on their falling through the atmos-
phere or falling into liquid air. The results obtained with thirty-seven
different substances are given in a table.

PA-30-2116
R-20. Ruff, O.; G. Niese, and F. Thomas
(Ann. d. Physik, 82, 8, pp. 627-630, March 22, 1927.)—Details are given
of an extension of Harms' drop method of determining capacities. Harms
worked with a maximum tension of the drop electrodes of 230 volts. The
authors have used high tensions up to 22,600 volts.

R-21. Ruff, O.; G. Niese, and F. Thomas
2114. Surface Tension and Electric Charge. O. Ruff, G. Niese and
F. Thomas. (Ann. d. Physik, 82, 8, pp. 618-625, March 22, 1927.)—A
relation is developed for the dependence of the surface tension on the
surface of a spherical conducting drop on the density of the electric
charge. This relation is experimentally confirmed for mercury.

R-22. Rumpf, H.
"The Strength of Granules and Aggregates," pp. 379-418
in "Agglomeration," W. A. Knepper, Ed. Interazione

R-23. Rumpf, H.
"Grundlagen und Methoden des Granulieren," Chem.-
Ing.-Tech., 30, 144 (1958).
In ersten und zweiten Teil dieser Arbeit werden Begriffe, Anwendung, und Eigenschaften der Gran-
ulaten sowie die physikalischen Grundlagen der Kornvergrößerungen behandelt. Der im dritten Teil
gegebenen Übersicht über die technischen Granulier-Verfahren und die Zerkleinierung- und Korn-
vergrößerungs-Verfahren. Bei allen Methoden müssen mehrere Verfahrensformen zusammenwirken.
Die Kombination in dem einheitlichen Verfahren hat dabei stets einen Zentrifugalgang für die verschiedenen
Die Grundlagen werden mit einem schematischen Darstellung der verwendeten Geräte
Methoden des Granulieren werden mit einem schematischen Darstellung der verwendeten Geräte
überblick des Fließschaltbild der Verfahren gebracht.

Author
S-1. Sachsse, H.

Am. J. Phys., 14. 4 pp. 304–12. (Jan. 1, 1932).—The method first used by Ehrenhaft and Millikan to determine the charge on particles of oil was applied to find the charge in the case of a number of kinds of smoke and dust and to investigate the relation between charge and magnitude of particles and the nature of their origin and previous treatment. The following results were obtained from experiments with the Millikan condenser and Faraday cage: (1) The diffused substances or aerosols AsCl₂, NH₄Cl, SO₂, TlCl, and paraffin oil got by condensation from the state of vapour are uncharged. (2) Aerosols obtained by dispersion into dust of liquid substances with air under pressure are likewise uncharged. (3) Aerosols obtained by other methods—explosion, combustion, whirling action with compressed air, so-called "friction"—are fully charged, apparently half + and half −. (4) The charges produced by "friction" are approximately proportional to the square root of the radius of the particle and carry about one-third of the maximum charge which a particle obtains in the negative field of a corona discharge (e.g., 5 cm units). Thus an MgO particle of 1 × 10⁻⁴ cm. radius carries about 100 elementary charges. (5) The charge of the whole cloud depends as to magnitude and sign on the conditions of origin of the cloud and perhaps before all on the influence of friction at the origin. (6) By friction, charges of both signs and of great magnitude can be given to dust—e.g., 30 e.s.u. per gm.

PA-35-5135

S-2. Salceau, C.

7417 DROP OF LIQUID FALLING IN AN ELECTRIC FIELD.
C. Salceau.
In French.
A study was made of the effect of applied potential difference and of falling distance to the stage of an electrometer during the fall of water droplet. From the similarity in the behaviour of water and dielectric liquids, e.g., acetone and xylene, the importance of small traces of impurities is stressed. Under the action of an external field surface polarization of charged droplets occurs, as increased field producing increased displacement of positive and negative charges.

PA 66-7417

S-3. Salceau, C., and O. Birau

7217 ELECTRICAL POTENTIAL ACQUIRED BY FALLING DROPs L.IQUIDS.
C. Salceau and O. Birau.
In French.
An experimental study of the influence of dipole moment in the liquid upon the charge acquired by drops leaving a charged electrode. Polar liquids tend to acquire a like potential to the electrode while non-polar liquids appear to show no effect.

PA 66-7217

S-4. Salceau, C., and G. Birau

1758 ELECTRICAL BREAKDOWN POTENTIAL OF FALLING LIQUID DROPS. FORMED BY DETACHMENT FROM A LEVEL SURFACE.
C. Salceau and G. Birau.
Water and various organic liquids are examined at 23°C. A linear relation is found between the measured breakdown potential and the permanent dipole moments of the appropriate liquid.

PA 65-1376

S-5. Salceau, C., and S. Zeno

353 THE ELECTRICAL POTENTIAL OBTAINED BY LIQUID DROPS FALLING UNDER GRAVITY.
C. Salceau. E. Zeno.
In French.
Continuation of the work described in Abstr. 1376 of 1962 which showed that the potential does not depend on the diameter of the tube from which the drops are detached. A table of potentials for water and nine organic liquids is given. The potentials are all negative and not positive as stated in error previously. The potential is explained as being an elastic potential due to the orientation of the liquid molecules.

PA 66-355

S-6. Sanzenbacher, R.

432 Electric Charges on Vapourised Particles. R. Sanzenbacher.
(Zeits. f. Physik, 39. 4 pp. 251–275, 1926).—A comprehensive series of measurements of the electrical charges carried by mercury particles was made under various conditions in the three gases, air, hydrogen and carbon. The results obtained show that mercury particles which are subjected to a relatively rapid vaporisation or condensation give normal values for the electric charge in CO₂ and in air both when the radius of the particles is less than 10⁻⁴ cm. and in the region in which as a rule sub-electrons are produced. In hydrogen normal charges were in general only found with particles subjected to strong vaporisation. Apparent variations of the elemental charge were obtained with mercury particles whose vaporisation was hindered. The bearing of these results on Regener's theories [see abstract 947 (1921)] is discussed.

PA 30-432

S-7. Sarfor, J. D.

20836 CALCULATIONS OF CLOUD ELECTRIFICATION BASED ON A GENERAL CHARGE-SEPARATION MECHANISM. J. D. Sarfor.
Using recent solutions for the electrostatic and hydrodynamic two-body problems of the fields and forces between freely falling spheres in an electromagnetic field, quantitative computations are made of the effectiveness of a general theory of cloud electrification that considers all particles in a cloud to be polarized by the electrostatic field of the atmosphere, and rebounding encounters to result in the transfer of charge to the direction required to increase the existing fields. The calculations employing observed cloud- and rain-drop size distributions give electromagnetic fields of the magnitude observed in the time required for the development of a thunderstorm.

PA 64-20836

S-8. Sarfor, J. D.

511.5 = 231.34.86
19491 SOME ELECTROSTATIC CLOUD-DROPLET COLLISION EFFICIENCIES. J. D. Sarfor.
Recent electrostatic and hydrodynamic solutions to the two-body problem of the forces on neighbouring spheres are combined to determine the motion of cloud droplets in a uniform electrostatic field. Collision efficiencies are obtained from the relative trajectories of one droplet with respect to another both with and without the electrostatic field. The collision efficiencies are compared to demonstrate the effect of electrostatic fields in the initial stage of droplet accretion. It is concluded that fields commonly observed in clouds can play an important role in the collision and coalescence of the droplets.

PA 63-16491
S-9. Satô, M.

"Contact Electric Layers." M. Satô. (Tokoku Univ., Sci. Reports, 14, pp. 232-239, July, 1925. In English.)—In a previous paper (Abstract 126 [1925]) the author has reported that when certain melted dielectrics, such as wax or resin, are solidified on a metallic plate, and then separated from it, some surface charge appears on the contact surface of the dielectrics. The present investigation has been undertaken to make the nature of this charge clearer. First, the signs and relative values of the surface densities of the charge when resin or wax is brought into contact with several metals have been determined. Henning’s measurements of the contact electric potentials are included. Next, experiments are described to test whether the surface charge is distributed only over the surface of the dielectrics or penetrates them to some extent; and also to decide whether the electric layers are caused by bringing the solid dielectrics and metals into contact. It is inferred that the apparent surface charge consists of double electric layers, one intense and near to the contact surface, the other weaker, farther away, opposite in sign and much thicker. The conclusion is drawn that the electric layers are caused only by the contact of dielectrics with metals or other dielectrics. Eleven diagrams and two tables of data are included.

PA-29-347

S-10. Scheffer, V. J.


S-11. Schaffert, R. M.


S-12. Scheffy, W. J.


CA-50-16002b

S-13. Schirmann, M. A.


Experiments are described which throw light on the mode of production of electrification when a stream of mercury vapour is shot through a glass tube. The apparatus consists virtually of a mercury-vapour jet pump. The electrification causes a luminous discharge which can be photographed. Two frictional effects are differentiated: (a) rubbing of condensed drops of mercury on the glass, and (b) rubbing of the vapour itself on the glass. The former alone is active for low velocities of the mercury-vapour stream. At higher velocities the disposition of the luminosity in the apparatus shows definitely the existence of the latter effect. Measurements of the decay period of the luminosity were also made. It is suggested that at the surface of a solid an electrical double layer is formed of which at least the outer layer lies in the film of gas or moisture adhering to the surface, and can be mechanically disrupted by the rubbing of a gas.

PA-31-997

S-14. Schlick, Ernst

"Electrically Charged Atenizer for Liquids," German Patent 967, 496 (November 14, 1907).


S-16. Schmitt, K. H.

INVESTIGATIONS ON SUSPENDED PARTICLES IN A TEMPERATURE GRADIENT. K.H.Schmitt.


To avoid convection currents the upper condenser plate in a kind of Millikan experiment was maintained at the higher temperature. Droplets of various silicone oils and kerosene were examined in argon, nitrogen, carbon dioxide, and hydrogen. Millikan’s law applies for large particles, whereas for particles of less than 10 μ radius a correction factor must be applied. The experimentally determined constants for this factor were about 1% larger than the theoretical values, when no temperature gradient had been applied. R, has the greatest proportion of elastically reflected molecules. With a constant temperature gradient of 40.4 °F per ft at a temperature difference on the suspended particles which obeyed the condition rP > 1 was verified in a model experiment on macroscopic spheres in a vacuum. The velocity of the particles was found to be independent of their radius in the range of small and comparatively large particles. For large particles the heat transport through the particle and through the gas were also of importance.

PA 63-4741
S-17. Schnitzler, H., and J. Somoljai

Effects of the Electrical Charge on the Coagulation of Dust. Describes a method to measure the relationship between the electrical charge and the coagulation of a dust cloud under constant climatic conditions. The distribution of the rates of vertical descent is measured with an electrical recording micrometer according to Giesel. At the same time, the state of charge of the whisked-up dust is recorded by a double condenser and two electrometer amplifiers. Some initial results are given. (In German.) Endluss der elektrischen Anladung und die Koagulation von Staub. Hermann Schnitzler and Josef Somoljai. Staub, v. 21, June 1, 1961, p. 241-246.

PA-43-1292

S-18. Schuurmann, R.

1986. Contact electrification of solid particles. R. Schuurmann in Proc. Phys. Soc., London, 53, pp. 547-553, Sept., 1941.—Solid particles carry with them electrostatic charges from contact with the storage vessel. The sign of the charge acquired in the air of the laboratory was determined for metal particles which were poured either from a stainless steel or from a glass beaker, and for particles of insulators and semi-conductors which parted contact with containers of silica, glass, or various metals. A closed, insulated metal funnel which is connected to an electrometer receives the charge which the particles carry with them from contact with a container from which they are poured. When the particles are made to stream from the funnel after the electrostatic charge has been removed from it, the funnel again acquires a certain charge, which the particles carry the opposite charge with them to the container. Copper filings poured from a container of either glass or silica acquired a positive charge, and silica particles poured from a copper trough assume a negative charge, while silica in bulk assumes a positive charge when it is rubbed against copper in bulk. Sb powder poured from a container of either glass or silica assumes a negative charge, and both glass and silica in bulk rubbed against a block of Sb assume a positive charge.

PA-44-2186

S-19. Schuurmann, R.

1988. Fleming’s method of electrification and Corin’s electrification apparatus. R. Schuurmann. Phys. Soc., Proc., 86, pp. 178-183, March, 1946.—Silica flour poured from a glass beaker or a copper trough carries negative charges away. The silica particles acquire these charges while in contact with glass or copper walls at room temperature. With the sole exception of what is known as “waterfall electrification”, cases of electrification through friction or through impact are in fact cases of contact electrification. The sign of the charge separated depends on the work function and the solution pressure of the metal with respect to the dielectric. The action of rubbing an insulator against a metal, for instance, silica in bulk against copper in bulk, can lead to an inversion of the sign of the static charges acquired; the silica can assume a positive charge. This is ascribed to the dependence upon temperature of the migration of positive ions from the metal to the insulator. The action of rubbing thus has two functions: firstly, it helps to establish intimate contact between two solids, and secondly, in the atmosphere it abrades particles from noble metals. In addition, in the case of less noble metals the rise of temperature of the surface irregularities increases the ability of the surface of the dielectric to accept positive ions. (See Abstracts 378 (1922), 408 (1923) and 2823 (1929).)

PA-45-7052g

S-20. Schoen, G.


S-21. Schonland, B. F. J.


PA-65-4997

S-22. Schultze, K.


The liquids investigated were classified according to their electrical conductivity, ranging from highly insulating transformer oil to aqueous salt solutions. The liquids were allowed to issue from fine glass or metal jets, a voltage of up to 12 kV being applied with respect to a plane 15 mm below this orifice. The nature of the atomisation was observed and the quantity of liquid dispersed per unit time measured. Optimum results were obtained with liquids in the conductivity range 2 x 10^-4 to 6 x 10^-3 cm^-1. The effects of hydrostatic pressure, orifice diameter and viscosity of the liquid were also studied.
S-23. Schumann, T. E. W.

2560. On Eiter and Geitel's Theory of the Electrification of Raindrops. T. E. W. Schumann. (Phys. Rev. 28, pp. 103–110, July, 1923).—The following experiments were made to test Eiter and Geitel's theory of the electrification of raindrops. Large droplets (A drops) falling between below with a fine stream of small drops (B drops), and the charge on the A drops was found to be of the same sign as that of the upper plate and to be proportional to the field strength. From the experiments the proportional number of collisions with B drops the charge per collision was computed and found to be zero for B drops of radius less than 18 mm, and then to increase rapidly with the radius to 4 mm. Photographs taken with a motion-picture camera show that the B drop first coalesces with the A drop, and then, if its momentum is sufficient, a protuberance is produced on the upper surface of the A drop which breaks up into a number of small droplets, which carry off with them not only part of the A drop, but also some charge. Very small B drops probably merely coalesce with A drops. In the case of falling rain, cloud droplets are too small to have a charging effect, and the effect of larger drops overtaking smaller ones is to weaken the existing field. Hence it is doubtful whether this phenomenon alone can explain the observed charges on raindrops, and it certainly does not explain such high potential differences as occur in lightning discharges.

PA-26-2560

S-24. Schwerter, H.


The charging of small drops of paraffin oil suspended in a corona discharge has been studied in order to determine (a) the magnitude of the charge; (b) the relationship between the radius of the particle and its charge. Further, since earlier studies of the purification of gases by electrical precipitation have not revealed whether highly charged particles occur in the particle, and whether the charge is essentially independent of the radius of the particle, it is found that over the range of 100–1000 mm the charge is almost independent of the particle concentration. The charge increases almost linearly with increase in the radius of the particle. Finally, in the electrical purification of gases highly charged particles occur rarely and are of no importance to the process.

PA-33-2273

S-25. Shergileyev, A. P.


A method and an instrument are described for the simultaneous measurement of individual electrical charges of particles from a sample containing from 25,000 to 100,000 droplets. The operating principle of the instrument is measurement of charges of the very small particles of solid aerosols, based on the precipitation of the particles from an air stream into an electric field. The number of charged droplets in an artificial cloud is shown to be a function of the length of time the cloud exists; the dispersion of charges in artificial clouds increases with an increase in the size of the particles.

T2-782

S-26. Sextl, T.

19219. On the Problem of the Electrical Charges of Sub-Microscopic Particles. T. T. Sextl. (Zeits. f. Physik, 20. 6, pp. 371–378, 1924).—This paper is part of a comment on the work of L. Schiller (see Abstract 1633 [1923]). Bär (see Abstract 8086 [1923]) is of the opinion that ultramicroscopic particles possess an appreciably smaller density than the original compact material from which they have been derived, and that through this smaller density the occurrence of subelectrons during charge measurements may be conditioned. Ehrenhaft on the other hand has emphasized the extreme improbability of the occurrence of Pt-particles of density 0.2, and dismisses Bär's assumptions as to the condition of the particles on the ground of the resistance law, also that Bär has 3 equations with 4 unknowns for the density determination of submicroscopic particles. Schiller has attempted to answer Ehrenhaft's objections by the assumption of non-spherical particles. The present author now attempts to show that neither the Schiller view, nor that of Bär, nor the Kaufmann-Regener assumption of an adsorbed gas layer at the surface of the particles, affords a critical explanation, and that a purely experimental determination of a resistance law for the motion of small spheres in gases, independent of any assumption as to the constitution of the electricity, must be obtained to solve the problem.

PA-27-2819

S-27. Sextl, T.

19219. The Electrostatic Charges on Submicroscopic Particles. T. T. Sextl. (Zeits. f. Physik, 16. 1, pp. 34–41, 1923).—This paper is part of a comment on the work of L. Schiller (see Abstract 1633 [1923]). Bär (see Abstract 8086 [1923]) is of the opinion that ultramicroscopic particles possess an appreciably smaller density than the original compact material from which they have been derived, and that through this smaller density the occurrence of subelectrons during charge measurements may be conditioned. Ehrenhaft on the other hand has emphasized the extreme improbability of the occurrence of Pt-particles of density 0.2, and dismisses Bär's assumptions as to the condition of the particles on the ground of the resistance law, also that Bär has 3 equations with 4 unknowns for the density determination of submicroscopic particles. Schiller has attempted to answer Ehrenhaft's objections by the assumption of non-spherical particles. The present author now attempts to show that neither the Schiller view, nor that of Bär, nor the Kaufmann-Regener assumption of an adsorbed gas layer at the surface of the particles, affords a critical explanation, and that a purely experimental determination of a resistance law for the motion of small spheres in gases, independent of any assumption as to the constitution of the electricity, must be obtained to solve the problem.

PA-27-2819


Electrical characteristics of positive corona are presented for air in a 2-in.-diam electrostatic precipitator operating under dynamic conditions at temperatures of 600–1100° F and pressures of 0 to 80 psig. Results show that current-voltage relationships depend solely on air density. Comparison of data on positive corona with previously published data on negative corona demonstrates a higher sparkover voltage and a wider range of operation for positive corona at temperatures above 375° F. The data show the possibility of achieving higher voltages with positive polarity as indicated by these experiments implies several advantages for the use of positive corona in precipitators to allow better removal of suspended material from hot gases.

Based on the physics of an ion in an electrical field, a theoretical equation is derived to define current-voltage characteristics of positive corona in air of various densities. Constants for the equation are evaluated from the data. Calculated current-voltage values at different air densities agree reasonably well with experimental data.

Author


The trajectories of a single charged particle trapped in an electrodynamic, quadrupolar-containment device are studied in a uniformly rotating coordinate system, in an attempt to simulate the behavior of a Foucault pendulum.

Author

S-30. Shaw, P. E.


Experiments are described which are designed to explain such effects as electric sandstorms and snowstorms, electric flashes seen in the ejectaments from volcanoes, and electric charges and sparking of organic powders in certain industrial processes. In this group of effects charges are produced by the impact of like particles. The apparatus used provides for the separate measurement of the charges arising on wind-blown particles, on surfaces of one material on which the particles are blown, and on the issuing air. It is shown that considerable charges arise, even when the particles and surfaces are chemically identical, thus indicating that the Volta effect is not sufficient to account for all the charge. Physical differences of the surface, e.g., train effects, are, therefore, suggested as contributory factors to triboelectric charges.

PA-32-1616

S-31. Shaw, P. E.


S-32. Shaw, P. E.

1162. Electrical Charges from Like Solids. P. E. Shaw. Nature, 118, pp. 600-600, Nov. 6, 1928.—The author summarizes a series of experiments made on a number of substances in tests of triboelectricity. He states three general principles: (a) really identical surfaces charge one another according to a definite rule; (b) friction between initially identical surfaces causes these to become stratified, the strain being revealed by the nature of the charges arising and by the fact that heating restores the surface; and (c) rough impact between like bodies in general leaves them with unequal charge. It is suggested that (a) and (c) may give a solution for the origin of electric sand storms and dust storms. [See also Abstract 2422 (1926).]

PA-30-1102

S-33. Shaw, P. E., and R. F. Hanstock

214. Triboelectricity and Friction. Parts V and VI. Surface Strain and Relaxation of Like and Unlike Solids. P. E. Shaw and R. F. Hanstock. Roy. Soc., Proc. 128 pp. 474-487, Aug. 5, 1929.—It has been shown [see Abstract 1610 (1929)], that charges arise when two identical surfaces are rubbed together. The effects are attributed to progressive strain on the surface, brought about by pressure and friction. In the present papers these effects are standardized by employing definite areas, known forces and stated temperatures. Complete recovery from strain can be attained by rising temperature. Curves are given showing voltage attained by a given number of rubs between the surfaces. In the experiments described in Part V like materials are used; in Part VI the materials are unlike. In the second case the charges are much larger and change sign with a fewer number of rubs. Experiments in vacuum give results similar to those in open air; the effects are thus claimed to be entirely due to changes in the solid surfaces. The two factors which complicate results obtained in frictional electricity are (1) surface strain; (2) evaporation of organic film on the surface derived from fabrics, etc. The authors show that the former may be minimized by carrying strain to the limit, and the latter eliminated by avoiding rubbing such as fabrics.

PA-34-214

S-34. Shaw, P. E., and C. S. Jex


Part II. Glass and Solid Elements.—Quantitative results are aimed at, the two surfaces being pressed together with a definite force and rubbed over a definite length. After each rub, the deflection of an electroscope is noted. Curves are given showing the results. Some elements (e.g., Ca, Cd, Fe, Pb, Si, Ag, etc.) never show a negative charge. Others (such as Zn, Sn, Al, Pb, Ni, Cr, Sb, Sn, etc.) show negative charges. Evidence is given of the predominating influence of the charging is done on a glass as in the open air. Reference is made to various theories on the subject, and it is urged that triboelectricity cannot be a purely statical effect; the kinetic effects must be important and may be paramount.

Part III. Solid Elements and Textiles.—Apparatus and methods used are the same as in Parts I and II, except that the element is rubbed, not on glass, but on the textile wrapped round glass rods. The results for the solid elements rubbed with silk, cotton, and specially prepared felt-papers are shown diagrammatically beside the corresponding results for glass given in Part II. It is shown that it is impossible to devise a simple tribo-electric series of one column to include all solids. For example, the five materials, zinc, silver, felt-paper, cotton, glass, are related in a continuous ring in the figure, the arrow in each case pointing from positive to negative.

PA-31-1671

S-35. Shaw, P. E., and C. S. Jex

2423. Triboelectricity and Friction. P. E. Shaw and C. S. Jex. Roy. Soc., Proc. 111 pp. 339-355, June 2, 1926.—Changes in the condition of glass surfaces when rubbed with flexible materials like cotton, linen and silk, are dealt with, measurements being made of (a) the electric charges displayed by the glass surfaces; (b) the coefficient of friction found between two of them after identical rubbing. The Hankel form
of electroscope is used, and a special tilting apparatus for measurement of the coefficient of friction (μ). Amongst the definite effects found are: (1) Owing to adsorption of condensable material the μ of a glass surface slowly descends from 1.2 to about 0.7; (2) ordinary textile materials rubbed on glass quickly reduce μ; (3) very clean textile materials slowly reduce μ; (4) a few values of μ is raised by heating the glass or placing it in a vacuum or in air; (5) the sign of the charge can be made + or − according as the rubbing is along or across the fibre of the yarn used; (6) if one of two identical surfaces of glass be heated and then rubbed on the other, it becomes negative to it.

PA-29-2423

S-36. Sher, Lawrence D.

S-38. Shulepov, Yu. V., and S. S. Dukhin

N64-16576 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

IN REFERENCE TO THE THEORY OF ELECTRICAL CAPACITANCE OF SPHERICAL AEROSOL PARTICLES


(IFT5-83-70/1-3; AD-438888)

From consideration of the elementary act of electrical conduction of aerosol particles as a two-body problem, formulas have been derived for the capture efficiency for an arbitrary ratio of the particle radii. The known formulas for capture efficiency, derived on the basis of the elementary electrical conduction act as a one-body problem and are particular cases of the formulas derived in the present study.

PA-29-2423

S-39. Sikina, R.

1794. CHARGED CONDENSATION NUCLEI FORMED IN A ROOM BY CORONA DISCHARGE WHEN ALTERNATING THE POLARITY OF THE CORONA POTENTIAL AND BY USING ALTERNATING CORONA POTENTIAL

R. Sikina.


The content of charged nuclei formed in a room varied by alternating the polarity of a corona device and depended on the period during which the corona of one polarity was switched on. The concentration of charges measured was greater during the negative period than during the positive one, when the action period of corona of one polarity was 30 minutes, but it was the opposite for the period of 5 minutes. When using alternating corona potential of 50 cycles per/sec only positively charged nuclei were established. By using alternating potential the picture was changed when air was blown through the corona device: the content of positively charged nuclei was diminished and negatively charged nuclei were also observed. An air circulation produced by the convection from an electric heater placed below the corona device was sufficient to cause a similar effect.

PA-60-1794

S-40. Sillslee, F. B.


See also:


The various systems of measurement, with their respective sets of units, used in the literature on electricity and magnetism are described in detail. Their historical development is summarized. The number in which each is derived from either of the two alternative points of view of the experimentalist and the theoretician is compared and contrasted. The desirability of recognizing both points of view in international standardization, particularly when discussion rationalized, is pointed out. The present state of the absolute measurements on which all electrical units are based is reported, and tables are included for the conversion of equations and numerical values from one system to another.

PA 65-1905

S-37. Shire, E. S.

S-41. Bilbee, F. B.

S-42. Silverman, L.; F. V. Conners, and D. M. Anderson

S-43. Simon, A. W., and L. C. Kron

S-44. Simpson, G. C.
Apparatus is described for measuring the electricity associated with relatively large quantities of rain, and for measuring the charges on individual drops. Precipitation of all kinds is sometimes positively and sometimes negatively charged. The various theories which have been proposed to account for the origin of this electricity and its observed distribution in clouds are critically discussed. The negative charge in the upper part of clouds below 0°C. are explicable by the collision of ice particles; the positive charge in the rain region may be due to the evaporation of drops or to the absorption of ions in an electric field; but no theory satisfactorily explains the positive charge invariably found on steady rain.

PA-45-2006

S-45. Simpson, G. C.

S-46. Simpson, G. C.

S-47. Simpson, G. C.

S-48. Singer, S.; Mak Goo Kim, and M. Farber


CA-8518c
S-50. Slade, F. H.

1463 Foreign Particles in Cereals. Frank H. Slade. Machinery

S-51. Smith, L. G.

(June, 1955).

The observations were obtained using equipment designed to record rapidly, without ambiguity, the electric charge and size of individual raindrops. The electric charge is measured by electronic induction on a metal cylinder as the drop falls through the air. The size of the smaller drops is determined from the time of fall between two such cylinders, while the size of the larger drops is measured by the change of capacity of a parallel-plate condenser as the drop moves between the plates. The point-discharge current, electrical strength and rain current were also measured. The observations show that on all occasions the range of charge on a particular size of drop is large, often including both signs, and that this range is not appreciably reduced by considering drops scattered during shorter time intervals. However, it is often found that the average charge and the limits of the range of charge show definite relations to the size of the drop. The variation of average charge is such that there is a certain size for which the average charge is zero; for smaller drops the average charge is opposed in sign to that of the electric field, while for larger drops the average charge has the same sign as that of the electric field.

S-52. Smythe, W. R.

1697 CHARGED SPHERE IN CYLINDER. W. R. Smythe.
The problem of a charged conducting sphere within a coaxial conducting cylinder is solved by a slight variation of an earlier method (see Abstr. 1973 of 1969). Errors in the terminal digits of Table 1 in that paper are corrected and the table enlarged. The charge density on the sphere, the potential between it and the cylinder, and its capacitance are given for ratios of the sphere radius to cylinder radius of 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, and 0.95. Tables give numerical results for five cases: the disk, the oblate spheroid with 2 to 1 axial ratio, the sphere, and the prolate spheroid with axial ratio 1 to 2. The thin prolate spheroid requires special treatment.

S-53. Smythe, W. R.

8972 CHARGED SPHERE IN CYLINDER.
The method first used to solve the problem of the simply charged right circular cylinder (see Abstr. 8159 of 1954) is applied to the case of a charged conducting sphere enclosed by a coaxial circular conducting cylinder. The charge density on the sphere, the potential between it and the cylinder and the capacitance are given for sphere to cylinder radius ratios of 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9 and 0.95. All results are accurate to one part in 10⁴ or better. An approximate formula for the capacitance of a sphere in a cylindrical box is given.

S-54. Smythe, W. R.

8159. CHARGED RIGHT CIRCULAR CYLINDER.
W. R. Smythe.
A new method permits the calculation of the electric field surrounding a charged conducting surface of revolution without the use of orthogonal functions. Detailed formulae show how to find the charge density on a right circular cylinder with any desired precision. The numerical examples worked out give the maximum deviation of the actual surface from that of a true cylinder of diameter d to be -0.0015d, -0.00037d, -0.00017d, -0.0016d, and -0.014d for lengths to diameter ratios 1, 1.1, 1.2, and 4, respectively. The capacitance calculation gives an accuracy of one part in 20000 for the ratios 1, and 2. A capacitance formula is worked out which is accurate to one part in 1000 over the ratio range 0 to 4. Additional formulæ indicate the method of solution for the bodies in longitudinal and transverse electric fields and the extension of two-body problems such as the thick plate parallel plate capacitor. A way to calculate the flow about bodies of revolution is indicated. Digital computers are well suited to this method as no function tables are needed.

S-55. Smythe, W. R.

(April, 1954).
Formulæ are derived for the force and scalar potential of a dielectric sphere in the field of a charged wire and for the force and vector potential of a permeable sphere and a circular cylinder carrying current. When the sphere is conducting the electric force is \( \mathbf{F} = \mathbf{q} \cdot \mathbf{E} = (q \cdot A)^{-1} \mathbf{A} \times (A \times \mathbf{E}) \) in M.K.S. units, where \( q \) is the charge per unit length on the wire, \( A \) the sphere radius and \( d \) the distance from its centre to the wire. The same formulæ, with \( q \) and \( A \) for \( \mathbf{E} \), apply to a sphere of large permeability in the magnetic field of a circular cylinder carrying a current \( I \).

PA-59-8159
S-56. Solov’ev, V. A.

Solov’ev, V. A.
A METHOD FOR THE MEASUREMENT OF CHAR- 
GES AND SIZES OF FOG DROPLETS (On Obshnym 
Mestnom Khimicheskym Zavodu i Raznorov Kapel’ 
Hill Trans. 765.
Order from 0TS $0.50  
60-21547

Trans. of envrnrn. Metabolism-chemistry Conference on Voprosam Inleiteriomy Obshk, Obshk i 
Gromovymy Elektricheske (21 no. 5) held in 1954 in 
A method and apparatus are described for the mea-
surement of charges and sizes of fog droplets, and 
data are presented which were obtained with the aid 
of such an apparatus

T4-85

S-57. Somolyai, J., and H. Schneitzler

Appl. for continuous measurement of the change 
on demand. R.2.344.507. (By Joseph 
Somolyai and H. Schneitzler). Ger. 1.J2.6,65. (Cl. 65). 

CA-56-P574c

S-58. Soo, S. L.

"Effect of Electrification on the Dynamics of a 
Particulate System," Ind. and Eng. Chem., Fundamentals 
3, No. 1, 75 (1954).

The significance of electrification on the dynamics of a gas-solid system was studied. At low temperatures, 
electrification of solid particles occurs because of impact with a wall. Basic conditions for motion 
of charged particles with spherical symmetry and quadrupole. It is shown that the peak effect due to 
motion of particle along the same axis is multiplicative. However, even a very slight charge on the solid 
particles will have an pronounced effect on concentration distribution in a flow of a gas-solid system.

Author

S-59. Soo, S. L., and R. C. Dimick

BET-539291 Women’s U. Under-50 
EXPERIMENTAL STUDY OF THERMAL, ELEFTRIFICATION 
OF A GAS-SOLID SYSTEM 
and Applied Sci., Apr 1962, 11 p. 5 refs. For Protection at the 
Symposium on Multi-Comtinent Thesis-Planes, Nov. 1963 
(For Protection of Multi-Plane System)

MS-18781

S-60. Soo, S. L., and R. C. Dimick

"Interaction of Solid Particles with an Ionized Gas." 
Preprint: Tenth Symposium (International) on Combustion, 

Consideration of equilibrium of ionization of a gas-solid suspension showed that the solid 
particles always become positively charged if the ionization of the gaseous atoms was negligible. 
However, the combination of high values of thermionic potential and low values of ionization 
potential of the gas may leave the solid particles negatively charged. Experiments with an arc 
flame of argon showed that addition of metals tended to increase the recombination rate 
while solids tended to decrease the recombination rate of argon.

Author

S-61. Spartakov, A. A., and N. A. Tolstoi

THE STABLE DIPOLE MOMENT OF PARTICLES OF 
Order from 0TS or SLA $1.10  
61-25444

Trans. of 87th Annual Conference on Thermoc-
DESCRIPTORS: *Dipole moments, *Acrinol., 
*Particles, *Smoke, *Polarization, Light 
*Reaction, *Turn, *Test methods, *Electrical properties, 
*Optics, *Proelectic effect.
Light passing through a thickness of 3 to 5 cm of 
tobacco smoke was modulated by a field of electric 
rectangular impulses. The curve of the modulation 
due to periodic dimming of the transparency of 
the medium. The effect was observed with any direction 
of polarization of the light. Each change of sign of 
the field led to a repetition of the modulation wave. 
The orientation of the smoke particles that caused 
the modulation of the light is possible only if the 
smoke particle is polar, i.e., has a stable dipole 
moment.

T7-46

S-62. Sproull, W. T.

"Collecting High Resitivity Dusts and Fumes, Labora-

tory Performance of a Special Two-Stage Precipitator," 


S-63. Stäger, A.

2564. Further Investigations on Contact Electrification for forty-

divided Halos, particularly Snow. A. Stäger. (Ann. d. Physik, 77 
8, pp. 232-260, Aug., 1923.)—Experiments were continued at a high level 
neer near Halle on the electric charge per unit mass for time, and for snow 
during light and heavy falls under different conditions of wind. Values 
are given, and the maximum was found to increase with the wind speed 
and to differ if a change occurred in the kind of snow falling or in its 
amount. The small light particles carried a negative charge and the 
larger heavy particles a positive charge. The potential gradient over 
street was mostly negative and seldom positive. Tests were also made 
on electrification produced by solid CO2 and by sand. The results 
obtained were applied to explain the illumination often seen with a dust 
cloud and the electrification arising during falls of snow, hail and soft 
hail, and also partly that for the storms produced by heat and whirlwinds. 
Where precipitation also occurs in the liquid form other sources of electrifi-
cation exist. [See also Abstract 1196 (1923.).]

PA-28-2564
S-65. Stankiewicz, N.  
NBS-12105* National Aeronautics and Space Administration. 
Lewis Research Center, Cleveland, Ohio. 
FIELD STATION CHARGING OF METALLIC COLLIDING 
NMSA TR D-30705 Obt. 10-76. 
With a two-electrode model of metallic colliding, the charging 
time in an applied electric field is calculated for the total 
charge and for the total charge on one of the spheres. Theoretical 
time-scale factor is discussed with regard to modified operating 
parameters, beam geometry, and current-density equation.

S-69. Stephenson, J. D., 
"Electrical Discharge in Gases at Normal Pressures and Temperatures," Phil. Mag. (7) 15, 241-262 (1933).

S-70. Stern, S. C.; Steele, D. R., and O. E. A. Bodeaum, 

S-66. Staszewski, W., and B. Adamczyk 
2182. SPONTANEOUS ELECTRIFICATION OF DUST PARTICLES IN A KUNDT'S TUBE. W. Staszewski and B. Adamczyk, 
Evidence is presented that in a Kundt's tube under suitable 
conditions spontaneous electrification of dust particles takes place. 
Apparatus time is needed for the apparatus to acquire a measurable 
charge, the sign of which depends on the material of the tube as 
well as that of the dust.

PA-62-2183

S-67. Stenzel, R. W., and W. F. Eberz 

PA-65-1170

S-68. Stenzl, J., 
"Critical Voltage of DC Corona," Elektro. Obszor 34, 
No. 17-18, 254-5 (December 1945).

S-63. Straubel, H., 
THE STABILIZATION OF ELECTRICALLY CHARGED 
PARTICLES IN ELECTRICAL FIELD. H. Straubel, 
Three 3-cm cylinder rings were arranged in a vertical axe. 
One of the outer ones was positive and the other negative, and an 
ac voltage was applied to the middle one. The equation of motion of a 
charged particle in the middle of the aperture of the middle ring 
was derived from a physical equation. When viscous damping was present, 
there was a stability region such that, for suitable ranges of a/m, 
and the amplitude of the ac field, a particle could be stably at rest. 
For voltages exceeding the stability limit, or when a/m was altered, 
instability set in sharply. The arrangement could be used for a 
measurement of the a/m ratio or for studies of evaporation of oil 
drops, etc. The particle was illuminated and the scattered light 
observed by means of a photomultiplier. The photomultiplier current 
was proportional to the square of the particle radius. The apparatus 
could thus be calibrated for particle size. Absolute measurement 
of the particle mass was not possible.

PA-63-15113

S-72. Straubel, H., 
Rate of evaporation and changes in the electrical charge 
of drops. Herald Straubel. Craftsman Monograph, 81, 
GA-54-160331
S-73. Straubel, H.
1186. MILLIKAN’S OIL DROP EXPERIMENT. H. Straubel.
Naturwissenschaften, Vol. 45, No. 14, 506-7 (1958). In
German.
A short note describing a modified version of the experiment
in which motion of the charges is caused by a modulating
electric field.
PA-59-1186

S-74. Straubel, H.
Straubel, Harold.
THE ELECTROSTATIC ATOMIZATION OF LIQUIDS.
2 refs.
Order from SLA $1.10
62-16531
Trans. of Zeitschrift für Angewandte Physik (West
Germany) 1954, v. 6, no. 6, p. 264-267.
DESCRIPTORS: *Electrostatics, *Atomization,
Liquids, *Organic compounds, Electron microscopy
The properties of various organic liquids are dis-
cussed with regard to the best atomization. It is shown
as to how the charged floating particles are applied to
applied experiments on the electron motion, either in
the Braun’s tube or in the electron microscope.
T8-863

S-75. Straubel, H.
266. Electrostatic atomization of liquids. H.
Straubel, Naturwissenschaften, 49, No. 11, 377
(1953) In German.
A brief note describing experiments in which a
liquid which would otherwise just not emerge from a
small nozzle forms a fine spray on the application of
a potential of 15-19 kV.
PA 56-82652

S-76. Stuetzen, O. W.
32, No. 11, 1171 (November 1962).
A contaminated fluid is charged and pumped into an electrodeless
collection space, where particulates are precipitated. An approxi-
mate theory of precipitation is given; it is supported by
experimental evidence. The method is especially suited for
cleaning insulating liquids.
Author

S-77. Stublinger, E.
"Electric Propulsion 1964," Astronautics and Aeron-
autics 2, 26-30 (August 1964).

S-78. Suzuki, S., and M. Tomura
Suzuki, S. and Tomura, M.
STUDIES ON THE MEASUREMENT OF CHARGES
ON FINE PARTICLES. PT. 2. CHARGE MEASURE-
MENT OF TOBACCO AND MOSQUITO INCENSE
AEROSOLS BY A CHARGE SPECTROMETER (I).
Order from ATS $9.75
ATS-93Q69
Trans. of Donald Shaashin (Japan) 1962, v. 4, no. 2,
p. 30-44.
DESCRIPTORS: *Aerosols, Particles, Electric
potential, Measurement, *Tobacco, *Smokes,
Insecticides, Calciades, *Electrophoresis,
Photographic images, Massurion, Spectroscopy.
T10-1151

S-79. Suzuki, S., and M. Tomura
Suzuki, S. and Tomura, M.
STUDIES ON THE MEASUREMENT OF CHARGES
ON FINE PARTICLES, PT. 3. CHARGE MEASURE-
MENT OF TOBACCO AND MOSQUITO INCENSE
AEROSOLS BY A CHARGE SPECTROMETER.
Order from ATS $7.85
ATS-43Q73
Trans. of Donald Shaashin (Japan) 1962, v. 4, no. 3,
p. 18-20.
T11-805

S-80. Swann, H. W.
3433. Survey of harmful static electrification.
Static electrification 5-68-5-70 (1933).
A survey of the history of harmful static electrifica-
tion in industry is given together with examples and
various remedies considered.
PA-57-3433

S-81. Swann, W. F. G.
"Fundamentals in the Behavior of Electrets," J.
Frank. Inst. 255, 513-530 (June 1953).
The paper cites certain results of an earlier paper by the present writer in which
are traced the consequences of the assumption that an electret is characterized by a
state of polarization, semi-permanent in the sense that it decays very slowly with the
time. The decay takes place under the influence of an ohmic conductivity.
The behavior of the dielectric in the case of an exponential decay is determined
by the initial polarization P0, which may vary across the electret, the initial potential
difference V0 between the surfaces of the electret, the coefficient, a, in the exponential
decay, and the quantity RC representing the product of the resistance and capacity
associated with the electret.
In the present paper it is demonstrated that, in the case of an electret which
shows a maximum in the curve representing potential difference between surfaces
plotted against time, all of the foregoing quantities may be obtained from measure-
ments of the initial potential difference, the maximum potential difference, the time
for the potential difference to fall to zero, and the time for it to attain its maximum.
The theory of the matter is extended to the case where the semi-permanent polariza-
tions is represented by a finite or infinite number of contributions, each having its own particular relaxation time.

The paper discusses the question of what determines the initial potential difference after the electret is removed from its forming plates. It is shown that a reasonable understanding of the facts can be obtained qualitatively and quantitatively by assuming that an separating the plates slightly from the surfaces of the electret the charge densities retained by the plates are limited by the condition that the resulting field in the air space is less than the breakdown field in air, at the moment of separation.

Author

S. S. SARYNOK

1055
INFLUENCE OF IRRADIATION WITH X RAYS ON THE ELECTRIFICATION OF HCI CRYSTALS. A. Sarynok.

The measurements of electrical charges on dust clouds of crushed HCl monocrystals previously irradiated with X-rays shows that the value of the mean charge depends on irradiation time. In the case of HCl irradiated with X-rays, a photoelectric effect is not observed, despite the presence of F centres.
T-1. Talwar, S.P. and S.S. Abbi


The stability of a conducting, gravitating, incompressible fluid sphere in a uniform external electric field is discussed by two different methods—the "energy method" and the "equilibrium method". The results obtained by both methods show that the stable configuration is a prolate of ellipticity,

$$ \epsilon / \alpha^2 = 1.85 $$

PA-63-7206

T-2. Taneya, S.


The electrification of sprayed condensed skimmed-milk droplets is studied by observing the electrical potential inside the flow of droplets. Most droplets smaller than 100 μ in radius are charged positively, while larger ones are negatively charged. The electrification of dried skimmed-milk powder in pneumatic conveying is studied by the same method. The powder is positively charged, the amount of charge increasing with particle concentration in the flow and with the flow velocity. The amount of charge on powder particles is determined in running in a V-shaped chute by allowing the particles to fall down in an a.c. field and observing the annular tracks of the particles. For dried skimmed-milk, dried milk, dried butter milk, flour and powdered lactose, it is found that very small particles (≈10 μ in radius) are mostly charged positively, the relative number of positively charged particles decreasing with the particle size. Particles ≈50 μ in radius are neutral. Such a big particle is in reality a composite particle consisting of a bigger particle and smaller ones.

PA-67-8599

T-3. Tassou, P.


II. Interpretation of the plates obtained.

Results. Ibid. 20, 25-57.

CA-37-3036

T-4. Telford, J.W., N.S. Thorndike and E.G. Bowen


T-5. Thomas, D.G.A.


The electrostatic charge acquired by a stream of fine coal particles after making contact with a metal surface has been found to be related to the degree of oxidation of the coal. The effect forms the basis of an instrument for quality control in an oxidation plant.

PA-57-3429

T-6. Thompson, J.J.

"On the Electricity of Drops," Phil. Mag. 37 (1899) p. 341

T-7. Thornton, W.M.


T-8. Tietze, A.

T-9. Tilney, R.

51-535 (1953).

Describes the three methods of applying static electricity to the production of parts to which it is required to apply liquid coating. Development of these processes has led to their commercial application, in the first case by the introduction of particles of causing material atomized by compressed air into an electrostatic field; in the second by the removal of surplus coating material from parts caused by dipping; in the third case by direct application of the coating material atomized and deposited by electrostatic force. The principles of these three processes are described and also mechanical and electrical arrangements for their application to commercial production. Finally some details are given of the types of production at present being handled and a summary of the results achieved by way of costing material savings.

PA-57-3416

T-10. Tkach, V.K.


CA-55-20534F

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T-11. Tonks, L.

2651. Instability and Rupture of Droplets and Bubbles in Strong Electric Fields. L. Tonks. Frank. Inst. J. 221, pp. 613-620, May, 1928. — An approximate quantitative theory of the equilibrium of a bubble or droplet in a uniform electric field is developed and applied to earlier experimental results. An explanation of the oscillation of bubbles in strong fields and the difference in behaviour of positive and negative bubbles is explained on the basis of the discharge of electricity from points.

[See also Abstract 3393 (1955).]

PA-39-2651

T-12. Trage, C.

174. Law of Charging of a Suspended Particle. C. Trage. Ann. d. Physik. 10, 7, pp. 832-846, Aug. 18, 1921.—The charge produced on a particle floating in an electric field is partly due to ions which move along the lines of force to the particle, and partly to the thermal movements of the ions. The author has devised a method of investigating the process in which the spherical particle is replaced by a 4 μ Wollaston wire, stretched parallel to a straight wire at a high negative potential (3000 volts), placed in the axis of an earthed metal cylinder. In the final apparatus the potential wire was surrounded by a concentric cylinder of wire gauge, which separated it from the Wollaston wire. This obviated the difficulty due to electrical wind from the central wire. The theory of Deutsch predicted charges higher than those observed, while that of Arrnett and Kallmann could be made to agree with measurements by making use of a suitable constant of integration. The value of this constant makes it probable that the undisturbed ionic density is brought by turbulence in the gas very near to the surface of the "particle."

PA-35-174

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T-13. Trebitsch, H.

532. Mobility of Solid Spheres of Radius not less than 10^-4 cm. and their Electrical Charges, H. Trebitsch. Zetfs. f. Physik. 39, 9, pp. 607-622, 1926.—Particles of selenium were observed in a gas at various pressures when subjected to an electrical force equal and opposite to gravity. Assuming the law of mobility, B, etc.,

\[ B = \frac{1}{6\mu a} \left[ 1 + \frac{1}{2} \left(A + B - 3V \right) \right] \]

where \( \mu \) is the coefficient of viscosity, \( a \) is the radius of the particle, \( l \) the length of the mean free path of the gas particles, and \( A, D \) and \( C \) constants, the values of \( A, D \) and \( C \) were determined from 155 series of observations, and were: \( A = 1 \times 634, D = 0 \times 172, C = 2 \times 773 \). With these constants, the radii of the particles and their electrical charges were found. Some charges were notably smaller than that on the electron, e.g. \( 2 \times 8 \times 10^{-10} \) e.s.u., and those particles with the smallest charges gave values of \( A \) which were in best agreement with the common value. The significance of this is shown to lie in the uniformity of the density of the separate particles. Also, as a general rule, small charges are associated with small radii. Further, the existence of electrons ought to entail, under specific conditions, equality in the values of \( l/A \), where \( s \) is the charge on the particle, whereas the tabulated values of \( l/A \) vary between 5-6 and 6-0.

PA-30-532

T-14. Tyverskaya, N.P.

Collision and the merging of charged drops. N. P. Tyverskaya. Trayk Glava. Gofka, Ostrumelivni 1958, No. 73, 123-31; Refrakt. Zhur. Geofiz. 1958, Abstr. No. 8217.—An app. was described for the study of the exchange of charges between drops on their collision without fusion and of the effect of the magnitude of the drop charges on the transition of ineffective collisions to completely effective ones, i.e., leading to fusion. The collisions of charged drops, even without fusion, were accompanied by charge exchange. The collisions of charged particles, independent of the sign of the charges, led to the emergence of a neg. charge with relative magnitude which increased with a decrease in the charge of the upper drop. The effect of the charge on the effectiveness of the fusion is attributed to the formation of a double layer; the charge on the drop which decreases the surface tension of the drop.

CA-53-12066b

T-15. Tukia, O.

6192. The electric susceptibility of water drops due to ionic polarization. O. Tukia. J. Phys. Soc. Japan, 6, 31-3 (June.-Feb., 1951). A new formula for the susceptibility of a water drop is developed in which account is taken of the ionic polarization within the drop. It is suggested that the analysis might provide a satisfactory explanation for tropospheric radiowave reflection.

PA-54-6192

T-16. Tunitsky, N.

T-17. Tunitskiy, N., et al

Charging of dust particles in an electrofilter. N. N. Tunitskiy, M. V. Tikhonov and I. V. Petryanov. J. Tech. Phys. (U. S. S. R.) 18, 1727-30 (1940).—The theory of dust charging of particles prepared by Pantshin (C. A. 28, 509) was applied to dust particles with triboelectric charges in the case when the accommodation coefficient does not differ from unity. The expression for the time necessary for full recharging of dust, and for the lowest charge values of these particles which passed the electrofilter was obtained. The discharge process of marble-dust particles in an electrofield is in accord with the theory of Pantshin. Dry coal particles lose their charge more slowly, but the coating of marble and coal particles is very similar.

PA-35-3540


Triboelectric charging of dust particles. N. N. Tunitskiy, M. V. Tikhonov and I. V. Petryanov. J. Tech. Phys. (U. S. S. R.) 18, 1730-4 (1940).—Triboelectric charging on small particles of coal, marble, and marble dust was measured by the method of N. Pantshin (C. A. 28, 509). For coal, marble, and marble dust the no. of particles bearing a given charge is practically equal to the no. of particles of normal humidity or 1-5 elementary charges per P, where P is the mean distance between the particles.

PA-35-3540


Particle discharge in an aerosol in a bipolar atmosphere. N. N. Tunitskiy, V. Zaitsevskii and I. V. Petryanov. Acta Physicochimica U. S. S. R. 13, 327-35 (1940) (in German).—The particle discharge and that of the whole of a dust aerosol in a bipolar-electric atmosphere, prepared according to Z = Zn, where Zn and Z are the charges, + values of 1 and 2 and n is proportional to the ion current and independent of the voltage. The Einstein-Fokker equations for the discharge in air are derived. The experimental data shown in 7 tables and 4 figs. on silic acid fog with n = 0.15 + 0.16 n and charged by a 2-kv prep., agree well with the values n calculated from the derived equation.

PA-35-2065
V-1. Van Ostenburg, D.O. and D.J. Montgomery

3414. CHARGE TRANSFER UPON CONTACT BETWEEN METALS AND INSULATORS. D.O. Van Ostenburg and D.J. Montgomery.


The equilibrium charge distribution between substances in contact is calculated in the one-dimensional approximation for metal-insulator and insulator-insulator systems. The direction of charge transfer is shown to equalize the potential levels, and the magnitude of charge transferred is found directly from the potential difference between the substances in contact.

PA-62-3414

V-2. Vedder, J.P.


Development work on charging and acceleration of microparticles gives promise of a micrometeroid simulator capable of producing velocities well into the astrospace range. Velocities of about 7 km/sec have been attained with highly charged micro-size diamond particles with a 70-kev accelerating voltage. Single particles electrostatically condensed in a high vacuum are charged positively by an ion current to give charge-to-mass ratios approaching 450 C/A.

V-3. Vick, F.A.


After an outline of the relevant parts of the modern theory of solids, the transfer of electrons from metals, semiconductors and insulators is discussed in contact. The importance of surface states is stressed.

PA-57-3425

V-4. Vieweg, H.F.

2926. Frictional Electricity. H.F. Vieweg. (J. Phys. Chem. 30, pp. 665-688, July, 1926).—The present investigation is undertaken with the following objects in view: (1) To arrange a frictional electric series of suitable materials; (2) to explain, if possible, iron, such a series how various factors determine the position a substance takes; (3) to learn what the effect of moisture is, and to what extent this may account for anomalies previously observed. A brief historical survey of the subject is given. Cossa's rule, which states that a frictional electric series of non-conductors from positive to negative corresponds to a series from highest to lowest diellectric constant, is considered. As a result of the study of the effect of moisture it is concluded that it is absolutely necessary to work in the absence of moisture if reproducible results are desired. Three curves showing the variation in charge on the gas with concentrations of ionised HNO₃, NaNO₃, and NaCl are given.

PA-29-2926

V-5. Vlgdorchik, Ye. A.

Vlgdorchik, Ye. A.


Von Eichborn, J.L.


V-6. Von Eichborn, J.L.

"Biological Effect of Unipolarly Charged Aerosols."


V-7. Vonnegut, B. and D.A. McCaig


Streams of highly electrified uniform droplets about 0.1 mm in diameter can be produced by applying potentials of 5-10 kV a.c. or d.c. to liquids in small capillaries. Monodisperse aerosols having a particle radius of a micron or less can be formed if the capillary is positively charged and if liquids having low electrical conductivity are used. Aerosols formed in this way show the colours of higher-order Tyndall spectra.
PA 56-5175

V-10. Vonnegut, B. and R. L. Neubauer

V-11. Von Schweidler, E.
W-1. Walker, E.A. and J.E. Coolidge


An eqn. for efficiency of precipitation is developed. Relation between humidity, applied voltage, size of water drops, and velocity. Graphs diagrammatic, table, p-plates. 0 ref.

EMI 3-2261

W-2. Wall, C.H.


The problem of determining the distribution of electric potential due to a linear charge within an earthed conducting rectangular tube of infinite length has been treated by J. Rauch, P. L. Bayley, and C. M. Hebert [see Abstrat 1190 (1927)]. The solution can be expressed concisely in terms of the sigma functions. A somewhat similar problem of determining the potential distribution around a linear charge between two coaxial circular tubes of infinite length and at zero potential has been solved by J. Rauch [see Abstrat 1190 (1927)]. In both of these problems the solutions were obtained by the method of electrical images. In the present paper the second of these problems is generalized. It is shown (1) that the solution of this generalized problem can be expressed in terms of the theta functions or of sigma functions, (2) that the generalised problem is a simple transformation of the first problem noted above. As subsidiary results there appear functions with multiplicative periods, and also an interesting relation between the sigma functions and the theta functions.

PA-29-2924

W-3. Wasser, E.


The evacuation method, which has led to consistent values of the constants in the law of resistance of the motion of particles, has also brought out in the charges of the particles large deviations from the accepted electronic charges. In order to determine the experimental error of the method, several measurements were made with substances of radial dimensions 10^{-5} to 3 \times 10^{-5} cm. The whole question of the accuracy of the separate observations was then investigated, and it is shown that the deviations of the particle charges from the atomic value cannot be explained either by way of uncertainty in the measurements or by the manner of using the different resistance formulae.

PA-31-792

W-4. Webb W.L. and R. Gunn


Samples of more than 35 natural clouds passed through a special condenser and an ion filter in such a way that the free electricity on the droplets and on the air could be measured separately. The net charge on typical cloud droplets is less than one ion per droplet. This shows that clouds droplets are not appreciably charged or that both positive and negative droplets are present and the distribution is such as to make the net charge very small. The measurements show that the capture of ions of a preferred sign by cloud droplets is not important.

PA-58-9206

W-5. Wells, W.F.


W-6. West, G.D.

3339. Forces Acting on Drops in an Electric Field. G. D. West. Phys. Soc. Proc. 44. pp. 336-341; Dis., 341-342, May 1, 1922.—If whilst a drop of electrolyte is falling in distilled water, a horizontal electric field is allowed to establish itself, the drop rapidly spreads out into a filament parallel to the lines of force. An explanation of this phenomenon is given on the basis of the charge at the boundary between two conductors that necessarily accompanies the transport of electricity. Experiments with dielectrics and with drops that contract instead of expand are described, and the paper is illustrated with photographs.

PA-35-3839

W-7. Woyl, W.A.


The difference in polarization of the positive and negative ions causes the more polarizable (i.e., the -) to be pushed towards the exterior and the less polarizable (the +) to withdraw slightly towards the interior, in order to reduce the surface energy. The effect is particularly marked in water because of the nonpolarizability of the H2O; the surface of the water droplet thus consists of a layer of O'' or OH'' ions followed by a layer of H', giving an electrical double layer; small droplets thus repel one another on collision (with large droplets the greater inertia overcomes the repulsive forces). There must be a transition from the "abnormal" atomic structure of the surface layer to the structure of ordinary water in the interior, and this requires a finite distance—perhaps some hundreds of atomic layers. Hence a water droplet must have a certain minimum size S to be stable, and S will be a function of temp.

Essentially, then, ice is covered with a liquid film, which is in equilibrium with the ice. The significance of these observations for solving, the disintegration of ice, for balance (waterfall)-electricity, for luminescence brought about by grinding (triboluminescence) and by ultrasonic vibration, (endoluminescence), and also for the oxidation which occurs when water is exposed to strong ultrasonic radiation, is considered in some detail.

PA-55-4944
On Wilson's theory of the collection of charge by falling droplets. Whipple, F. J. W., and Chalmers, J. A. "Chem. J. Roy. Met. Soc., 70, pp. 103-118, April, 1944.-Wilson's theory of selective absorption of ions by droplets of water falling in an electric field is developed mathematically in some detail, and trajectories are drawn for ions of different signs and velocities relative to the drop. The effect of turbulent flow is to modify the stream-line theory in some cases, the rate of charging being affected more than the final charge. The results obtained are in good agreement with such experimental work as has been carried out. The application to the production of thundercloud fields is complicated by the low conductivity produced by ion absorption on cloud particles, but tentative calculations show that the process may be of importance in the charging of raindrops below the cloud.
PA-48-2043

W-9. Whitby, K.T.

W-10. White, H.J.

W-11. White, H.J.

W-12. White, H.J.
"Electrical Resistivity of Fly Ash."
Air Repair 3, No. 2, 79-87 (Nov. 1953).

W-13. White, H.J.
"Electrostatic Precipitator for Electric Generating Stations."

W-14. White, H.J.

W-15. White, H.J.
Various aspects of the electrostatic process of cleaning smoke-laden air, with emphasis on the part played by the corona discharge, are discussed. 17 ref.

W-16. White, H.J.
"Particle Charging in Electrostatic Precipitation."
AIEE Trans. 70, 1186 (1951)
W-17. White, H. J. and W. M. Cole
"Design and Performance Characteristics of High-Power, High-Efficiency Air Cleaning Precipitators."

"Electrical Precipitation Fundamentals"

"Electrostatic Collection of Fly Ash"

W-20. Whitman, V. E.
"Electrostatic Precipitation of Dust Contaminants" (Phys. Rev. 28, pp. 1567-1591, Dec. 19, 1956).—Dust clouds were formed by blowing various pure chemical substances through tubes and the net electric charge imparted was determined as a function of the composition of the dust, tube material, area of contact between dust and tube during the blowing process, velocity with which the dust moved through the tube, and length of path of the dust through the tube. An apparatus is described with which photographic records of the paths of particles in an electric field were obtained. Such photographs show the presence of positive, negative, and neutral particles in all dust clouds, even of very pure substances. The ratio of positive to negative electrostatic charges in a cloud is found to change as the larger particles in the cloud settle out, but evidence is obtained which contradicts the hypothesis that the large particles carry an opposite charge from the small particles in a given cloud. The paper closes with a few remarks bearing on the relation of the present experimental data to the concept of a triloelectric series.

W-21. Wigand, A.

W-22. Wigand, A. and E. Frankenberger

W-23. Wild, J. W., and J. D. Stranathan
"Influence of External Treatments on Electret Behavior," J. Chem. Phys. 27, No. 5, 1955 (Nov. 1957). The following effects of external treatments upon electrets have been observed: (1) When the surface of an electret which exhibited a homocharge was placed in a lattice, the sign of the equivalent surface charge changed to that of the heterocharge. This heterochARGE then decayed and the homochARGE finally became dominant again. The magnitude of the final homochARGE was smaller than that of a control electret which was not placed. (2) Repeated cleaning of an electret, with these allowed for recovery between successive cleanings, resulted in repetition of the cycle described in (1). (3) Wax deposition (not subjected to an electric field during manufacture) which were given a frictional charge and then cleaned, showed no reversal of sign; they did exhibit a small recovery after being placed. (4) Electrets subjected to 100% relative humidity exhibited an abrupt decrease in equivalent surface charge. Removal of the moisture resulted in a gradual, slight recovery. (5) The curve relating the equivalent surface charge and the logarithm of the pressure of the air surrounding an electret, has the same form as the curve of the sparking potential for air versus the logarithm of the pressure. Thus, all the treatments described resulted in a decay of the homochARGE, followed by a partial recovery upon removal of the disturbing influence. The observed behavior can be explained in terms of the electret mechanism proposed by Giese.

"Electrostatic Coalescer Systems"
AICHE 55th Annual Meeting, Chicago, Dec. 2-6, 1962
Preprint No. 31.

The various types of electrical coalescer systems available to industry are described. These are applicable to emulsions and dispersions in which the continuous phase has a sufficiently high resistivity to sustain an appropriate voltage gradient without excessive current drains. Processes in which electrical coalescers can be used include the resolution of water-in-oil emulsions generally; the separation of acids and alkaline solutions from oils; the separation of the phases in many solvent extraction systems; the removal of liquid catalysts by alkylation procedures; and the removal of solids from oils by water-washing.

If the electric fields are properly designed and the chemistry of the system is appropriate, the powerful coalescing forces that can be brought to bear on the dispersed material can produce rapid and complete separation of the phases present.

Application of the equipment to oil field dehydration, crude oil desalting, distillate treating and other processes are discussed, giving size and equipment cost.

Author

W-25. Wilson, H. F., R. J. James and E. J. Campau

"Electrostatic Charge Effects Produced by Insecticidal Dusts.
" J. Econ. Entomol. 37, 651-5 (1944).

W-26. Winkel, A.

Wissenschaft. 16, 27-89 (1942).

CA-37-40185

W-27. Woolf, W.

"Electrostatic Coalescer Systems"
AICHE 55th Annual Meeting, Chicago, Dec. 2-6, 1962
Preprint No. 31.

The various types of electrical coalescer systems available to industry are described. These are applicable to emulsions and dispersions in which the continuous phase has a sufficiently high resistivity to sustain an appropriate voltage gradient without excessive current drains. Processes in which electrical coalescers can be used include the resolution of water-in-oil emulsions generally; the separation of acids and alkaline solutions from oils; the separation of the phases in many solvent extraction systems; the removal of liquid catalysts from alkylation procedures; and the removal of solids from oils by water-washing.

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Author

W-28. Woessner, R. H. and R. Gunn


With the object of illuminating the fundamental processes responsible for the electrification of aerosols, a number of measurements have been made to compare the initial distribution of charges carried by various aerosols with their final equilibrium state. Measurements have been made on freshly condensed water droplets and sulfur particles, on both freshly dispersed and aged sulfur dust particles, and on sprayed water droplets; all lying within the 1- to 2-μ radius range.

The measurements show that when numerous ions are formed within the aerosol space the particle charge is not completely discharged but rather the ions greatly hamper the attainment of an equilibrium distribution. Moreover, it is found that irrespective of the initial measured distribution of charges, the final equilibrium distribution approaches a Gaussian curve whose width is dependent upon the mean particle radius and is usually symmetrical about the axis of zero charge.

Because the frequent collision of water droplets can hardly produce appreciable electrification by friction, and because the equilibrium charge on water droplets and on silica particles of the same size are indistinguishable, it is concluded that the maintained charges on aerosols are a direct consequence of the diffusion of the ambient atmospheric ions onto the particles. The equilibrium distributions approach the theoretical forms recently worked out by Ross Gunn.

Author
W-29. Wolf, L.
p. 240-268, Jan. 18, 1889.
An experimental study of the production of electricity by friction between metallic and insulating surfaces, under conditions which are made as definite as possible. Argues that reproducible results are obtained for the magnitude of the charges developed, and for the effects of electric fields on the sign and magnitude of these charges. The results are discussed in terms of the "motion pressure" theory of electrification.
PA-32-1617

W-30. Wooding, E.R.
Concentration rate when there is a potential barrier around the aerosol particle is calculated and two examples are considered.
BET 6-10839

"Structure and Electrification." in Byars, H.R.
(Ed.) "Thunderstorm Electricity," Univ. of Chicago Press, Chicago, 1953, pp. 139-149.

W-32. Workman, E.J., and S.E. Reynolds
1950. Production of electric charges on water drops.
E. J. WORKMAN and S. E. REYNOLDS; E. W. B. GILL.
The implication is refined which is implied in a recent communication [Abbr. 2545 (1952)] that the potential difference accompanying the freezing of aqueous solutions be interpreted as contact potentials. The effect of impurities on the sign of the resulting potential difference and the mechanism of charge separation during the freezing process are discussed.
PA-55-7250

W-33. Workman, E.J., and S.E. Reynolds
The discovery of an electrical effect accompanying the orderly freezing of aqueous solutions is reported. Potential differences as great as 230 V are measured across the water-ice interface during the freezing process. At a freezing rate of about 1 cm per min, a current of 1 mA is measured. The character of the effect is a function of the nature and concentration of the solute. The dependence of the effect on the structure of the ice of the solute and the water-ice interface structure of water is shown. Possible application of this effect to chemical detection and to the formation of thunderstorm electricity is discussed.
PA-53-5802

W-34. Workman, E.J., and S.E. Reynolds
1953. A suggested mechanism for the generation of thunderstorm electricity. E. J. WORKMAN and S. E. REYNOLDS. Phys. Rev., 74, 709 (Sept. 15, 1953). -Preliminary tests on the potentials developed between the liquid and solid phases of water during a rapid freezing process indicate that contact potentials cannot be advanced as an explanation of the results obtained. Freezing of water in an earthed metal cup produces a potential difference as soon as a thin film of ice separates the water from the cup. The initial polarity is found to depend on the local field of the water, a reversal of polarity being sometimes observed as freezing approaches completion. Test results obtained on water drops impinging on cold ice are suggested to satisfy the requirements for the initial electrification in thunder clouds.
PA-52-4316

Z-1. Zebel, G.

Zebel, Gisner.
7 refs.
Order from JLA no. 81, pp. 83-104.

The strong dependence of physical and chemical properties on aerosol on particle size distribution of charged aerosols. With the aerosol containing a large number of particles per square centimeter, the particle size distribution generally changes so quickly that an experimental determination of the particle size distribution as a function of time is experimentally difficult. This result can be obtained only by one measurement with the help of the time rate of change of particle size distributions according to the theory of Kolosbuschke. As an example, the complete calculation is based on the solution of the resulting integrals-differential equation was obtained by means of an electronic computer.

71-381

Z-2. Zebel, G.

Zebel, Gisner.
10 refs.
Order from JLA no. 83, pp. 50-60.

A basic theory is presented concerning the behavior of electrically-charged aerosols. The differential equation for the expansion of electrically-charged aerosols in the electric field produced by the particles themselves is calculated. Combined with the electric field, an integral-differential equation for the changes of the particle size distribution of aerosol-electrodes. The following conclusions result from the theory. Two aerosol particles are to be considered at strongly charged if when they are to connect their electric potential energy is large compared to the thermal energy KT. For strong charges of the same sign on particles the probability of coagulation depends exponentially on the product of the charges on the particles. For strong charges of opposite sign on particles the probability of coagulation depends only proportionally on the product of the charges of the particles. If an aerosol is stabilized against coagulation by strong unsymmetric charges, then, in addition to the inhibition of coagulation, there arises a mass flow of the aerosol into the aerosol particles endeavor to get away from one another due to electronic repulsion. For an aerosol with strongly unsymmetric charges, consisting only of particles of the same size and with the same charge, the mass flow resulting from electronic repulsion is given exactly by a formal relationship between the number of particles per cm² and the time. In a formal sense, but not in physical significance, this law agrees with the coagulation law of Smiljakovitch (Z. phys. Chem. 92: 105-144, 1918). T2-39

Z-3. Zeleny, J.

3393. Electrical Discharges from Drops in Air. J. Zeleny.
Frank. Inst., 219. pp. 689-706. June, 1938. - A study of previous work on discharges from charged attached drops from and from uncharged drops falling in electric fields shows that the surface electric intensities at these drops, when the discharges begin, satisfy the theoretical relations for surface instability. Glow discharges, if initially present, are conditioned by the surface formation arising from instability. Experiments are described that indicate that the highly charged droplets ejected by an alcohol surface may have mobilities not much below those of normal air ions while such droplets coming from a water surface may have mobilities even greater than those of air ions. Calculations, by Stokes' law, show such large mobilities for both kinds of drops to be possible. Further experiments show that under certain conditions the whole discharge current from an alcohol drop is carried solely by droplets of the liquid, resulting from surface instability, and under more restricted conditions the same may be true for a water drop.
PA-38-3393

Z-4. Zeleny, J.

137. Variation with Temperature of the Electrification Produced in Air by the Disruption of Water Drops and Its Bearing on the Prevalence of Lightning. J. Zeleny. Phys. Rev. 44, pp. 887-948, Nov. 14, 1933. - The total charge carried by the negative ions which are produced in the air when a water drop is disrupted by falling through a horizontal stream of air was measured for different stream velocities at temperatures between 1°C. and 63°C. The dependence of this charge upon the size of the drop was found from observations made with drops differing in volume between 0-078 c.c. and 0-092 c.c. For blasts exceeding that necessary just to disrupt the drops, the charge obtained per drop disrupted increases rapidly both with the velocity of the blast and with increase of temperature. The rate at which the charge changes with increase of temperature of the drop depends upon the magnitude of the air stream employed for producing the disruption. For drops of 8-8 mm. diameter falling from a height of 8 cm. through a horizontal cylindrical stream of 1 cm. diameter and having an average velocity of 20 m/sec., the relation between the numbers of negative ions produced per drop disrupted at the temperatures 1-5°C., 24-3°C., 33-1°C and 63-8°C., respectively, was found to be 1:3:4:11. In the range of temperatures found in the atmosphere at different times the amount of electrification produced in the air when raindrops are disrupted by air currents of a given magnitude may be at least three times that occurring when the rain-water is warm as when it is cold. Rain temperature is therefore an important factor in determining the frequency and intensity of lightning discharges.
PA-37-17

Z-5. Zeleny, J.

Z-6. Zeleny, J.
"On the Conditions of Instability of Electrified
Drops with Applications to the Electrical Discharge
from Liquid Points." Proc. Cambr. Phil. Soc. 16,
71 (1915).

Z-7. Zoltoer, K.D.
"The Electrical and Mechanical Properties of Thin
Liquid Films."
SUPPLEMENTARY SURVEY

(Additional open literature references through May 31, 1965)
SA-1. Akazaki, M.

Corona Phenomena from Water Droplets on Smooth Conductors Under High Direct Voltage.—The effect of high direct voltage on the formation and dislodging of water droplets hanging from a smooth conductor is shown and used to explain the resulting corona characteristics, such as pulse amplitude and repetition rate, audible noise, radio influence and loss current, and corona current waveform.—M. Akazaki. *IEEE Transactions on Power Apparatus and Systems*, v. PAS-84, Jan. 1965, p. 1-8.

SA-2. Amelin, A. G.

Amelin, A. G.

MSTS SERVE MAN. 20 Dec 61 [87]p. 15 ref.

BIBL: 11753.

Order from OTS or SLA $8.10 62-15353


DESCRIPTION: *Fog, Clouds, Artificial precipitation, Vapors, Condensation, Scientific research.*

This book examines the basic properties of mist, the conditions of their formation and prevention, and examples are given of the utilization of mist in various fields of science and technology. T7-891

A general survey article written at an elementary technical level. The author indicates that charged insecticides can be deposited at over twice the rate of uncharged ones with even greater improvement in uniformity of surface covering but gives no details of data.

SRI
SB-1. Ballou, J. W.

"Static Electricity in Textiles."

SB-2. Bandel, H. W.

A survey study has been made of point-to-plane corona in dry air for a range of pressures and point sizes. It has been found that negative points can be satisfactorily triggered by ultraviolet illumination and that the discharges encountered in past attempts have probably been due to too intense illumination and possibly the presence of dust on the points. Under some conditions transitions from point to point to point discharge have been observed for negative points at high voltage. With positive points the occurrence of pre-onset streamers has been found to depend on higher pressures and the presence of water vapor to give sufficiently high photon absorption. Breakdown streamers are not observed with standard geometry for the usual points sizes, because the first one always closes the gap resulting in breakdown. For points of around 2 mm dia., the gap must be at least twice standard length with room air, and about two and one-half times standard length with deionized air, for breakdown streamers to be observed.

PA 54-9504


Ice points of 1 and 2 mm dia., mounted 8 cm from a plane, were used in corona studies. Threshold voltages, for corona onset, with +ve and -ve points and the corresponding current/voltage curves were determined. The effect of point conductivity on the nature of the discharges is described, and the difference between +ve water and ice points is accredited to relatively efficient photo-emission in the latter case.

PA 54-7915

SB-4. Barrett, P.

Compare phenomenon with atomicization of dissolved electrolytes. 6 ref.

BMI 3-9231

SB-5. Barrett, P.


CA 46-5465

SB-6. Barrett, P.


CA 47-58231

SB-7. Barrett, P.


CA 44-8184c

SB-8. Beach, R.

"Preventing Static-Electricity Fires. Parts I, II, III."
Chem Eng. 71, No. 26, 72-78 (Dec. 21, 1964)
ibid 72, No. 1, 63-66 (Jan. 4, 1965)
ibid 72, No. 3, 85-88 (Feb. 1, 1965)
SB-9. Benz, R.
"Electrostatic Neutralizer Discharge and Safety Characteristics." Elec. Engr. 71, 329-34
(April 1952).

Static electricity in industry is a menacing problem to production and personnel. Presented here is an evaluation of various types of static neutralizers with test data showing their comparative effectiveness to assist engineers in selecting suitable anti-static equipment.

Author

SB-10. Bolster, D.
911. Investigations on the strength of several materials. Orderly compaction of aerosols. [H.
The author describes methods for determining the strength of threads formed by sediments of colloid particles in a gaseous medium. The values thus obtained are compared with those calculated under the assumption of the exclusive presence of London and van der Waals forces. There is a good agreement between experimental and theoretical values. Where this is not the case it is assumed that the forces are not independent of surface diffusion or that they are due to the influence of additional Cundari forces. [Res. Abstr. 3955 (1936) and 1420 (1937).]
PA 44-911

SB-11. Bennett, C. J. et al

SB-12. Berghaus, H.

SB-13. Blanchard, D. C.

SB-14. Bonelli, L.

SB-15. Böning, P.

SB-16. Bowen, H. D., P. Hobblethwaite, and W. M. Carlton
"Application of Electrostatic Charging to the Deposition of Insecticides and Fungicides on Plant Surfaces." Agricultural Engr. 33, No. 6, 347-50 (June 1952).

SB-18. Bricard, J.


Summary: The idea of the mean free path of small ions is introduced in a theory previously published, and a value of the combination coefficients of these small ions on very small aerosol particles are evaluated. Theoretical results are discussed in comparison with experimental values.

Author


6155-104572 Aeroprop General Corp., Downey, Calif. Research Div.

INVESTIGATION OF THE COALESCENCE OF WATER DROPLETS Summary Report


Laboratory studies of the coalescence of water drops after contact under conditions simulating or exaggerating those commonly prevalent in the atmosphere and in clouds are reported. Efforts to find additives in the droplets atmosphere and in clouds are reported. Efforts to find additives to the droplets and to the air environment that would shorten the delay of coalescence were unsuccessful. However, the effects of minimizing radiation, drop environment, drop size, and collision velocity were investigated to evaluate the presumable that coalescence is promoted by a charge difference between the two colliding droplets. Theoretical analysis of the results qualitatively confirms the following: (1) The rate of coalescence increases directly as the square of the potential difference between the drops, under conditions in which the surface tension pressure is not negligible. (2) Coalescence time is inversely proportional to both surface tension and velocity. (3) An increase in the temperature enhances coalescence. (4) A sufficiently strong contact pressure or a fast relative velocity between otherwise stable drops often causes coalescence.

NSR-10457, 01-12

SB-20. Browning, K. A. and B. J. Mason

11401 PRODUCTION OF ICE CRYSTALS AND ELECTRIC CHANGE BY SPLINTERING OF FREEZING DROPLETS IN THUNDERCLOUDS. K. A. Browning and B. J. Mason.


According to the Mason-Latham mechanism (Abstract 20834, 20835 of 1961; 6012 of 1963), the main thunderstorm charge is generated by the impaction, freezing and splintering of supercooled droplets on pellets of small hail. The rates of charge and splinter production are calculated using the Latham-Browning model of the thunderstorm. The rime supercooled droplets capable of producing charge at the required rate of about 1 amp in the region of strong updraught if large cloud droplets of r > 25 μ are present in concentrations of ~ 10 cm⁻³ near the 0°C level. Splintering of these droplets while freezing on pellets of small hail would produce ice crystals in concentrations about one-tenth those of the large droplets between the -10°C and -30°C levels. The calculations indicate that the bulk of the thunderstorm charge cannot be generated and separated in regions of weak updraught because the production of splinters would lead to rapid glaciation of the cloud and the disappearance of supercooled water droplets.

PA 66-11401


Size distribution of droplets in clouds above freezing temperatures, is measured by charging droplets in an electric field and allowing them to impinge on collecting cylinders of different diameter. The droplets are separated, according to size, by flow around the larger cylinders. The charge deposited on each cylinder is measured in a manner to determine the size distribution, when the collection efficiency is known. A derivation is given of the electric field equation used and of the rate of acquisition of charge by water droplets. A flight instrument used to evaluate the method indicated required improvements in technique.

AMR 5-310
SB-22. Buell, A.

LUEHL 1932
Wasserfall-Effekt und Oberflächenstruktur von Flüssigkeiten (Water-fall effect and surface structure of liquids), A. Buell (Zuerich, Switzerland). Kolloid-Z. Vol. 69, No. 3, 1932, pp. 346-353, 6 fig., 3 tabl., 34 ref. (without titles).
Cited in LOEBS 1946. Discusses: basic principles and experimental methods; sprays can be produced by (1) water-jet impact against solid obstacle, (2) bubble through the liquid which burst at the surface and produce droplets, and (3) air flow which aspirates the liquid from a container, as a perfume atomizer. Heads: use of the electric double layer; order of magnitude of charge carriers; electrolytes; colloidal solutions; potential difference; gas adsorption; dipole moment; mercury and amalgams. Refers to LENARD 1893 (electricity of waterfells), and LENARD 1920.

do J. II-91

SB-23. Bytner, E. K. and F. A. Gisina

N54-20269 Joint Publications Research Service, Washing-
on, D. C.

EFFECTIVE COEFFICIENT OF CAPTURE OF AEROSOL PAR-
TICLES BY RAIN AND CLOUD DROPLETS

E. K. Bytner and F. A. Gisina. In Turbulent Diffusion in the
Surface Layer of the Earth's Atmosphere 6 May 1964 pp 133-
181 refs (See N54-20269 13-21) 018-55 00

Numerical evaluation is performed of the coefficients of
capture of subparticulate by rain and cloud droplets influenced by
diffusion mechanisms of capture. The effective coefficient of cap-
ture is computed for a given distribution of sizes of suspended par-
ticles and water droplets. Different mechanisms of capture by
droplets or rain predominate in different ranges of sizes of sus-
pended particles. The predominant capture of subparticles with radii
ranging from 10⁻⁷ to 5×10⁻⁵ cm is that due to electron capture interactions of the particles and cloud droplets. For subparticles with radii ranging from 5×10⁻⁷ to 5×10⁻⁵ cm, capture is due
mainly to electronic and polarization mechanisms, and for
particles with radii ranging from 5×10⁻⁵ to 1×10⁻⁴ cm, cap-
ture is dominated by the polarization effect.

N54-20269, 13-21
SC-1. Cahn, J. W.


Calculations are made to show that an electrically charged sphere becomes metastable when the ratio of electrostatic to surface energy is in excess of 0.7.

PA 66-9432

SC-2. Carson, R. S.

N66-12022y Illinois U. Urbana Charged Particle Research Lab

ELECTRICAL SPRAYING OF MACROSCOPIC LIQUID PARTICLES UNDER PULSED CONDITIONS

Ralph E. Carson 15 Jan 1966 56 p. ref.

(Grams: NSF G-19778, AF-AFOSR-107-62)

AFOSR 66-1470, AD-A00423B

It was found that glycerine, Octoil, and Octol doped with tetra-n-butylammonium perchlorate readily sprays from the end of a fine capillary, maintained at a high dc potential, in short periodic bursts that continue over a prolonged time interval of at least several hours. The dependence of the natural pulsed spraying on applied voltage, on liquid constants and pressure, and on the geometry of the apparatus is determined by observing the spraying current; typical results are given. New techniques are presented for determining the specific charge spectra of the droplets emitted in selected intervals during the spraying pulses by time-of-flight mass spectrometry, and for taking microphotographs of the liquid surface at any instant before, during, and after the spraying pulses. A method for synchronizing the spraying to an external pulse is indicated.

N55-12023, 02-28

SC-3. Cho, A. Y. H.


Micron-sized particles (0.3 to 15 μm in radius) of metals such as aluminium, carbonyl nickel, molybdenum; semiconductors such as magnetite and zincosum hydride; and insulators such as aluminum oxide, silicon oxide, and oxaphosphors are charged by contact electrification in electric fields up to 8000 V in a 0.3-cm gap. The charges are measured with a drift-tube detector and a quadrupole mass spectrometer and compared with a theoretical value which includes the contact potential and the electric field. Experimentally, the contact charge is quite important for particles less than one micron in radius, but relatively unimportant for larger particles. The experimental values are in good agreement with the calculated values for the range of materials and particle sizes studied.

Author

SC-4. Cochet, R.


Les lois de charge des particules submicroniques sont necessaires a l'etude de leur comportement dans les electrodites et les appareils electromediques d'analyse des aerosols. Nous proposons ici une correcion a la loi classique de charge des particules micrométriques dans les champs electromediques qui permet d'appliquer cette loi aux particules submicroniques.

La verification experimentale de cette theorie appliquee a des sphérophiles de gomme laque dont les rayons sont compris entre 0.2 et 0.5 micron et chargés dans des champs ionisés compris entre 1500 V/cm et 6000 V/cm donne des résultats interessants. Nous avons mis en évidence un minimum de vitesse de precipitation pour les sphérophiles dont les rayons sont de l'ordre du dixième de micron.

Author

SC-5. Cochet, R.


Afin d'étudier l'action des aerosols electrostatiques sur les brouillards, nous avons d'abord utilisé différentes méthodes permettant de déterminer, soit par le calcul, soit graphiquement, le coefficient de captation γ d'une sphère électrisee en tenant compte du champ créé par l'aerosol électrisé, puis exposé les méthodes de calcul permettant de suivre le grossissement de cette sphère abandonnée dans un brouillard. La théorie générale de la captation a été vérifiée dans le cas particulier des cylindres et dans ce cas les trajectoires des gouttelettes de brouillard à proximité d'un conducteur cylindrique électrisé ont pu être chevronographiées.

Les calculs du coefficient de captation initial des sphérophiles solides électrisés montrent que les petites sphérophiles de l'ordre du micron ne sont utilisables que si elles sont plus fortement chargées que dans les conditions habituelles.

Author

SC-6. Coehn, A. and A. Curs


Author

CA 19-604
SC-7. Coehn, A. and J. Franken
"Contact Electricity of Solid Dielectrics Against Conducting and Nonconducting Liquids."
Ann. Physik 48, 1005-13 (1915);

"Contact Electricity in High Vacuum."
Z. Physik 5, 242-63 (1921).

"Contact Electricity of Gases in Relation to Conducting and Non-conducting Liquids."
Ann. Physik 43, 1948-78;

SC-10. Coehn, A. and V. Raydt
"The Quantitative Validity of the Law Concerning the Charging of Dielectrics."
Ann. Physik 30, 777-804

SC-11. Coen' er, W.
"Recording Dust Measurements with Gas Ion-Deposition Techniques."

SC-12. Cohen, E.
NASA-27981, Spedal Technology Labs, Redondo Beach, Calif.
RESEARCH ON CHARGED COLLOID GENERATION Final Report, Apr. 1963–Mar. 1964
E. Cohen, Wright-Patterson AFB, Ohio, AF Aeron Propulsion Lab., Jun. 1964 112 p
(Contract AF 33(657)-10999)

The experimental research involved in the electrical-dispersion-of-liquids technique of generating a charged colloid beam is described. Charge-mass ratios were obtained by using a quadrupole focusing mass spectrometer during the single capillary tube stage of the work. When multiple needles were operated in parallel to increase the beam current, time-of-flight measurements replaced the quadrupole spectrometer. Data are presented both for the results obtained with single capillary tube operation and for the operation of many tubes in parallel.

NASA-27981, 20-07
SC-13. Cooke, B. A.


Particles were allowed to slide down an etched aluminum chute. The results showed that an adsorbed moisture film on the surface of particles of an ionic salt (e.g., NaCl) increased the amount of charge generated. For very thin glasses the converse was true. Also, the charge on glass spheres covered by a moisture film, soon reached a limiting value when the amount of siding was increased, but this was not evident for the ionic salts under the same conditions. The results for ionic salts contradicted the common principle that appreciable electrostatics accompanies friction between two surfaces only if one or both of them has a low electrical conductivity. It is suggested that charge separation between an ionic salt and metal is mainly due to ion transfer whereas the electrostatic rule has been based on systems where electron transfer is predominant.

PA 58-8725

SC-14. Cooperman, P.


A new probe method is developed by which steel balls are fired, through the discharge water investigation, into a Faraday cage in which the charge is determined by an electrometer. Test results are different for a co-axial cylinder and for parallel wires between plates. The results obtained critically examined. Conclusions are drawn on the distribution of the field strength and current density in electrical precipitators.

EA 60-188

SC-15. Culp, G.

N64-33819. An E50 Test of Tech. Wright Patterson AFB. Ohio. School of Engineering


Liquids studied included distilled water, oncologically deoxygen water (HgSO4 in H2O) and liquid nitrogen. The liquids were forced under pressure through small metal capillary tubes held at high positive potentials with respect to a nearby ground plate. Liquid nitrogen was studied at atmospheric pressure and in vacuo; water was investigated only in vacuo. Particles sprayed from the capillary tubes were monitored with charged particle detectors to measure any net electrical charge. Results obtained showed that, in all cases, there was no charge attached to the sprayed droplets, and this lack of charge is to be expected since the droplets were below the breakdown voltage of the liquid. The results are consistent with the hypothesis that the sprayed droplets contain no charge.

N64-33819, 24-11

SC-16. Cunningham, R. G. and D. J. Montgomery


An apparatus has been constructed to rub filaments together under constant mechanical and ambient conditions and to measure the charge remaining after separation. The apparatus is similar to that of Hersh and Montgomery, with refinements to obtain better control of mechanical variables and to allow variation of ambient pressure. A photometer has been added near the filaments to detect the incidence of electrical breakdown of the atmosphere. Many of Hersh's findings for 45°-45° rubs have been confirmed, specifically those on reproducibility and triboelectric pairs.

On the other hand, some findings have not been substantiated when the range of variables is extended. For nylon rubbed on polyethylene, the charge q shows a square-root dependence on the normal force F, in place of the linear dependence found by Hersh. The charge shows an inverse proportionality with diameter d, in contrast with the independence noted by Hersh. For tantalum rubbed on nylon, the charge is found to depend on a combination of velocity v, conductivity σ, and presumably dielectric constant E, together with a characteristic distance l to be determined empirically. The charge dependence on length of rub L is taken to be the proportionality found by Hersh, the combined relation

\[ q = \frac{c}{(L_0/L)} \left(1 - e^{-\alpha L_0}ight) \]

is suggested, where the sign and the magnitude of \( c \) are in principle determined by the details of the band structure, but in practice are fixed experimentally. No detailed theoretical picture has been obtained to justify the rest of the expression, and it must be considered at present as an empirical relation whose generality and basis remain to be established.

Author
SD-1. Darowsi, G.

SD-2. Davis, M. H.
N64-21300 RAND Corp., Santa Monica, Calif.
ELECTROSTATIC FORCES AND CLOUD-DROPLET INTERACTION
M. H. Davis Mar 1964 11 p (P-2885 AD-432228)
The purpose of the investigation was to study electrostatic effects on cloud-droplet trajectories, coalescence, and charging. The case of droplet interactions in warm clouds where droplet radii are less than 25 microns was investigated. Under those conditions, Hocking's solution to the hydrodynamic forces was found to be valid and was used. The electrostatic forces were computed for separations greater than the radius of the larger drop by the "charge-and-dipole" approximation. The assumption that cloud droplets can be treated as conducting spheres is critically examined and appears valid.

SD-3. Davis, M. H.
The electrostatic boundary value problem of two conducting spheres in a uniform electric field is solved in biharmonic coordinates. The spheres may have any relative size, may be charged or uncharged, and the field may vary with the line of centers. Components of the force acting on one of the spheres along and perpendicular to the line of centers are derived, and numerical results are presented. Cited BARTOR 1904 and 1966, and BARTOR and DAVIS 1960. One important application is in the field of cloud physics, because electrostatic effects can influence the coalescence of cloud droplets; results are of interest in the physics of colloids. In the treatment the water droplets are considered conducting rather than dielectric spheres, and distortion of droplets when they are close together is neglected. Treatment is highly mathematical, involving potential functions, Laplace's equation, Legendre polynomials. Results are presented in generalized form, and related coefficients are plotted as graphs.

Also available as ASTIA document No. AD 254 862.

SD-4. Deryagin, B. V.
11441 THE FORCE BETWEEN MOLECULES.
B. V. Deryagin.
A review article dealing with intermolecular forces and their electromagnetic origin.

Cited in DERYAGIN 1960. Reviews previous and current theories (London, Casimir, and Polder, HAMAID 1937) on existence and magnitude of molecular forces in objects of finite size. Discusses method of direct measurement of the molecular attraction of two solid bodies as a function of the gap separating them; supplies the results to problems of surface phenomena and colloid chemistry. Describes and illustrates the beam-type microbalance with photodetector, negative feedback; used two quartz glass specimens, one plane and one spherical; gap between those was determined on basis of Newton's rings which were observed with a microscope. Discusses extreme cases in clearing the surfaces and eliminating spurious forces such as static electricity. Measurable range of forces is from 2 x 10^-6 to 20 dynes, and of gap widths 10^-4 to 10^-3 cm. Found that attraction between a spherical and a plane surface is proportional to the radius of the sphere. Results confirm existence of long-distance molecular surface forces; discusses applications of findings to theory of coagulation (FUCHS 1924).

SD-6. Deryagin, B. V. and S. S. Dukhkin
Deryagin, B. V. and Dukhkin, S.S.
SUR LE ROLE DE LA DIFFUSION DANS LES PHénomèNES ELECTROCINÉTIQUES. THÉORIE D'UN phénomène de L'EFFET D'UN POTENTIEL DES PARTICules EN MOUVEMENT. 8pp. 4 refs., CNRS X 688.
Order from OTS, ETC or CNRS $1.10 TT 63-26430
Another trans. is available in English from CB $5.00.

SD-7. Deryagin, B. V. and Ya. I. Rabinovich

SD-8. Deutsch, W.

SD-9. Deutsch, W.
SD-10. Devin, S. E.
ON THE CONSOLATION OF AEROSOLS. I.
E. E. Devin.
The compaction of homogeneously charged aerosol of
diatom powder (200) was studied under essentially uniform
experimental conditions. The experiments were carried out in a
chamber (21 cm) under "still" conditions. The decrease in
carbon concentration of the aerosol in the chamber due to com-
parison and dispersion of the aerosol was measured for 3-4 hours. From
the experimental data, the compaction constant (k) and the deposi-
tion constant (g) were evaluated by the use of the equations and
analytical method of Langmuir and Gillham. A good agreement
within the accuracy of the measurements, was obtained between
the experimental and theoretical values of k predicted from
Brown's theory of compaction.

PA 67-4717

SD-11. Dimick, R. C. and S. L. Soo
THERMAL ELECTRIFICATION OF A CONDUCTING SPHERE
R. C. Dimick and S. L. Soo Aug 1954 11 p refs Submitted
for Publication
NRL 14-57-2865
Thermal electrification of a conducting sphere placed in a con-
centrate vacuum by thermal expansion was analyzed by space charge
was studied. A method of solution of the integral equation of the
electric field is presented

N64-33576, 24-23

SD-12. Dimick, R. C. and S. L. Soo
SCATTERING OF ELECTRONS AND IONS BY DUST PAR-
TICLES IN A GAS
R. C. Dimick and S. L. Soo Charleston, Va U. School of
for Publication
NRL 14-57-2865
Scattering of a partially ionized gas with dust particles
was studied. Results show modification of an earlier approxi-
imation by Rogan with consistent degree of approximation

N64-19637, 12-24

SD-13. Dimick, R. L.
"Jet Disperser for Compacted Powders in the
1-10 or Range."
Arch. Ind. Health 20, 8-14 (July 1959).

SD-14. Dinger, J. E., B. J. Mason and J. B. Matthews
ELECTRIFICATION ACOMPANYING MELTING OF ICE
AND SNOW.
J. E. Dinger, B. J. Mason and J. B. Matthews.
Dinger in this letter points out that the negative results obtained by
Matthews and Mason (Bull. 2203 of 1954) could be due to CO2
"poisoning," to which Dinger and Mason found this effect to be
extremely sensitive. Mason and Matthews in a reply agree with the
criticisms and express the intention of experimenting with CO2-free
water.

PA 67-23767

SD-15. Dinnal, K.
"A Summary Report on a Series of
Measurements to Test an Electro-Aerosol
Apparatus." Bericht a.d. Bahnologisch en

SD-16. Dodd, E. E.
"Short Method for Evaluation of the
Townsend Integral for Electron Avalanche

SD-17. Druett, H. A. and K. R. May
DRETT and MAY 1954
Production of Individual Sized Droplets by High-Voltage "Firing" from a
2 ref.
Uniform size droplets can be produced in the range below 10 microns with the Lanier
vapor condensation apparatus, between 10 to 1000 microns by the spinning disc principle,
100 micron to several mm, by the vibrating tip, interrupted jet, and microjette princi-
ples, and 800 micron to 6 or 7 mm, by liquid falling by gravity from the tip of a vertical
tube. Only the last method is suitable to produce individual droplets, but only large ones.
Developed method for producing individual droplets, down to 10 micron size, by using a
micropipette and applying a momentary high-voltage to the liquid. The technique, re-
quired pipette atts., how to make them, and required voltages for each size pipette, are
given in detail. Used the droplets for experiments on the evaporation rates of various
airborne droplets, but suggest also other uses, such as combustion studies, sprayworks
of insecticides to specific areas on insects, etc.

de J 11-140

SD-18. Dukhin, S. S. and B. V. Deryagin
"Diffusion - Electrical Potential of a Falling

CA 54-24112b

SD-19. Dunskii, V. D. and N. S. Smirnov
"The Effect of Ionizing Radiations on
Aerosol Dispersion."

CA 54-7288d
SE-1. Ehrenhaft, F.
"Development and Progress on the Question of the Size and Charge Determination of Individual Particles."
Phys. Zeits. 39, 673-87 (1938)

SE-2. Eigen, M. and L. DeMaeyer
SELF-DESOCIATION AND PROTONIC CHARGE TRANSPORT IN WATER AND ICE.
M. Eigen and L. DeMaeyer.
A comprehensive survey on experimental techniques, results and theoretical interpretations concerning the self-dissociation and protonic charge transport in water and ice is given. Direct measurements of individual properties of "normal" and "defective" protons in ice molecules, concentrations, reaction rates etc. are presented. The proton transport in hydrogen-bonded media is completely different from normal ionic migration and corresponds more to electronic transport processes in semiconductors. Generally the proton transport through hydrogen bonds involves two processes: (1) the formation for rearrangement of H-bond structure with orientation, favorable for a proton transition, and (2) the charge transfer within the H bond. The first step is rate determining in water, whereas the second one is decisive for the charge transport in ice. The requirement for a theoretical treatment therefore are (1) for water: a theory of "structural diffusion" of the H-bonded hydration complex of HDO, and (2) for ice: the quantum-mechanical theory of the protonic motion within the potential well of the H bond. The mechanism of structural diffusion provides an explanation of the anomalous ROH and OH- mobility and their recombination rates in water. Arguments demonstrating the analogy between protonic and electronic charge transport are given.
PA 63-7738

SE-3. English, W. N.
Positive and negative point-to-plane corona in air.
The process has involved a careful comparison of positive and negative corona and observations at reduced pressures in the range 756 to 210 mm Hg. Oscillographic observation of corona pulses with a time resolution of the order of 10^{-6} sec, visual and photographic observations of the corona, and current-voltage measurements have thrown new light on fundamental corona processes.
Some of the significant results obtained are as follows:
For a polished Pt point of 0.03 mm diameter of curvature, the thresholds of positive and negative corona were 0.8 and 0.9, respectively.
The high-speed photographs of the positive corona showed that the Trichel pulses were approximately equal but showed a small pressure-dependent difference. Both curves showed linear Ohm's law regions, and the negative current was always the larger; these effects are due to space charge. The negative corona revealed the fluctuations and dependence on surface conditions noted by previous workers.
PA 51-2847

SE-4. English, W. N.
Corona from a water drop.
Studies with a water drop point in a point-to-plane gap have yielded important results. A point in the water drop has a very low secondary electron emission coefficient, and for the first time a large difference in positive and negative intermolecular onset potentials in air due to this has been observed. The luminosity obtained with a negative drop point and the complex oscillograph pulses on both polarities have been accounted for by considering positive corona from charged droplets leaving the water point and assuming that true negative corona from a water surface is impossible. The space charge weakening of the field about a positive point, long assumed to explain the disappearance of the pre-corona streamers, is here confirmed by the reappearance of a stable drop point well above the initial potential required for disruption of the water surface.
PA 51-2848

SE-5. English, W. N. and L. B. Loeb
216. Point-to-plane corona onset.
The effect of point material and point radius of curvature on positive and negative intermolecular corona onset potentials has been studied with a point-to-plane gap in air at atmospheric pressure. The negative Trichel pulse onset is independent of point material but does depend on point history and radius. This surprising result is shown to come from the circumstance that the Trichel pulse onset depends on current densities needed to condition the point surface and yield a higher value of the second Townsend coefficient to give the increased currents. Trichel pulse onset thus does not mark the onset of a self-sustaining discharge. The self-sustaining discharge initiates at lower potentials and leads to currents of a low order until the cathode spot cleans up.
PA 52-6216

SE-6. Evans, D. G. and W. C. A. Hutchinson
RECEIVED THE ELECTRIFICATION OF FREEZING WATER DROPLETS AND OF COLLIDING ICE PARTICLES.
D. G. Evans and W. C. A. Hutchinson.
When supercooled droplets of diameter 1.3 mm were sprayed at -6.2°C and froze in an environment at -10°C and (n of 10 cups), the average charge on positive residues was 1.5 x 10^{-5} e, and on negative residues 2.3 x 10^{-6} e. The charges were comparable with those found in similar measurements by M anon and Maybank but were usually far too large to be accounted for by the Laithwaite-Mason temperature-gradient theory. When ice crystals differing in temperature by up to 10°C were brought into an explosive contact, any charge produced was less than 10^{-6} e. This result is not inconsistent with the Laithwaite-Mason theory and does not confirm the much larger values reported by Reynolds et al.
PA 67-2212
SF-1. Favale, A.


SOME ELECTRICAL CHARGING PROCESSES FOR VEHICLES IN SPACE AND POSSIBLE CONSEQUENCES

A Favale, Jan 1964 B p ref
(R11-179)

This report illustrates quantitatively two types of charge accrual and discusses qualitatively some charge loss phenomena. Two methods for producing electrical charges on vehicles are discussed: vehicle charging due to the earth's own surface charge and vehicle charging due to ionization of space radiation.

N64 25993, 18-09

SF-2. Freier, G.


Abstract. Measurements have been made on large, freely falling drops interacting in a strong electric field. The measurements show definite coalescing effects due to the electric field, and the results can be interpreted as being due to induced dipole interactions. The effective radius of the drops can become 30% greater than the geometrical drop radius when interactions take place in electric fields between 1 stat volt/cm and 10 stat volts/cm.

Author

SF-3. Freier, G. D.

THE ELECTRIC FIELD OF A LARGE DUST DEVIL.


An electric-field mill recording of the electric field of a desert devil at a distance of 30 m shows that the field changes negatively and positively 450 V/m and 300 V/m respectively from the steady values of 100 V/m. It is suggested that an electric dipole of moment 1.7 x 10^6 c.g.s. cm at a height of 31.4 m will explain the main features of the recording, although the required velocity is then too low by a factor of 35.

PA 64-20844

SF-4. Frickel, R.


SF-5. Fuchs, N. A.


SF-6. Fuchs, N. A.

3471. Stability and Charge of an Aerosol. N. Fuchs. Ztschr. f. Physik, 98, 11-12, pp. 736-745, July 13, 1934. - The application of Smoluchowski's coagulation theory to charged aerosols shows that a unipolar charge causes coagulation, while a bipolar charge acts much more forcefully on the same sense. But if we take the rate of decay of the concentration of particles as our criterion of stability of an aerosol, the latter is greatly reduced by a unipolar charge in consequence of the electrical scattering of the particles.

PA 37-3471

SF-7. Fuchs, N. A. and I. Petryanov

31. Size and Charge of Cloud Particles. N. Fuchs and I. Petryanov. Kollal Zeits. 69, pp. 171-174, Nov., 1932. A photographic method is described for measuring the size, charge, and concentration of the droplets in a cloud in cases where the radius of the drops is above 0.3 μ. The method is applied to the determination of (1) the distribution of the drops of a condensed or dispersed oil cloud according to their size, and (2) the charges in a cloud charged by ultra-violet rays in relation to the sines of the droplets.

PA 37 11

9077. Electronic spray analyzer for electrically conducting particles. J. M. Geist, J. L. York and
(June, 1951).

Analysis of sprays and other suspensions frequently involves sampling with microscope, slides, or
other relatively large devices, followed by tedious counting procedures. This paper presents some
calculations to show the advantage of using small samplers and describes preliminary work in
the development of an electron microscope which utilizes a small sampler to measure and count the
particles. Metal spheres, with diameters from 300 to 6,000 microns, and drops of water, alcohol and acetone,
with diameters from 2,500 to 4,000 microns, prove data to show that the electrical pulses created upon
interception of the particle by the probe wire are proportional to the 1/6 power of the particle diameter.
The effects of probe geometry and particle size are shown, and the underlying mechanisms are discussed.

For further development of the geometry of the probe, the electronic spray analyzer may offer an extremely rapid
method for determining the drop size and size distribution in the sprays of an operating source, with a
minimum sampling error.

PA 54-9077

SG-2. Germer, L. H.

1975. ELECTRICAL BREAKDOWN BETWEEN CLOSE ELECTRODES IN AIR. L.H.Germer.

133

Voltage below the minimum which can give breakdown by successive
ignitions of air molecules was measured by two different methods. This
minimum current varied widely in successive experiments, increasing in general with increasing voltage.
With minimum values of the order of 10^-17 amps. The results of these experiments are consistent
in that the minimum current for breakdown occurs from the inside surface.

The number of ions in the space at one time is so small that they
cannot cooperate to enhance the gas field at the cathode, which is a
conclusion having important consequences for the theory of breakdown.

PA 62-5753

SG-3. Gibson, E. G.

"Ionization Phenomena in a Gas-Particle Plasma." Ph.D. Thesis, Calif. Inst. of Technology,

SG-4. Gignoux, D., H. F. Anton, and J. J. Shea

NBS-10878* A Cosmic, Inc. Washington, D.C.
DEVELOPMENT OF A CHARGED COLLOID SOURCE FOR
ELECTROSTATIC PROPULSION Report No. 82
D Gignoux, H F Anton and J J Shea Oct 1964 78 p rels
(Contract NAS-4108)
(NASA CR 54170) OTS HC $300/MF $75
A large number of tests were performed with a rotating nozzle source of induction-charged colloid. The geometry was
improved, resulting in an increase of the charge to mass ratio by one order of magnitude with respect to a previous program.
Analytically, the ideal propellant was shown to have high ion velocity, low density, low surface tension, low vapor pressure,
and high conductivity. The experimental values of the system parameters agreed conclusively with those predicted
analytically. The search for a better propellant disclosed several promising avenues. Beam currents up to 1.5 milliamperes
were obtained. The system has very promising application to high-efficiency electrostatic thrusters.

NBS-15876, 06-28

SG-5. Gladkova, Ye. N. and G. L. Natanson

Methods of Measuring the Size of Monodisperse Smoke Particles with a Nephelometer of 0.1 to 0.5 microns (in Russian), Ye. N. Gladkova and G. L. Natanson, Inst.

Mean size of monodisperse smoke particles can be determined by light diffusion (LAMINOV and SINCLAIR 1949), or by photographing the image on a microprojector in an electrical field (FUCHS and PETERYANOVA 1951). Discussion the latter method, giving
analytical derivations, describing experimental procedure, listing magnitude of charge on
particles of a monodispersed aerosol, refers to the Russian experiments on the electrostatic charge. (See some pertinent Soviet literature (PETERYANOVA, LISOVSKY and NATAN
SON 1948; FUCHS 1949).)

SG-6. Glonti, G. A.

1968. ON THE THEORY OF THE STABILITY OF LIQUID JETS IN AN ELECTRIC FIELD. G.A.Glonti.


The electrostatic field equation is combined with the general
hydrodynamic equations for a viscous fluid, to study the criteria for stability of a cylindrical jet of liquid dielectric in an electrostatic field. The effects of viscosity and direction of the field are examined as well as that of jet radius. Conditions for equilibrium at the surface are given.

PA 62-9289

"Effects of Electric Fields on Water Droplet Coalescence."

"Growth of insolvent precipitation particles by collision and coalescence with cloud droplets is one of the primary mechanisms of natural rainfall. Comparison of previous research shows wide divergence between various theoretical and laboratory values of collision efficiencies and coalescence efficiencies. In an effort to obtain additional laboratory measurements of droplet coalescence, high-speed photographs were taken of colliding droplets at the breakup point in a Rayleigh jet. With 0.04-micron diam droplets, less than 30 per cent of the collisions result in coalescence under no field condition. At fields of about 40 x 10^8 cm, the coalescence was about 100 per cent under all conditions of field.

Author

SG-8. Green, H. L. and W. R. Lane

"Particulate Clouds: Dusts, Smokes, and Mists."

SG-9. Gudris, N. and L. Kulikova

The Evaporation of Small Drops of Water. N. Gudris and L. Kulikova. (Zeits. f. Physik., 25, 2, pp. 121-122, 1924.) The vapor pressure $p_v$ of a convex surface is higher than that $p_v$ of saturated vapor on a flat surface of the same liquid. A drop of the liquid surrounded by saturated vapor therefore tends to evaporate. Calculations based on the theory of diffusion indicate that drops of water and mercury of radius about $10^{-4}$ to $10^{-3}$ cm should be completely evaporated within a few seconds. Schaefer, Karpowicz, McKeehan, and Targowski have found, however, that the radius of a drop decreases only by 10 to 20 % during a period of several hours; also the rate of evaporation decreases, whereas the pressure difference $p_v - p_v$ in $^{-3}$ cm. The authors' investigation of the evaporation of drops of water in various gases shows that the rate of evaporation depends largely upon the absorption of the gas by the drops. This explains the observed progressive retardation of evaporation and the influence of the "age" of the drop. Observations of evaporation under different vapor pressures show that the rate of evaporation of the drop does increase with the pressure difference $p_v - p_v$ in $^{-3}$ cm. By reducing the vapor pressure on the drops, it is possible to delay their evaporation; and if the reduction is such that the vapor pressure on the drops is less than that on a flat surface, the drops increase in size instead of evaporating. The experimentally determined pressure on the drops in the state of equilibrium agrees with that calculated by Kelvin's law. The authors' observations show that the evaporation of drops of the size stated is, within the limits of accuracy of the experiment, affected neither by the magnitude nor the sign of their electrical charge.

SG-10. Gudris, N. and L. Kulikova

"Vaporization of Small Water Drops."

SG-11. Guyton, A. C.

"Electronic Counting and Size Determination of Particles in Aerosols."

CA 19-3186

CA 40-5606
SH-1. Hampe, P.

"Electrostatic Charging."
Rev. Viticulture 92, 256-61 (1947)


"Electrification following the Contact of Solids."

The charge found on solids after they have been rubbed together can only be a direct consequence of friction when the rubbing is vigorous; more usually, the charging is the result of contact, rubbing complicating the phenomenon. Opinions differ regarding the origin of contact charging, but certain experiments support a working hypothesis, according to which the charging is due to electron transfer when both materials are either semiconductors or metals, but to ions when insulators take part. Electron transfer is associated with the setting up of a contact potential. Ion transfer can be caused either by a potential difference, in which case the current flows within the e.m.f. or it can be caused by forces that are not electrical in nature, in which case the current flows against the potential difference generated by the 'mechanical transfer' of charge.

Author

SH-3. Harper, W. R.

"Contact Electrification of Semiconductors."

Recently published experimental findings on the electrification of solid powders by sliding down a metal plane can be explained by an extension of the present author's theory of the separation electrification of metals. The mechanism of the electrification of insulators must, in most cases, be quite different.

Author

SH-4. Hauer, F. W.

"Bewegung und Ladung Kleiner Teilchen im Ionisierten Elektrischen Feld."

SH-5. Hayes, J. (ed.)

N64-29522* Jet Propulsion Lab. Calif. Inst. of Tech., Pasadena
ASTRONAUTICS INFORMATION. ELECTRIC PROPULSION
Literature Search No. 887
Judith Hayes comp Jan 1964 120 p refs
(Contract NAS7-100)
(NASA CR 85831, JPL/ML-LS-87) O15 $0.80
This literature search has been compiled to update and supplement a search entitled 'Electrically Propelled Spacecraft and Associated Suborbitals' issued in May 1963. The annotated references are classified into two general categories: General, Electromagnetic, Electric Spacecraft, and Nuclear-Electric. Within each section, references are arranged in chronological order. An author index and corporate-source index are included.

N64-29522, 21-27

SH-6. Hendricks, C. D.

N64-19840 Illinois U Urbana
CHARGED PARTICLE PROPULSION - A DOUBLE ENERGY-CONVERSION PROBLEM
Charles D. Hendricks In Argonne Nat'l Lab. AMU ANL Conf on Direct Energy Conversion, Nov 9-11, 1963 Dec 1963 p 89-99 (See N64-19826 12041 O15 $2.50)
An electrically sprayed liquid-droplet source of heavy particles was investigated. The parameters that were found to affect the spraying process are flow rate, carrier diameter, spray potential, conductivity, viscosity temperature and surface temperature. Specific charge distributions are included for airplane and centrifugal sprays, and sodium phosphate spray.

N64-19840, 12-27

SH-7. Herman, J. R.

8330 On the Electrical Properties of Blowing Snow - Average charge per particle is on the order of 10^{-9} e/atom, which is two to three orders of magnitude greater than that found on freshly fallen or "snowball" snowflakes. - John R. Herman. Annales de Geophysique, v. 30, no. 3, July-Sept. 1964, p. 235-241.

RMI 13-8332

SH-8. Hersh, S. P. and D. J. Montgomery

"Static Electrification of Filaments."

In order to study the generation of charge on fibrous materials, an apparatus was constructed in which a fiber is held fixed while a second is rubbed across at standard controlled mechanical and ambient conditions. It was found that the reproducibility was usually within ± 1%, when the same two fibers were rubbed repeatedly; that the charge generated was dependent on the manner in which the materials were rubbed, and that the magnitude of the charge generated was directly proportional to the length of material rubbed, and to the normal force between the fibers (although in some cases a maximum value was reached), but was independent of the apparent area in contact between the fibers and of the tension on the fibers. The effects produced by changes in velocity are more complicated to describe. Charge transfer was found to be independent of velocity when insulators (except Teflon) were rubbed together. For metals on
in insulators other than Teflon, the charge generated was found to increase linearly with velocity until a limiting value was reached, and then to remain constant. When Teflon and Teflon were rubbed together, the charge increased linearly with velocity without reaching a maximum. When Teflon was rubbed with insulators, the charge increased linearly with velocity in some cases but remained constant in others.

A study of the dependence of the sign and amount of charge transferred on the nature of the materials rubbed was undertaken, and a triboelectric series was established. For metals on insulators, the amount of charge generated was found to be related to the work function of the metal and the position of the insulator in the triboelectric series.

For insulators rubbed on insulators, the amount of charge transferred appeared to be independent of the positions of the insulators in the series.

Author

SH-9. Hertz, H.
"Über die Berührung fester elastischer Körper."

SH-10. Hicks, W. W. and J. C. Be-kett
5689. THE CONTROL OF AIR IONIZATION AND ITS BIOLOGICAL EFFECTS. W.W. Hicks and J.C. Beckett.
It has been established that ionized atmospheres have demonstrable effects on human beings as well as on animals. An explanation of these effects has been sought more recently at the cellular level, where results lead to significant changes. Investigations is proceeding on all levels for the purpose of clarifying results already observed and establishing damage and other techniques which will make artificial ionization a valuable resource for human well-being.
PA 61-5569

SH-11. Horgan, J. J. and C. D. Hendricks
INVESTIGATION OF THE CHARGE-TO-MASS RATIO OF ELECTRICALLY SPARRED LIQUID PARTICLES: J. J. Horgan and C. D. Hendricks (Illinois University, Dept. of Electrical Engineering, Urbana, Ill.).
Grum 41 AF#9174-59, 613-51, 62-9, 63-51.
Analysis of the charge-to-mass ratios (specific charges) of particles generated by the electrical stimulation process. The study involves the surface energy of the dispersed systems of particles, the effects of space charge on the source, and the effects of conductivity on the annihilation process. Experimental data are presented in support of these theories. Further, a colloidal suspension in glycine in experimentally shown to produce particles of high specific charge (400 coul/mg) when electrically dispersed under appropriate conditions.
A65-18496, 08-28

SH-12. Hopper, V. D. and T. H. Laby
2144. The electronic charge. V. D. Hopper and T. H. Laby. Proc. Roy. Soc. A., 178, pp. 243-272. July 31, 1941.—The determination of η by a new oil-drop method in which the electric field is horizontal is described. The expression for η in terms of quantities measured is similar to that which applies to H. A. Wilson's method. The correction for the departure from Stokes's law is obtained from Millikan's relation. The oil drops used are larger than those used by previous experimenters, and their velocities of fall and the

velocity in the direction of the electric field could be estimated with satisfactory accuracy. Assuming η = 1.3 x 10^-9 cgs, unit, the value of η obtained is (4.904 - 0.0007) x 10^-9 cgs, unit. This contributes an error of 1:500 in η and is its major uncertainty by the oil-drop method. Recent determinations of the electronic charge by the X-ray method are analyzed. The mean value of η by this method is (4.8007 - 0.0007) x 10^-9 cgs, unit, and this result differs from the mean of the determinations of Millikan and the authors (4.8007 - 0.0002) x 10^-9 cgs, unit, by 0.0007 x 10^-9 cgs, unit, which is less than the error due to the viscosity of air. Assuming the X-ray value of η, the viscosity of air can be deduced and is found to be of R309 ± 0.5 x 10^-9 cgs, unit at 23°C.
PA 44-2168

SH-13. Horgan, J. D. and D. L. Edwards
19239. FORCES IN DIELECTRIC FLUIDS. J.D. Horgan and D.L. Edwards.
The paper concerns the forces of dielectric liquid produced by a highly charged needle conductor immersed in the liquid. Experimental work has indicated that the effect is due to ionization of the liquid and is not a polarization effect as has been thought.
PA 61-16239

"Aerosol Size Distribution from Ion Mobility."

"Apparatus for the Improvement of Bioclimatic Condition of Room Air."
SK-1. Kelly, D. P.


N64-30005, 21-21

SK-2. Kisiuk, P.

1967. Electron emission at high fields due to positive ions. P. Kisiuk.


Two mechanisms were proposed in order to obtain the observed large yield of secondary electrons in positive breakdown at high electric fields. In one of these a single ion approaching the cathode surface creates a "pass" by decreasing the width of the potential barrier. In the other the increased overall field due to a large number of ions in the gap is supposed to account for the increased emission. The first effect is re-established and appears to be effective in the observed breakdown of extremely small gas in air. It may also be effective in breakdown at high pressures and in liquid and solid dielectrics.

PA 62-7067

SK-3. Kittel, C.

"Introduction to Solid State Physics." 617 pp., John Wiley and Sons, N. Y., 1956

SK-4. Klinkenberg, A.


SK-5. Klumb, H.

KLUMB 1954


Methods for producing highly dispersed aerosols: Electrostatic atomisation; Atomisation by compressed air; Centrifugal atomisation; Chemical and thermal methods.

New method of measurement: deposition by centrifugal force on glass slides for ultramicroscopic evaluation (SCHWENDEMANN) on a transparent plastic film. Spectrum of size distribution is directly visible; the method is termed: Aerosol Spectrometry.

de J 1-180

SK-6. Klumb, H. and A. Schütz


Die bisher vorliegende Literatur (1) zeigt, daß über die elektrische Aufladung von Aerosolen besonders über die Möglichkeit der künstlichen Aufladung relativ wenig Forschungsergebnisse vorgenommen wurden, obwohl die elektrische Kohäsion nicht ohne Einfluß auf die Stabilität des aerosolischen Systems zu sein scheint. Mit dieser Arbeit soll ein Beitrag zu diesem Thema geleistet werden.

Author

SK-7. Klyaschik, B. N. (editor)


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SK-8. Kontaratos, A. N. and S. T. Demetriades
A recently developed analytical expression relating $U/p$ with $E/p$ is in the Townsend ionization coefficient, $E$ the applied field strength, $p$ the pressure, and an appropriate breakdown criterion to theoretically formulate the experimental Paschen's law. Variations of both temperature and pressure are considered in this derivation. Theoretical and experimental values of both $U$ and $E$ are consistent with the experimental results. The distribution of current density on the surface of anodes in mercury-arc rectifiers is also discussed. (3 pages)

Author


SK-10. Krasnogorskaya, N. V.
A quantitative analysis of the possible mechanisms of charging of particles of clouds and of precipitation on the basis of an analysis of experimental data obtained at the earth's surface and in the free atmosphere, is adduced. A comparison of the experimental data with the results of calculations demonstrates that not one of the known mechanisms of precipitation of ions onto the drops can explain the high observed values of raindrop charges. High charge values may be acquired by raindrops in a cloud by way of gravitational coagulation; in proportion to the fall of drops from a cloud earthward, their charges decrease owing to conductivity of the air.

Author

SK-11. Krohn, V. E., Jr.
Charged droplets of glycerol containing dissolved antimony trichloride have been produced with narrow distributions of charge-to-mass ratio centered as high as 470 coul/kg and without significant numbers of ions accompanying the droplets. The distribution centered at 470 coul/kg would have a specific impulse of 2000 sec if it were accelerated through 4,300,000 v.

Author

SK-12. Krohn, V. E., Jr.
Charged droplets of liquid metal have been produced in sufficient quantity and with charge-to-mass ratio which are adequate for some propulsion applications. Unfortunately, a serious problem remains; namely, the production of large numbers of metal ions along with the droplets under all operating conditions which have been tried.

Author

CA 60-201e
SL-1. Ladenburg, R.

1914. Physical Phenomena of Electrical Gas Purification. Part III. R. Ladenburg, Ann. d. Physik, 14-5, pp. 610-420, Aug. 18, 1912—Discussion of the phenomena of gas purification in cylindrical filters shows that suspended particles of dimensions above 10^{-10} cm. maintain, by their charge and the action of the electric field of the radial corona discharge, their size proportional to their velocity and serve to explain the effectiveness of the filter. Particles of dimensions below 10^{-5} cm. have velocities of only 1 to 3 cm/sec. and play only a subordinate part. The electric wind from the point of the emitting electrode to the collecting electrode imparts, under the conditions obtaining in the electro-filter, additional velocities of 20 to 60 cm/sec. to the gas and to the particles suspended in it, but this is reduced by axial streaming of the gas. The exponential formula given by Deutsch for the degree of purification of an electro-filter allows an estimate to be made of the radial velocity of the suspended particles from measurements with a filter of given length and radius and with a given axial gas velocity. [For Part II see Abstract 600 (1911).]

PA 35-5195

SL-2. Langer, G. and J. L. Radnik


A practical apparatus was developed for electrostatic size classification of aerosol particles of 0.1 to a few microns in diameter. The aerosol, suspended by a stream of clean air, is charged by passing it close to an intense positive discharge at high speed. It enters as a stream into an electrostatic field between parallel plates. Charging rates several times above those predicted by conventional theory permitted good randomness. A high natural charge on the aerosol led to adverse effects on classification. Various aerodynamic forces were measured, and results of practical significance were obtained. With small aerodynamic forces, the higher-order Tynall spectra were observed from the classified deposit.

PA 64-7951

SL-3. Latham, J.


Experiments showed that water drops of radius 0.1 cm falling for 30 seconds through a horizontal electric field were disrupted and lost mass if the field strength exceeded a critical value. As the field strength was increased above this critical value the mass loss increased rapidly and in a field of 11,800 V cm^{-1} the drop lost about 25 per cent of its mass for higher values of field strength the mass loss increased more slowly. Experiments also showed that the magnitude of the mass loss was dependent upon the charge of the drop. For exposure times less than about 2 x 10^{-7} sec drops falling in a field of 11,800 V cm^{-1} the mass loss was not measured but as the exposure time was increased above this value the mass loss increased rapidly and for an exposure time of about 0.1 sec the mass loss was 25 per cent; for longer exposure times the mass loss increased more slowly. An explanation of the importance of this disruption process in modifying the concentration and size distribution of raindrops and cloud droplets inside a thundercloud.

PA 68-9079

SL-4. Latham, J.


An analysis is made of available observations on the electrical properties of natural and artificial snowstorms. An explanation for this electrification is given in terms of a theory of charge transfer associated with temperature gradients in ice, which has been shown earlier to provide a feasible theory of thunderstorm electrification. Further analysis shows that sandstorms exhibit similar electrical effects to those of snowstorms, and it is suggested that the temperature gradient effect may provide an explanation for sandstorm electrification.

PA 67-10726

SL-5. Latham, J.


Experiments showed that the exposure of a frost deposit to an air-stream caused ice splinters to be blown away from the deposit. These splinters were negatively charged if the air-stream was warmer than the deposit, and positively charged if it were colder; if they were at the same temperature then no electrification was produced. In a typical experiment, with the frost deposit 10°C warmer than the air-stream, the average charge carried away on a frost splinter was 8 x 10^{10} e.s.u. These results can be explained, in sign and magnitude, by the Latham-Mason theory of charge transfer associated with temperature gradients in ice; in the frost-electrification experiments a temperature gradient was produced down a frost needle owing to the difference in temperature between the air-stream and the frost deposit, thus causing the outer and inner tips of the needle to acquire equal and opposite charges. If the needle were then broken and blown off by the air-stream it would carry away a charge of one sign leaving that of the other sign on the frost deposit on which it had grown; the sign of the observed charging was in agreement with the theory. Putting into the temperature-gradient equations measured values of the dimensions of an ice splinter and the temperature difference between its ends it was possible to calculate the theoretical charge residing on the ends of an ice splinter; this value was found to be in good agreement with the measured average charge per splinter.

PA 66-21040


Experiments showed that if certain assumptions which he states briefly are adopted the results of Evans and Hutchinson (Abstract 2023 of 1914) and Mason and Mayhew (Abstract 2083 of 1911) can be reconciled with the temperature gradient effect. Hutchinson in his reply cannot accept that these assumptions are satisfactory to explain quantitatively the electrification.

PA 67-23768
SL-7. Levin, L. M.
Book review available: OTS, U.S. Dept. of Commerce, SW/593. Lib. of Congress
Number QC921.5.4

SL-8. Lifshits, E. M.
"The Theory of Molecular Attractive Forces Between Solids." E. M. Lifshitz
A macroscopic theory is developed for the interaction of bodies whose surfaces are brought within a small distance of one another. The interaction is considered to consist of the medium of the fluctuating electromagnetic field. The limiting cases of separations small and large compared with the wavelengths of the absorption bands of the solid are studied. Upon going to the limiting case of rarefied media, the van der Waals forces of interaction between individual atoms are obtained. The effect of temperature on the interaction of the bodies is considered.
PA 59-3577

SL-9. Lifshitz, E. M.

SL-10. Lindblad, N. R.

SL-11. Loeb, L. B.

SL-12. Loeb, L. B.
1949. Recent developments in analysis of the mechanism of positive and negative corona in air.
The mechanism of the negative Trichel pulses in air at atmospheric pressure is re-analyzed in the light of recent data (Abst. 2867-9 (1949)). The building up of an intense positive space charge, providing an auto-accelerating ionizing mechanism, and the choking-off by neg. ion formation is outlined, also the effect of these and other factors on pulse duration and frequency. The differences in pos. and neg. corona currents are investigated, and the character of the pos. corona mechanism analyzed on the same basis as the neg. The pos. point removes electrons quite effectively, leaving a field distorted by one sign of space charge only, and thus less complicated; the volume sensitive to triggering electrons is much larger. The observed near equality of pos. and neg. pulse thresholds is shown to be fortuitous.
PA 52-1040

SL-13. Loeb, L. B.
1949. The threshold for the positive pre-onset burst pulse corona and the production of ionizing photons in air at atmospheric pressure.
Loeb, L. B. Phys. Rev., 73, 798-800 (April 1, 1948).—Describes briefly the various forms of corona discharge and their connection with Geiger counter discharges. The burst pulse onset voltage in a particular experiment was consistent with a photon absorption coefficient lying, reasonably, between 10 and 100 cm^-1.
PA 51-2130
SL-14. Loeb, L. B.


After a brief summary and discussion of Townsend's theory of the electrical breakdown of gases in the light of certain recent criticisms, it is shown that these are compatible with his theory except for one serious discrepancy. This discrepancy lies in the fact that the assumed fields at which breakdown occurs in air, at atmospheric pressure, and in inert gases at low pressures, the field of Townsend's theory cannot have the significance given it by Townsend, as the positive ions are incapable at these fields of acquiring the ionizing energy. Various solutions proposed are discussed and found inadequate. It seems necessary, in order to keep this otherwise successful theory, to doubt the validity of the assumption generally made for plane parallel electrodes that the potential drop between the plates is uniform before the spark passes. If fields about ten times as great as those calculated from the uniform drop existed, the theory could be applied. It is shown that such fields are possible under the conditions of the spark potential experiments, due to space charges resulting from the difference of ionic and electronic velocities. The existence of such fields requires a finite spark-lag interval of about 10^{-4} second, as yet not definitely observed.

PA 31-2169

SL-16. Loeb, L. B. and R. A. Wijesman

4000. The theoretical criterion for streamer service in an electrical field. LOEB, L. B. AND WIJESMAN, R. A.

Letter in J. Appl. Phys., 19, 797-9 (Aug., 1948).-- An extension of previous work on sparking equations for the higher pressure regions (Abstr. 2130 (1948)) which were based on the assumption that the streamer advance proceeds by avalanches built up from single photoelectrons ahead of the advancing streamer. The present work deals with advance due to several simultaneous avalanches, and the final sparking equation involves, besides Townsend's e, etc., photoionization cross-sections, and the number of photons produced for each positive ion in the streamer tip. A trial-and-error method of solving the equation is described.

PA 52-4000

SL-17. Lupinski, J. H. and K. D. Koppel


Abstract. Polymers of a new type with an unusual combination of properties have been synthesized. They are of high molecular weight, they are soluble in organic solvents, and they can be cast as films. Their electrical conduction is electronic in the solid state and can be controlled up to a conductivity of 10^4 ohm^{-1} cm^{-1}.

Author
SM-1. Makhotkin, L. G. and V. A. Solov'yev


SM-3. Matthews, J. B. and B. J. Mason

2283 ELECTRIFICATION ACCOMPANYING MELTING OF ICE AND SNOW: J. B. Matthews and B. J. Mason.
Attempts to measure the electrification produced by the melting of ice and snow, known as the Dinger–Gunn effect, have been made with three different experimental arrangements. In one of these snow crystals were grown and melted under very clean conditions inside a diffusion cloud chamber. The results of the three experiments are consistent in failing to detect a separation of charge and in indicating that any charge produced was <10^{-5} e.s.u./g or two orders of magnitude smaller than reported by Dinger and Gunn. This result was unaffected by varying the purity of the ice, its air contact and the rates of freezing and melting, and the pH value of the water. Accordingly, it is concluded that charging associated with the melting of snow or hail is unlikely to be an important feature in the electrification of clouds and precipitation.

PA 67-2283

SM-4. Matting, A.

"Color Spraying by Electrostatic Principles."


Formative time lags for the development of a positive point-to-plane corona in dry air were measured experimentally at pressures ranging from atmospheres to 1000 centimeters of Hg. Simultaneously, a photomultiplier tube showed that the observed formative lags are associated with a filamentary streamer type of corona. These corona formative lags are of the order of 10^{-3} sec even near threshold and vary much more slowly with overvoltage than do uniform field formative lags in air. The results indicate that no long build-up process is associated with the formation of the filamentary streamer type of corona in air, and in particular rule out any cathode secondary mechanism from playing a role in the formation. Near atmospheric pressure, with the experimental conditions used, the corona formative time lags were often too short to be resolved from the statistical scatter; when resolvable they were found to be too long to be ascribed solely to a single transit time of the initiating electron avalanche across the high field region of the gap. The results therefore do not preclude a fast build-up process in the gaps preceding streamer formation. Threshold measurements on both impulse and d.c. corona indicate that the steady glow type of corona has a different threshold than the streamer type. No formative lag data on the steady glow corona were obtained.

PA 57-5647


N64-24030* National Aeronautics and Space Administration.
Lewis Research Center, Cleveland, Ohio
ELECTROSTATIC THRUSTORS FOR SPACE PROPULSION: PRESENT AND FUTURE
(NASA-TN-X-51764). OTC 5700

Electrostatic thrustors are components of electric propulsion systems now being developed for space vehicles. The paper examines an existing experimental thrustor, states a number of deficiencies in it, gives reasons for these shortcomings in terms of the basic physical processes for each thrustor type, and summarizes research and development programs on these problems.

N64-24030, 16-27


SM-8. Miller, C. G. and L. B. Loeb


Direct-current corona studies were made on coaxial cylinders with inner cylinder at negative potentials in pure N₂, pure O₂ and mixtures of 1%, 10% O₂ in N₂ and on clean dry air from 27 to 750-millimetre pressure. Observations of current potential relations from field ionized ionization currents to arc near breakdown as possible were made noting thresholds for current transitions, pulsed discharges and other oscillographic as well as visual appearances. Negative corona does not exist as such as truly pure N₂. Unless a high series resistance was in the line once the critical region of potential was reached, the gap broke down to an arc. With current-limiting resistor bombardment of the filament with positive ions from the low order pre-discharge released enough gaseous impurity so that after ten minutes the resistor could be removed and the internal resistance of the negative ion space charge near the anode held the current at 2000 µA. The behaviour indicated that breakdown was preceded by a low-current Townsend discharge that cleared up or conditioned the filament. In all the negative-wire studies the onset thresholds vary with the past history of the wire, and the threshold potential at higher pressures overshoots the minimum operating potential of the discharge once it has set in. Studies with 1% O₂ indicate that the threshold discharge with clean gas is a continuous current with a diffuse glow which in time contracts to a cathode spot with Trichel pulses. Similar behaviour appears to be at lower pressures. There is evidence for a continuous heavy background of Townsend discharge along the whole wire until the visible spot and heavy pulsed discharge appears. Lower pressures in pure O₂ show many current transitions and oscillations between discharge forms.

PA 54-5440

SM-9. Miller, C. G. and L. B. Loeb


D.C. corona studies were made from 27 mm to 750 mm pressure. Positive corona in pure N₂ does not exist as such. Pre-discharge Townsend currents by photon action on the cathode condition the outer N₂ cathode until it spontaneously develops a glow discharge focusing in a spot on the anode wire. The discharge sets in at high potential and persists with lowering of hundreds of volts. Increase in current gives multiple spots and irregular current fluctuations. At lower pressure potential overshoot gradually disappears and the discharge begins as a regular glow discharge. Positive coronas with 1% O₂ show burst pulses at threshold, these being longer in duration (1000 usec) than in air because of spread down the wire. At lower pressure burst pulses lasted still longer. Breakdown streamers were observed at lower pressures where the applied potential was adequate.

The Townsend equation for current in coaxial geometry applies above threshold both for N₂ and N₂ + 1% O₂. In air the positive corona sequence showing only burst pulses at threshold and breakdown streamers were observed. Burst pulses lasted 2 to 4 times those with 1 mm dia. point-to-plane corona in air owing to spread along the wire, which was less extensive than in 1% O₂. In pure O₂, the high absorption of photons ionizing the gas led to pre-onset streamers and no burst pulses at threshold above 200 mm pressure. Below 200 mm stress of pulses and burst pulses, and below 200 mm only burst pulses, were observed. The streamers above 200 mm spread down the whole length of the tube by transparency of O₂ to photons liberating electrons from the N₂ cathode.

PA 54-5405

SM-10. Molmud, P.


SM-11. Montgomery, D. J.

SN-1. Natanson, G. L.

"Diffusive Deposition of Aerosols on a
Cylinder in a Flow in the Case of
Small Capture Coefficients."
Transl. available: Proc. Acad. Sci. USSR,

SN-2. Natanson, G. L.

"The Condensation of Aerosol Particles by
Electrostatic Attraction on a Cylinder Around
Which They are Streaming."
Dokl. Akad. Nauk, Phys. Chem. Section,
112, No. 1, 95-99 (1957).
OESTERLE 1957
Study of physical and chemical factors on electrostatic atomization of paints, for obtaining an uniform coating.

Oswald, W. J.

DETECTION AND STUDY OF MICROORGANISMS IN THE UPPER ATMOSPHERE Progress Report
(Grant NsG-104-61)
(NASA-CR-50281) OTS $2.50 ph

Research progress has been made in the following areas: (1) refinement and modification of electrostatic precipitator configuration; (2) generation of test aerosols; (3) study of electrical characteristics of the electrostatic precipitator under low air density conditions; (4) design of flight sampler; and (5) development of bacteriological techniques.

N64-22763, 16-15
SP-1. Papée, H. M., et al
25000 SOME POSSIBLE CHEMICAL CONTRIBUTIONS TOWARDS THE FORMATION OF THE ATMOSPHERIC ELECTRIC CHARGE.
Laboratory experiments show that some solid particles which occur in the atmosphere can act as strong electron emitters when irradiated with visible light, while other substances, because of their chemical composition, can assume substantial negative electric charges. Implications resulting from these effects are discussed.
PA 66-25890

SP-2. Pautheenier, M.
"Lois de Charge des Particules Sphériques Conductrices dans un Champ Électrique Bi-Ionisé."
Colloque International - La Physique des Forces Electrostatiques et Leurs Applications (Published by Centre National de la Recherche Scientifique, Paris, 1961).
On commence par rappeler les lois de charge, aujourd'hui classiques, des particules sphériques — conductrices ou dielectriques — dans le champ électrique mono-ionisé (exemple du champ cylindrique avec fil coronisant axiale). Incidemment, on rappelle qu'une première difficulté de la précipitation électrique peut résulter de l'état de division de la matière.
Une difficulté beaucoup plus grave se présente lorsque, dans certains circonstances, l'électrode de dépôt émet des ions de signe contraire au fil coronisant (phénomène dit de contre-émission étudié dans la note n° 2. Le champ électrique est alors parcouru par un double flux d'ions des deux signes (champ bi-ionisé). Nous calculons ici la nouvelle loi de charge des particules sphériques dans le champ bi-ionisé. Dans le cas des sphériques conductrices qui tait l'objet précis de cette étude on trouve que la loi de charge est de forme exponentielle. La charge limite (ici statique) peut être très faible; même si le champ électrique est peu modifié par la c.e.m., la vitesse de précipitation se trouve réduite et l'efficacité de l'électrofiltre diminuée.
Si dans la charge les particules se comportent comme isolantes, M. Rapp ne montrera que cette circonstance vient encore diminuer la charge limite et la vitesse de précipitation.
Author

SP-3. Pautheenier, M.
"Expériences de Poudrage Electrique des Végétaux."
Dans la thérapie végétale, le champ électrique ionisé peut être un auxiliaire efficace: les fines particules utilisées sont chargées, puis précipitées par le champ électrique sur les plantes qui constituent l'électrode telle du montage. L'expansion spontanée de nuages électrisés permet la fixation des particules à l'intérieur même d'une masse de feuillages. La répartition de la poudre est excellente, et, par temps sec, son adhérence aux feuilles très énergique. Author

SP-4. Pautheenier, M.
"Apparition de la Centre-Emission et des Champs Electriques Bi-Ionisés dans de Nombreux cas de Dépoussiérage Étude Théorique Récente d'un La Précis Conclusions."
Depuis longtemps, de nombreux expérimentateurs ont signalé que si le dépôt de particules sur l'électrode de précipitation d'un électro-filtre a une résistivité suffisante, ce dépôt se perce d'une multitude de petits trous, origines d'aiguilles lumineuses de signe contraire au fil coronisant (phénomène de contre-émission). En même temps, le rendement de l'électrofiltre diminue.
Récemment un chercheur du Laboratoire a réalisé un cas de c.e.m. parfaitement uniforme en appliquant une toile de nylon à l'intérieur d'un cylindre de 30 cm de diamètre pourvu d'un fil coronisant axiale, et il a fait une étude théorique de la question.
Une nouvelle équation de Poisson généralisée permet encore de résoudre le problème; moyennant quelques hypothèses simples contrôlées expérimentalement, on arrive à calculer, pour un courant total I correspondant à 1 cm de hauteur du cylindre, le champ bi-ionisé E, le courant excité J, (du fil coronisant) et le courant excité J, (coeurant de c.e.m.).
La détermination expérimentale de J, et J, se fait par exemple en mesurant au microélectromètre la charge instant de l'onde conductrice qui tombe dans le champ E.
Savant l'importance de la c.e.m. et que le champ soit notablement modifié, le courant peut être supérieur au courant excité J, émis par le fil.
Par suite de l'abaissement de la charge limite des particules, l'efficacité de l'électrofiltre peut diminuer notablement (cf. Note 1). Des exemples numériques sont donnés.
Author

SP-5. Pautheenier, M. and R. Cochet
See Abstr. 1226, 3671, 4137 (1951). Droplets of water form on the wires and, becoming pointed, emit ions resulting in power loss. Expressions are calculated for the movement of droplets in the neighborhood of the wires and for the rate of capture of the droplets by the wire. In a particular case 10 1 g of water was collected per cm of conductor in 26 min, this being sufficient to cause emission of ions corresponding to a loss current of 30 μA/m.
EA 54-4457
SP-6. Pauzenier, M. and G. Duhaut
468. A first contribution to the study of the electric field in H. DC lines. Investigation of vibrating rain drops. Carricier, M. and Duhaut, G. Rev Gen. Electr. 28, 35-45 (Jan. 1949) in French. A test cylinder is described in which conductors suitable for d.c. transmission are examined and which permits visual observation in addition to measurements with the aid of a cathode and a spectrocope. The mechanical movements of the conductors caused by water drops suspended from a test conductor are examined. Below a certain voltage of the conductor the water drops are found to oscillate and to rise up to a discontinuous current discharge. With increasing voltage the frequency of the oscillations decreases until the water drops act as fluid points and the current rises above 1 mA. An oscillographic record of the discharge current is given and the current values are correlated with the mechanical movements of the water drops.
EA 52-1600

SP-7. Pauzenier, M. G. Duhaut, and L. Deson
After earlier work [Amer. 1600 (1949)] has shown the effect of mechanical vibrations and of electric lines from a storage battery drop at voltages below the normal breakdown strength of air, the change in the shape of a suspended water drop with increasing voltage is shown by means of shadow photography and the discharge currents are plotted as a function of the gradient at the conductors of varying diameters. From an estimate of the number of rain drops on a line conductor, the resulting electric lines are determined and the minimum conductor diameter is derived which is required to avoid this type of loss for a range of surface gradients.
EA 53-2452

SP-8. Penney, G. W. and G. W. Beveritt
Electrostatic precipitators operating at high cleaning efficiency have been very effective in keeping room walls and furnishings clean. At low cleaning efficiency serious trouble may arise because of escape of dust-carrying electric charges of one sign into the room. One of the main sources of this problem is the voltage gradient; the rate of dis- coloration caused by space charge varies directly as the room size for geometrically similar rooms, as the second power of the dirt content of the air, and as the cube (square) of the precipitated inefficiency. Under particularly severe conditions a neutralizing scheme may be desirable, one being described.
EA 53-710

A relationship between the drop sizes found by the breakup of an unstable liquid jet with and without the presence of a longitudinal electric field is developed. Experimental results are in satisfactory agreement with the relation derived.
AM 18-1871

SP-10. Peskin, R. L. and R. J. Racó
"Some Results from the Study of Ultrasonic and Electrostatic Atomization."

1358. CHANGE OF SODIUM CHLORIDE SURFACES IN ELECTRIC DISCHARGES.
A convenient and simple laboratory method for introducing surface defects into sodium powdered solids is described. The method is applied to monodisperse sodium chloride particles, and the extent of the chemical change associated with the defects is found to depend linearly on the specific surface of the halide.
PA 60-13588

992-20531 Lockheed Missiles and Space Co. Sunnyvale, Calif.
DETECTION TECHNIQUES AND ATMOSPHERIC DISPERSAL OF TOXIC GASES AND AEROSOLS: AN ANNOTATED BIBLIOGRAPHY.
Charles P. Pace. Comp. Apr 1966 65 p. refe (56-63-39. Dept. 3-32-81-1) Potential and actual environmental hazards from diffusible toxic agents and the use of meteorology to help evaluate, understand and minimize these hazards have become increasingly significant. The scope of this bibliography includes such areas as detection techniques and instrumentation. Annotated refe. Potential and actual environmental hazards from diffusible toxic agents and the use of meteorology to help evaluate, understand and minimize these hazards have become increasingly significant. The scope of this bibliography includes such areas as detection techniques and instrumentation. Annotated refe. Potential and actual environmental hazards from diffusible toxic agents and the use of meteorology to help evaluate, understand and minimize these hazards have become increasingly significant. The scope of this bibliography includes such areas as detection techniques and instrumentation. Annotated refe.
PA 66-13588

SP-13. Plumlee, R. R.
505-181453 Illinois U, Urbana, Charged Particle Research Lab
EFFECTS OF ELECTROSTATIC FORCES ON DROP COLLISION AND COALESCENCE IN AIR
The coalescence of a pair of drops 2 millimeters in radius, immersed in air, is investigated by first considering a mathematical model which includes the hydrodynamic flow of the air from between the two approaching surfaces, the effect of the flattening of the adjacent surfaces, and the effect of an electrostatic potential between the drops. With this model, the times required for the surfaces to move a given distance is determined.
EA 53-710
as a function of the viscosity of the air and the potential difference. High-speed photographs of the profile view of two colliding drops are used in support of this model. The time interval between the onset of the collapse of the drops and the moment of collision is measured. It was found that the time for collision is independent of moderate changes in the air pressure, varies linearly with the potential difference, and decreases for an increase in the collision velocity. Also, the time interval during which change flows between the drops before they actually collide is investigated.

SP-14. Pohl, H. A.

FORMATION OF LIQUID JETS IN NONUNIFORM ELECTRIC FIELDS. H.A. Pohl.
A note on the paper by Bergson and Edsinger (preceding abstract) suggesting that the fountain effect is a combination of dielectrophoresis and electro-osmosis.
PA 64-16240

SP-15. Pohl, H. A.

292. SOME EFFECTS OF NONUNIFORM [ELECTRIC] FIELDS ON DIELECTRICS. H.A. Pohl.
Experimental and theoretical studies show the effect to be rather striking for particles larger than molecular size. The results show that the effect can be used to produce a fairly efficient pumping action of non-conducting liquids, to cause continuous and easily measurable separations in coarse suspensions, to cause selective precipitation, and to produce mixing. By this means, liquids may be thrown several feet into the air with an electromechanical efficiency of about 297. A separation factor of at least 3 is continuous separations including may be produced in a suspension of polystyrene chloride in carbon tetrachloride—benzene mixture. Suspensions of polar materials in non-polar liquids may also be separated or precipitated. In one demonstration type of experiment, drops were "hung" in mid-air.
PA 62-282

SP-16. Potekhina, N. D.

THEORY OF SURFACE EUTERIZATION. N.D. Potekhina.
Zh. Tekh. Fiz. (USSR), Vol. 34, No. 6, 1051-2 (June 1964). In Russian.
The temperature dependence of the flux of ions and atoms with surface ionization is examined for two cases of adsorption. In the first case, the level of adsorbed atoms at the forbidden band (semiconductor) is considered; in the second case, the conduction band is involved. It is assumed that the degree of filling is small enough for interactions between the adsorbed atoms to be neglected. The condition for which the heat of evaporation of ions can be determined from the J(T) dependence is shown (J is the flux of ions at the surface). The application of the Stephen-Langmuir formula for surface ionization on semiconductors is demonstrated. This is a contribution to the work of Avak'yan (1953-56).
PA 67-26023

SP-17. Pruppacher, H. R.

10720 THE EFFECTS OF ELECTRIC FIELDS ON CLOUD PHYSICAL PROCESSES. H. R. Pruppacher.
A review of literature on the effects of electric fields on drop collision and coalescence, on the growth of ice particles, and on ice nucleation in supercooled water.
PA 67-10720

SP-18. Pruppacher, H. R.

388 THE EFFECT OF AN EXTERNAL ELECTRIC FIELD ON THE SUPERCOOLING OF WATER DROPS. H. R. Pruppacher.
The effect of electric fields on the supercooling of water drops was studied by a special experimental technique which permitted the observation of the action on water drops of a d.c. electric field of 1 to 30 kV/cm. These experiments, documented by a motion picture film, showed that freezing could be initiated in the water drops at a temperature which was only a few degrees below 0°C by applying external electric fields which had field strengths of several kilovolts per centimetre. It was found that the electrofreezing effect was not due to an orientation of water molecules in the water sample, nor was it due to particle matter produced by sparks or corona discharges since no such discharges took place during the experiments. It was found that the effect was a consequence of the movement of the drop in the electric field along a solid surface. It was concluded from the experiments (1) that an external electric field is able to accelerate the ice-nucleation ability of a solid surface and (2) that the characteristics of the effect make it very unlikely that freezing can be initiated by electric fields in atmospheric clouds since the solid surfaces with which the drops have to be in contact during their deformation are not present in mature thunderstorm clouds.
PA 67-368


7846 PRIMARY MECHANISM FOR CHARGING AN AEROSOL LAYER AND SUBVERSION STRATOCUMULUS 'S CLOUDS. I. B. Pudovkina and Yu. S. Jedunov.
Results of measurements of the atmospheric electric field over a net of high mountain stations during the formation and development of valley clouds are given. A model for charging an aerosol layer when the vertical ascent of ions through the atmospheric electric field is disturbed is considered. A qualitative comparison is made between variations in electrical characteristics obtained from model calculations and experiment.
PA 67-7846
SR-1: Rayleigh, Lord

"On the Equilibrium of Liquid Conducting Masses Charged with Electricity."

Phil. Mag. 14, 184-186 (1882)

SR-2: Rayleigh, Lord

"Lois de Charge des Particules Sphériques Isolantes en Champ Electrique Mono-Ionisé et Bi-Ionisé."


On se propose d'expliquer le mécanisme de la charge des particules diélectriques sphériques (qui constituent la quasi-totalité des poussières provenant des centrales thermiques), dans un champ électrique ionisé, analoge à celui des filtres de dépoussiérage.

La poussière qui capte des ions est soumise à un couple électrique ayant tendance à la faire biaiser. Ce couple subit, tant que la densité superficielle de charge n'est pas uniforme. Les poussières de quelques microns de diamètre sont un moment d'insertion extrêmement petit; elles peuvent pivoter très rapidement et la densité superficielle est pratiquement uniforme à chaque instant.

Dans ces conditions, l'équation des lignes de force, en voisinage d'une sphère diélectrique, est analoge à celle correspondant aux sphères conductrices. On obtient pour expression de la charge limite prise par une sphère:

\[ Q = \frac{2\pi}{\varepsilon^2} \eta \left( \frac{1}{\varepsilon + 2\varepsilon_0} \right)^{\frac{1}{2}} \]

avec \( \gamma = \sqrt{\frac{2\pi}{\varepsilon^2}} \).

Cette expression est valable pour les diélectriques en champ mono-ionisé, ainsi que pour les conducteurs en champ bi-ionisé (\( \varepsilon = \varepsilon_0 \)). On peut aussi l'appliquer en champ mono-ionisé, en écrivant que \( \varepsilon = 0 \) et que \( \varepsilon = \varepsilon_0 \), en supposant les ions ionisés par le SI continue.

La charge prise par une poussière diélectrique, dans un filtre de dépoussiérage, a même signe que les ions ionisés par le SI. Elle est inférieure à celle prise par une poussière conductrice. La précipitation sera défavorisée pour trois raisons:

1) Influence de la permittivité du diélectrique;

2) Minimale neutralisation des particules sur la paroi, entassement du dépôt et contre-dépôt;

3) Si leur diamètre est trop grand, la repos des poussières sur elles-mêmes n'est pas assez rapide pour que la densité de charge soit uniforme; la charge limite diminuerait. Elle serait même si la rotation est constante.

Author

SR-3: Reynolds, J. M.

"Stability of an Electrically Supported Fluid Column."

J. Reynolds.

Phys. Fluids 8, Vol. 5, No. 1, 161-70 (June 1965)

An analytical and experimental study has been made of the cylindrical interface between two dielectric liquids under the influence of electrostrictive forces and surface tension. The analysis indicates that, for high-frequency applied fields such an interface can be unstable. Far stability, the applied voltage must be great enough to suppress tension effects and lower than some analytically determined critical value. For voltage greater than this critical value, experiments indicate that the interface is deformed in an unusual manner.

Author

SR-4: Richards, H. F.

"The Contact Electricity of Solid Dielectrics."

Phys. Rev. 22, 122-33 (1923)

The electric charges produced by wringing optically flat surfaces together were measured in order to determine whether or not there is a possibility of formulating a single contact theory which will include both the metals and the dielectrics. Experiments with flint glass and steel proved that the frictional charge is independent of the amount of friction, provided only that intimate contact be established, and is proportional to the area of contact. The relation between the frictional charge and the area of contact is in no wise affected by the ionization of the residual air molecules between the surfaces by means of an intense beam of X-rays, and was also found to be independent of the duration of contact for periods varying up to 17 hours. The failure of the double layers to recombine under these conditions proves that it was sustained by a specific field.

The dependence of the effect on the dielectric constant. The charge per cm² of material 1 in contact with material 2, was found for five different pairs of the materials, quartz, fluorite, crown glass, flint glass and steel, to satisfy, within 14 per cent, the equation \( Q = C \delta R - \delta K \), where \( K_1 \) and \( K_2 \) are the dielectric constants and \( C \) is a positive constant, whose mean value is 4.43 c.m.², provided the value \( K = 3.1 \) be assigned to steel. This equation is consistent with the results of Couper's measurements of electric semiaxes.

The electric effect of compressing amorphous dielectrics was determined by pressing two kinds of sheet rubber, of dielectric constants 2.94 and 3.96, against several hard materials, whose dielectric constants ranged from 2.8 to 7.8. The charge on the compressible dielectric was found to be independent of the nature of the material against which it was pressed, proving that this is not a metallic effect and that amorphous as well as crystalline substances can be electrified by pressure.

The electric effect of collision of a solid insulator and a metal was found, with four pairs of materials, to be consistently opposite in sign to the frictional effect. This result shows that collision must be considered to produce two different effects, one of which is the volatlic charge, while the other is a transfer of electrons from the metal to the dielectric, due in all probability to the inertia of the mobile electrons.

Dielectric constant of steel, as suggested by these results, is not infinity but 3.1.

Author
SR-5. Richards, H. F.

"Electrification by Impact."
Phys. Rev. 16, 290-304 (1920).

Electrification by Impact. Measurement of the Charge Produced by Collision between a Metal and a Dielectric.—After briefly discussing the unsuccessful attempts which have been made to formulate a satisfactory theory to explain electrification by friction, the author suggests that impact of dielectric upon metal, without sliding friction, may cause an electrical effect whose laws will shed light upon the frictional phenomenon. An apparatus is described for measuring the electric charge produced when a die or sphere of dielectric material collides with a metal disc. The charges obtained in this manner ranged from 0.15 to 9.2 per cent of the metallic potentials employed. These charges are of the same order of magnitude as those obtained by friction. The experiment was performed with various metals and dielectrics, and in every instance the metal received a positive charge. In no case was there any evidence of the opposite variation which others have claimed to be characteristic of electrification by friction. Curves are given which show the variation of charge with velocity of impact and with the mass of the impinging system. The charge produced by a single collision increases with each of these factors but the charge per unit of material removed is a greater function than the mass of the moving body, in determining the amount of the charge. In certain cases velocities were attained at which the electrification due to a single impact reached a maximum value.

 Relation of Charge to Capacity.—The quantity of charge produced by a given collision was found to be independent of the capacity of the metallic system. Effect of Electrical Impacts.—When many impacts were performed in rapid succession, the amount of charge increased to a maximum. This maximum was due to a charge lagged rather than the quantity of charge present on the dielectric by the potential of the metal wall.

Discussion of Results.—The author concludes that there is no direct dependence of the electrical energy upon the mechanical energy lost in impact, and that electrification by impact is similar in nature to that produced by friction. The results are considered to support Helmholtz's theory regarding the nature of electrification by friction.

Author

SR-6. Robertson, A. J. B., B. W. Viney and M. Warrington

1957 THE PRODUCTION OF POSITIVE IONS BY FIELD IONIZATION AT THE SURFACE OF A THIN WIRE.
A. J. B. Robertson, B. W. Viney and M. Warrington.

Wires of platinum and tungsten 6-10 μ in diameter were used. They were placed along the axis of a coiled cylinder. When the wire was charged positively with respect to the cylinder and any of the gases ethylene, water, oxygen, nitrogen, nitrous oxide, ammonia, ethane monoxide and hydrogen was present, a current was observed, with a voltage between wire and cylinder less than 20 V. The current was directly proportional to gas pressure except with water and ammonia. It appeared to be due to field ionization at the surface of the wire. Currents exceeding 10⁻⁷ A were obtained with wires 5 cm long. Field ionization was also brought about with a thin wire between parallel plates. With the plate apparatus and with the cylinder apparatus, a fraction of the ions produced could be extracted through a slit cut in one plate, or to the cylinder. The electric field at the wire surface was not great enough, for a vacuum surface, to produce field ionization. It was proposed that a more intense local ionization of field occurs because of surface roughness. The field ionization factor for a 10 μ diameter platinum wire was investigated by measuring the field ionization of electrons from the wire, first as a function of field at constant temperature and secondly as a function of temperature at constant field. The temperature variation of field ionization from 050 to 1750° agreed very well with the theory given by Good and Mollé (1956). Corrections for thermionic emission at the higher temperatures from the flat parts of the surface were made with a method which used the Schottky equation. The field ionization factor found in this way was 79. Such a value explains the occurrence of field ionization.

Author

SR-7. Rohmann, H.

"Messung der Große von Schwebeleitungen."
Z. Phys. 17, 253 (1923).


"Contact Electrification across Metal-Dielectric and Dielectric-Dielectric Interfaces."

An apparatus is described by means of which a spherical dielectric surface can be compressed under various loads against a plane metal disk or a plane dielectric disk. A transfer of electric charge across the interface is recorded when the surfaces are separated. The point of charging between any two materials depends upon the relative positions of those material in an electrolytic series; a metal surface does not always assume a positive charge as found for impact electrification. For two given contacting materials the amount of charge is proportional to the contact area between the surfaces and provided that one of the surfaces has a resistivity of 10⁷ (5 x 10⁷ cm) then the charge density for various combinations of material is approximately proportional to the lower dielectric constant in each combination. This result suggests that the charging may be limited by electrical back-discharge between the separating surfaces. It is considered to be unlikely that the electrification originates from a difference in the contact potentials of the two surfaces involved.

Author


"Electrostatic Effects in Fiber Filters for Aerosols."
Heating and Ventilating 51, 102-8 (May 1954).
SR-10. Russell, A.
"The Problem of Two Electrified Spheres."

SR-11. Russell, A.
"A Treatise on the Theory of Alternating Currents."

SR-12. Russell, A.
"The Coefficients of Capacity and the Mutual Attractions or Repulsions of Two Electrified Spherical Conductors when Close Together."

"An Equilibrium Value for the Charge-to-Mass Ratio of Droplets Produced by Electrostatic Dispersion."

CA 61-10080f
SS-1. Salt, R. W.
"Effect of Electrostatic Field on Freezing of Supercooled Water and Insects."
Abstract. Supercooled water and two species of insects froze at higher temperatures than normally when placed in an electrostatic field. The effect became more certain and occurred earlier as the amount of supercooling was increased. The amount of supercooling in the presence of the electrostatic field was not related to the amount in its absence.
Author

SS-2. Sayasov, Yu. S.
12005. ON EQUILIBRIUM EROSION PRODUCED BY DUST PARTICLES. Yu. S. Sayasov.
Gives a full theoretical analysis of the equilibrium erosion produced by spherical aerodynamic particles. The general equation obtained, can be used with the help of elliptical F-functions, for the calculation of the concentration of eroded. Shows how the equation is reduced to limiting cases to: (a) Dela’s equation at sufficiently low temperatures; (b) Balla’s equation (see above, 1484 of 1951; and 4994 of 1954) at sufficiently high temperatures.
PA 62-12405

"Source of Uniform-Sized Liquid Droplets."

SS-4. Schmitzler, H.
"The Rate of Charging of Dust in a Corona Field."

SS-5. Schulman, J. H. and H. C. Parreira
N 245778 Columbia U., New York, N.Y. Stanlly-Thompson Lab.
ELECTRICAL PHENOMENA AT THE ICE/WATER INTERFACE
Contract No. 286641
TR-1
The experimental equipment designed for investigating electric phenomena that occur at the ice-water interface is described. This equipment consists of an automatic apparatus for recording streaming potentials on ice-water systems, a main component of which is the streaming potential cell, the solution reservoir and pressure balance, the pressure gage, pressure transducer, and the electronic circuit, and an apparatus for producing and measuring electric potentials at the ice-water interface during freezing. The main components of the latter are the freezing potential cell, the freezing wall, and the measuring and recording devices. This equipment will be used to study the electric potentials generated whenever liquid water is forced through ice capillaries under pressure gradients (freezing potentials), and the electric potentials that appear during the freezing of water of dilute aqueous solutions (freezing potential).
N 245778, 17-09


SS-7. Schultz, R. D. and R. E. Wiech
"Electrical Propulsion with Colloidal Materials."

SS-8. Schutz, A.
SS-9. Schutz, A.

An Arrangement for Recording Contact-Electrical Measurement of Dust. – A new arrangement for recording dust measurement is reported in which concentrations of 0.1 ng/m³ can be clearly indicated. The apparatus continuously measures the charge formed on a metal probe by contact-electrical processes upon the impact of solid suspended particles with the probe. (In German.) Eine Anordnung zur registrierenden kontakt elektrischen Staubmessung. – Alfred Schutz, Staub, v. 54, Sept. 1984, p. 359-365.

BMI 13-8674

SS-10. Shashoua, V. E.


SS-11. Shashoua, V. E.


SS-12. Sher, L. D. and H. P. Schwan


Test results are presented in which a mechanically induced electrostatic charge on certain fabrics is employed as an aid in the removal of particulate matter (atmospheric dust) from air at room temperature. The theory of mechanically induced static charges and some experimental data are presented. A so-called tribo-electric series of common fibers is developed. The electrostatic mechanism of aerosol filtration for the three most important precipitating forces is described. Tests were made on a two-stage fabric filter unit using a fixed fabric A, charged to one sign by contact with a moving fabric surface B, as an aerosol conditioning (charging) stage. This was followed by a moving belt of fabric B acting as the collecting stage which was charged by a moving fabric surface A. Test results show that the basic uncharged collection efficiency of the unit on atmospheric dust can be doubled due to the mechanically induced charge at no increase in resistance to airflow. Other results show the effects of particle conditioning, filtering velocity, fabric charge, type of fiber, and humidity on efficiency.

Author

SS-14. Smith, F. T.

"ON THE IONIZATION OF SOLID PARTICLES. P. T. Smith. J. chem. Phys., Vol. 20, No. 4, 788-7 (April, 1958.)" An extension of the work of Schulz (Abstr. 548/527) to negatively charged particles. The results are presented as a graph of the ratio of true electron density to saturation density (always less than unity) versus inverse temperature.

PA 61-6006

SS-15. Smith, P. L. and G. W. Penney

SS-16. Sodha, M. S.

Thermal and photoelectric ionization of solid particles. M.S., Sodha.
A discussion of the various physical processes relevant to the ionization of solid particles is given. Detailed considerations of the rates of thermionic and photoelectric ionization from charged particles, electron attachment and recombination with charged particles and energy exchange in these processes are presented. From these considerations an expression for the equilibrium constant of the ionization reaction of solid particles was derived. This expression has been used by earlier workers based on intuitive considerations in their investigations of the charge distribution of particles in thermal equilibrium. The steady state and transient charge distribution and energy exchange under non-equilibrium conditions were also investigated. Expressions for refractive index and absorption coefficient of the medium for electromagnetic waves were derived.

PA 66-9731

SS-17. Sodha, M. S.

Thermionic emission from spherical metallic particles. M.S., Sodha.
An expression for the rate of thermionic emission from a charged spherical metallic particle, where the free electron theory is applicable, was derived. This expression was used to investigate the charging of particles owing to thermionic emission in the absence of surrounding space charge.

PA 65-3066


Properties of two-phase flow—Electric Phenomena
The interaction of solid particles with an ionized gas, their electrostatics by thermal and surface interaction, and the dynamics of a two-phase flow including charged solid particles were investigated. Measurements of oxides and metals in an arc-heated jet of argon show that, in the interaction of an ionized gas and solid particles, the solid particles may collect electrons by thermal emissions, a process that is in competition with thermionic emission from the solid particles. The combination of low thermionic potential and high ionization potential tends to leave the particles negatively charged. The slowing nature of oxides on recombination processes explains the significance of an oxide in a rocket jet on its electron concentration. In the case of alumina, the effect of thermal electrification plays a significant part in slowing the recombination process. The radioactivity attenuation by a rocket jet due to free electrons in the gas phase is influenced by the material of the solid particles on the jet. It is indicated that the electron charge effect for overshadows the two-dimensional effect as a nozzle flow (two-phase flow).

N64-18857, 11-24


Distributions of concentration, mass flow, and velocity of solid particles were studied with a fiber-optic probe and an electrostatic probe. Concepts concerning these distributions and electrostatic charges on solid particles were furthered and substantiated. The relation between electrostatic charge on solid particles and diffusivity of solid particles, and the difference between static loading and mass flow ratio of phases were proved.

Author


SS-21. Straubel, H.


SS-22. Sweet, R. G.

High frequency recording with electrostatically deflected ink jets. R. G. Sweet.
A high speed oscillograph, using ordinary ink and paper, has been developed that provides a new approach to the old problem of producing instantly visible, high frequency records with inexpensive writing materials. A high speed jet of ordinary fountain pen ink is divided into a uniform procession of drops, each of which is independently charged in proportion to an input signal voltage. After projection through a constant transverse-deflecting field, the charged drops are collected on a moving chart to form an instantly visible, permanent record of the input signal. Drops are typically formed at a rate of 150,000 sec-1; each has an independent trajectory and makes an individual mark representing an independent sample of the input waveform. The ink streams may be switched on or off at high speed by providing, between the drop-launching point and the record surface, a collector that intercepts drops having a specific trajectory. Besides oscillography, which is discussed in detail, the technique has applications in other fields requiring marking at high speed or marking without pressure or physical contact.

PA 68-7915
ST-1. Tamura, T.

"Ionizing Radiations Excited in a Positive Burst Pulse Corona in H₂."

The onset of a positive burst pulse corona was measured at different pressures in hydrogen. From the extrapolated value of reduced field strength to indefinitely high pressure the effective absorption coefficient of the radiation active in the formation of a positive burst pulse corona was deduced. The estimated values differ for different values of the field strength at the tip of the positive electrode. It seems that there are at least three components of radiation with values of absorption coefficient $\mu_{\text{max}}$ of 0.055, 1.15 and 150 cm$^{-1}$ active at values of $E/\mu_{\text{max}}$ around 29-31. 110-660 and 1300-5600 volt cm$^{-1}$ Torr$^{-1}$ respectively.

Ratio $f$ of numbers of ionizing photons to ions and excitation coefficient were calculated for these components. A possible explanation for the excitation of the most penetrative component is also presented.

Author

ST-2. Tamura, T.

"Formation of a Positive Burst Pulse Corona in Air, H₂, and O₂."

Lech's condition for the onset of a positive burst pulse corona was applied to the case of point-to-point electrodes arrangement and a formula, which gives relations between the field strength to pressure ratio, ratio of ionizing photons to electrons in an avalanche and the effective absorption coefficient for this ionizing radiation, was obtained.

From the measured starting potential versus pressure curve the limiting value of the field strength to pressure ratio for the case of indefinitely high pressure was obtained by extrapolation, and from this value the effective absorption coefficient $\mu$ for the burst pulse forming radiation was estimated.

The estimated values for the effective absorption coefficients at 760 Torr are 2700 cm$^{-1}$ for air, 3375 cm$^{-1}$ for nitrogen and 2200 cm$^{-1}$ for oxygen. As these values are of the same order of magnitude as for the radiations in the range of the resonance bands in the ionization continua, the wavelength of the ionizing radiations effective in the positive burst pulse corona formation might be assumed to be in the range of the ionization continua. Moreover the ratios of the numbers of ionizing photons to those of electrons in a burst forming avalanche were deduced. They are approximately 1.6-1.8 for air, 1.4-1.5 for nitrogen and 1.8 -1.9 for oxygen.

Author
SV-1. Velkoff, H. R. and J. H. Miller

A65-10873
CONDEMNATION OF - APOR ON A VERTICAL PLATE WITH A TRANSVERSE ELECTROSTATIC FIELD.

Abstract: 50-500,000 microamps, 5.00.

Description of an exploratory experimential program to determine the improvements in heat transfer which could be achieved in the condensation of vapor by the application of electrostatic fields. Form-113 was utilized as the working fluid in the tests, and condensation of the form vapor was produced on a cooled vertical copper plate. A series of electrodes was utilized to vary field strength, and geometrical configuration of the field, and the particular electrostatic action being studied. Results of the tests indicated that very large increases in heat transfer can be obtained with the use of screen electrodes placed parallel to the cooled copper plate. Increases of 100% were achieved which were controllable and readily reproducible.

A65-10873, 02-33

SV-2. Velkoff, H. R. and J. H. Miller

A64-21178 Air Force Systems Command, Wright-Patterson AFB, Ohio, Aero Propulsion Lab.
Henry R Velkoff and John H Miller Feb 1964 54 p rts (RTID-TOR-63-4008; AD-633738)

This experimental program was conducted to determine whether electrostatic fields could be applied effectively to increase the heat-transfer coefficient in the condensation of vapor. A series of tests using several types of electrodes and various field strengths was conducted to study the effects of various electrostatic actions on the condensation process. In these tests, Form-113 vapor was condensed in a tank and condensed on a cooled copper plate. Results of these tests indicate that large increases in heat-transfer coefficient can be realized by applying an electrostatic field with a screen electrode placed parallel to a cooled copper plate. The increases were controllable and readily reproduced.

A64-21178, 14-13
SW-1. Wagner, P. E.


An investigation has been made of the electric polaron charge produced in vacuum on several inorganic insulators when they are put into rolling contact with nickel, platinum, and copper surfaces. The primary role of relative motion is to increase the area of the insulator that ultimately undergoes contact, thereby increasing the total charge separated. With quartz, all evidence favors electron transfer which occurs because the nonconductor has a higher effective work function than the metal. Field emission-induced back leakage of electrons during separation of the charged surfaces is considered to reduce the charge originally separated to that actually measured. Little difference is seen between the charging properties of quartz cleaned chemically in room air and quartz subsequently outgassed at 70°C in vacuum better than 10⁻⁴ mm Hg. No evidence in electron diffraction is found between bound and noncrysalline quartz. No evidence directly supporting electron transfer is found for the other insulators tested, synthetic single crystals of Al₂O₃, MgO, NaCl, KCl, and KBr, and the possibility of ion transfer is considered. All charge against nickel seems less reproducible than does quartz. The alkali halides and MgO which contain excess Mg or O as a bulk impurity charge positively, while stoichiometric MgO charges negatively. With Al₂O₃, there is a strong dependence of charge density on crystallographic orientation. Alteration of charging properties by surface and/or bulk conduction is found to be negligible for all insulators tested, within the reproducibility of the charging measurements.

PA 60-1247

SW-2. Ward, A. L.

"Ionization, Diffusion, and Drift Velocities in a Pulsed Townsend Discharge."


Introduction—It is one of the familiar properties of ultramicroscopic particles that some portion of any given type are electrically charged. Moreover, it is now accepted that the charges carried by any such particles are always multiples of the elementary unit, the electron. When the particles are not ionized by some powerful agent, the charged particles form but a fraction of the whole number and most of the charged particles possess but a single electron. Compared with the number carrying one electron, in statistical work the number doubly charged is negligible. The observed motion of the particles in a given electrostatic field is thus a measure of their size.

SW-3. Wasser, E.


Zeits. f. Physik, 78, 7-8, pp. 492-509, Oct. 12, 1932.—Measurements with selenium particles dispersed in an inert gas at pressures up to 30 atmospheres, at which the mean free path is very small, show that the charges on all the particles approximate to that of the electron, and provide no evidence in support of the view that smaller charges exist; many of the particles, however, exhibit deviations from the normal structure and density of the material in bulk, and previous reports regarding the existence of smaller charges than that of the electron are attributed to such deviations.

PA 36-377

SW-4. Watson, P. K. and A. H. Sharbaugh

20845 CHARGE-STORING TECHNIQUE FOR MEASURING SMALL CONDUCTION CURRENTS UNDER MICROSECOND PULSE CONDITIONS. P. K. Watson and A. H. Sharbaugh.


A new technique has been developed for measuring small conduction currents due to microsecond duration pulses of voltage; the method is equally applicable to longer duration pulses. It uses a charge-storing technique in which the conduction current through the sample is integrated on a capacitor whose voltage is measured after the high voltage pulse is terminated. The sensitivity of the method can be increased by integrating charge over a large number of pulses. With high voltage pulses as short as 1 usec, the technique enables one to measure currents of 1 μA with an accuracy of about 5%.

PA 67-29845

SW-5. Weiner, J. and L. Roth (Eds.)

"Electrostatic Printing."

Bibliographic Series Number 212, 111 pp., The Institute of Paper Chemistry, Appleton, Wis., 1964.

SW-6. Wells, P. V. and R. H. Gerke

"An Oscillation Method for Measuring the Size of Ultramicroscopic Particles."

The usual method of observing the motion of the charged particles is much improved in precision by reversing the direction of the field by means of a rotating commutator. In this way the particle is made to perform repeated oscillations, the amplitude of which may be measured with considerable precision, making possible for the first time the precise measurement of the size of a single ultramicroscopic particle.

The following paper presents some of the results obtained by this method with ultramicroscopic particles suspended in air.

Author

SW-7. Whitby, K. T., B. Y. H. Liu, and C. M. Peterson
"Charging and Decay of Monodispersed Aerosols in the Presence of Unipolar Ion Sources."
Paper presented at the 39th National Colloid Symposium of the ACS Division of Colloid and Surface Chemistry; Clarkson College of Technology, Potsdam, N. Y., June 21, 1965.

SW-8. Whitby, K. T., D. A. Lundgren, and C. M. Peterson
"Homogeneous Aerosol Generators."
Int. J. Air Water Poll. 9, 263-77 (1965).

SW-9. Whitby, K. T. and C. M. Peterson
"Electrical Neutralization and Particle Size Measurement of Dye Aerosols."

SW-10. White, H. J.
"Industrial Electrostatic Precipitation."

"Electrostatic Charge Effects Produced by Insecticidal Dust."
J. Econ. Entomology 37, 651-5 (1944).
SY-1. Yammoto, K.

"On the Positive Column of Electrical Discharge Without Walls." (in English)
Memoirs of the Faculty of Engineering, Nagoya University 2, No. 2, 74-98 (Oct. 1950).

SY-2. Yurkstas, E. P. and C. J. Meisenzehl

SOLID HOMOGENEOUS AEROSOL PRODUCTION BY ELECTRICAL ATOMIZATION
Edward P Yurkstas and Charles J Meisenzehl 30 Oct 1964
(Contract W-7405-ENG-48)
(UO-652)
The report describes research into the generation of solid homogeneous aerosols from a source producing uniform, charged droplets from liquid solutions by electrical atomization. The process involves the ejection of the material from a capillary and its dispersion in air or other gaseous medium by the application of an electrical field to the material. The development of the method together with the mechanism for uniform droplet and particle formation, the relationships involving the physicochemical properties of the source and the material to be ejected, along with consideration for stable and continuous production of the aerosol, are discussed.

M64-33069, 24-11


ELECTROHYDRAULIC METHOD OF FEEDING AND ATOMIZING LIQUID FUELS AND OTHER LIQUIDS AND DEVICES FOR ITS ACCOMPLISHMENT
L A Yutkin and L I Gol'tsova 3 Jan 1963 7 p Translated into ENGLISH from Soviet Patent no 119402, 20 Jan 1951 p 1-3
(FD RR 63-478/1-2 AD 412975)
The proposed method of feeding and atomizing liquids and the device for this purpose are based on the complex action of a single electrohydraulic impact that occurs as dischargers in a volume of liquid inside a special device, which is used for supplying, atomizing, and pumping a new portion of the liquid. The device is in the form of a chamber, consisting of a hollow space and having one and closed by a movable piston. There is a channel at the inlet to the chamber; this channel is bent in the form of many elbows through which liquid is fed into the chamber. The purpose of the channel is to buffer the shock impulse that is traveling in the direction of the feeding reservoir. Through an analogously designed channel, the liquid constantly flows out of the chamber. A long nozzle for ejecting the liquid is located at the other end of the chamber.

M64-22649, 15-07
SZ-1. Zawidzki, T. W.
"Vonnegut's Spraying Fountain, An Oxygen-pressure Dependant Chemical Process."

SZ-2. Zobel, G.
"Deposition of Aerosol Flowing Past a Cylindrical Fiber in a Uniform Electric Field."
Paper presented at the 39th National Colloid Symposium of the ACS Division of Colloid and Surface Chemistry; Clarkson College of Technology; Potsdam, N. Y., June 21, 1965.

SZ-3. Zeleny, J.
"Electrical Discharges from Pointed Conductors."
Phys. Rev. 18, 103-123 (1920).
SURVEY OF GOVERNMENT SPONSORED PROJECTS
GC-1. A. D. Little, Inc.
Author Unknown
Letter Report
Contract No. DA 18-108-405 CML 852
"Research on Electrical Phenomena Associated With Aerosols"
Oct. 24, 1962

GC-2. A. D. Little, Inc.
AB-299 716  Div. 3, 25
(TESR/FUB) OTS price $6.60
Author: A. D. Little, Inc., Cambridge, Mass.
ELECTRICAL PHENOMENA ASSOCIATED WITH AEROSOLS.
Final rept., 15 June 60-15 Feb 63.
by Bernard Yassenget, D. Reed Baffett and others.
(Contract DA 18-108-405-cml-852)
Unclassified report

DESCRIPTIONS: Chemical warfare agents.

TAB 166-3-1.

GC-3. A. D. Little, Inc.
Doyle, A. W.
Letter Report
Contract No. DA 18-108-405 CML 852
"Research on Electrical Phenomena Associated With Aerosols"
Feb. 19, 1962

GC-4. A. D. Little, Inc.
Doyle, A. W.
Letter Report
Contract No. DA 18-108-405 CML 852
"Research on Electrical Phenomena Associated With Aerosols"
Dec. 29, 1961

GC-5. A. D. Little, Inc.
Author Unknown
Letter Report
Contract No. DA 18-108-405 CML 852
"Research on Electrical Phenomena Associated With Aerosols"
Dec. 21, 1961

GC-6. A. D. Little, I.C.
Doyle, A. W.
Letter Report
Contract No. DA 18-108-405 CML 852
"Research on Electrical Phenomena Associated With Aerosols"
Nov. 8, 1961

GC-7. A. D. Little, Inc.
AB-274 276  Div. 25, 3
(TESR/FUB) OTS price $8.60
Author: A. D. Little, Inc., Cambridge, Mass.
RESEARCH IN ELECTRICAL PHENOMENA ASSOCIATED WITH AEROSOLS.
Quarterly rept. no. 5, 15 July-15 Oct 61.
by Bernard Yassenget, Arnold W. Doyle, and
D. Reed Baffett, 15 Oct 61, 10p. incl. Illus.
(Contract DA 18-108-405-cml-852)
Unclassified report

DESCRIPTIONS: (Electric fields phenomena associated with *Aerosols, Electrons, *Particles.) (Drops, Evaporation, Voltage, Water, Surface tension, Electrical properties, Electrostatic precipitation.) (Spray Nozzles, Atomization, Scattering.)
The rate of charge on a charged volatile particle was investigated. Charged droplets were held suspended in an electric field and allowed to evaporate. Charge and mass were measured as a function of time. Charged water drops evaporate until the electrical forces on the surface are equal to the surface tension forces at which time the droplets disrupt to eject a number of small highly charged droplets. The fraction of charge and mass lost with each ejection and the effect of maximum charging on evaporation rate of a drop are discussed.

TAB 166-3-1

GC-8. A. D. Little, Inc.
AB-260 745  Div. 25, 4, 7
(8 Aug 61) OTS price $8.60
Author: A. D. Little, Inc., Cambridge, Mass.
RESEARCH IN ELECTRICAL PHENOMENA ASSOCIATED WITH AEROSOLS.
Quarterly rept. no. 5, 15 Jan-15 Apr 61.
by Bernard Yassenget, Arnold W. Doyle, and
Philip M. Stilley, 21 July 61, 12p. incl. Illus.
(Contract DA 18-108-405-cml-852)
Unclassified report

An ion spectrometer was built to measure the mobilities of charged aerosols. Mobilities were measured for particles down to 0.3 microns in diameter. Difficulties were encountered with the smaller particles; however, large particles are easily handled. The electrical mobility of organic liquids was studied. Particle size at ion velocity and low frequency was seen to vary as the square root of surface tension. At high voltages the electrical conductivity can strongly influence the mobility. The susceptibility of a liquid to reduction stimulation at higher voltages was found to be dependent on electrical conductivity. Charge per drop for a given drop size was found to be constant. Particle and capillary diameter do not have a strong influence on the stimulation process over the range investigated.
GC-12. A. D. Little, Inc.
Author Unknown
Final Report
Contractor: AFCBC, Geophysics Research Directorate
"A Study of the Techniques for Measuring the Concentration of Space Charge in the Lower Atmosphere"
Jan. 31, 1958

GC-13. Aerojet-General Corp.
Berg, T. G. O. and W. J. Flood
Report No. 0395-04(14)SP
"Investigation of Electrification of Powders in Flow Through Tubes and Nozzles II. Charge Analysis of Deagglomerated Powders"
Nov. 1963

GC-14. Aerojet-General Corp.
Berg, T. G. O. and L. E. Avis
Report No. 0395-04(13)SP
Contract No. DA 18-108-405 CML 829
"Exploratory Experiments on Kinetics and Mechanisms of Communion"
Oct. 1963

GC-15. Aerojet-General Corp.
Berg, T. G. O. and W. J. Stansbury
Report No. 0395-04(12)SP
Contract No. DA 18-108-405 CML 829
"Investigation of the Force of Adhesion Between Powder Particles II. Plexiglas Powder."
Oct. 1963

GC-16. Aerojet-General Corp.
Report No. 0395-04(11)SP
Aerojet-General Corp., Downey, Calif. Ordinance Div.
INVESTIGATION OF ELECTRIFICATION OF POWDERS IN FLOW THROUGH TUBES AND NOZZLES. I: A CHARGE ANALYZER
T. G. Dare Berg, G. C. Fennell, and W. J. Flood J. Jun. 1963
40 p. refs.
(Contract DA-18-108-405-CML 829)
(Rept. 0395-040608SP AD-448189)

As a part of an investigation of the electrification of powders in flow through tubes and nozzles, a charge analyzer has been designed, constructed, and tested. The charge analyzer has two electrodes at a 1000 volts with respect to ground. At a stationary state the current from each electrode is equal to the rate of deposition of charge. The two currents are recorded and integrated with a planimeter. The electrodes are weighed on a microbalance for determination of the amount deposited. The nozzle is located at one end of the pair of electrodes. Experiments have been conducted with several airborne powders. In the range 1x1 to 30x1 of particle diameter, flowing through a hypodermic needle of 0.8-mm diameter and 3 ft length of flow rates between 50 and 500 cc/min. The average positive charge, the average negative charge, and the average absolute charge are proportional to the square of the flow rate. The charge is acquired in friction between the powder particles and a deposit on the tube wall.
N65-12221, 02-23

GC-17. Aerojet-General Corp.
Berg, T. G. O.
Report No. 0395-04(07)SP
Contract No. DA 18-108-405 CML 829
"Homogeneous Condensation of Vapors"
May 1, 1963

GC-18. Aerojet-General Corp.
Berg, T. G. O. and D. C. George
Report No. 0395-04(06)SP
Contract No. DA 18-108-405 CML 829
"High-Speed Photography of Condensation of Water Vapors in an Expansion Chamber"
April 1963

GC-19. Aerojet-General Corp.
Berg, T. G. O. and T. A. Gaukler
Report No. 0395-04(05)SP
Contract No. DA 18-108-405 CML 829
"The Mechanism of the Tribu Effect III. The Effect of the Humidity of the Air."
March 1963

GC-20. Aerojet-General Corp.
Berg, T. G. O., M. J. Hunks, and W. J. Stansbury
Report No. 0395-04(04)SP
Contract No. DA 18-108-405 CML 829
"Investigation of the Force of Adhesion Between Powder Particles"
March 1963
GC-21. Aerojet-General Corp.
Berg, T. G. O., et al.
Bimonthly Prog. Rpt. 0395-04(03)BP (May/June 1962)
Contract No. DA 18-108-405 CML 829
"Research Study on Dissemination of Solid and
Liquid Agents."
pp. 57-74 on "Electrostatic Studies"
July 12, 1962

GC-22. Aerojet-General Corp.
Author Unknown
Progress Report No. 0395-04(02)BP (March/April 1962)
Contract No. DA 18-108-405 CML 829
"Research Study on the Dissemination of Solid
and Liquid Agents"
May 16, 1962

GC-23. Aerojet-General Corp.
Progress Report No. 0395-04(01)BP (Jan/Feb. 1962)
Contract No. DA 18-108-405 CML 829
"AGC Research Study on Dissemination of Solid
and Liquid Agents"
Feb. 1962

Berg, T. G. O. and M. J. Hunkins
Spec. Rpt. No. 0395-04(01)SP
Contract No. DA 18-108-405 CML 829
"Effect of Charge on Coalescence of
Sodium Chloride Crystals"
Feb. 1962

GC-25. Aerojet-General Corp.
Contract No. DA 18-108-405 CML 829
"Research Study on the Dissemination of
Solid and Liquid Agents"
Jan. 29, 1962

GC-26. Aerojet-General Corp.
Berg, T. G. O., et al.
Contract No. DA 18-108-405 CML 829
Title Unknown
Jan. 9, 1962

GC-27. Aerojet-General Corp.
Berg, T. G. O.
Report No. 0395-03(10)SP
Contract No. DA 18-108-405 CML 829
"The Mechanism of Adhesion
Between Solid Aerosol Particles"
Dec. 29, 1961

GC-28. Aerojet-General Corp.
Prog. Rept. No. 0395-02(09)BP (Sept./Oct. 1961)
Contract No. DA 18-108-405 CML 829
Title Unknown
Nov. 15, 1961

GC-29. Aerojet-General Corp.
Berg, T. G. O., G. C. Fernish, and M. J. Hunkins
Report No. 0395-03(08)SP
Contract No. DA 18-108-405 CML 829
"Electrostatic Charging of Men and Women in
Various Clothing"
Nov. 1961

GC-30. Aerojet-General Corp.
Author Unknown
Prog. Rpt. No. 0395-02(06)BP (May/June 1961)
Contract No. DA 18-108-405 CML 829
Title Unknown
July 26, 1961

GC-31. Aerojet-General Corp.
Berg, T. G. O.
Report No. 0395-50(05)SP
Contract No. DA 18-108-405 CML 829
"The Electrification of Dripping Drops"
July 6, 1961
GC-32. Aerojet-General Corp.
Berg, T. G. O.
Report No. 0395-50/04/SP
Contract No. DA 18-108-405 CML 829
"Dissemination and Use of CW Agents"
July 3, 1961

GC-33. Aerojet-General Corp.
Berg, T. G. O. and N. Brunetz
Report No. 0395-50/03/SP
Contract No. DA 18-108-405 CML 829
"Behavior of Charged Particles on Glass Slides"
July 1961

GC-34. Aerojet-General Corp.
Prog. Rpt. No. 0395-02/05/SP (March/April 1961)
Contract No. DA 18-108-405 CML 829
"Research Study on Dissemination of Solid and Liquid Agents"
May 23, 1961

GC-35. Aerojet-General Corp.
Berg, T. G. O.
Report No. 423-2
Contract No. DA 18-108-405 CML 829
"Dissemination and Use of CW Agents"
May 2, 1961

GC-36. Aerojet-General Corp.
Berg, T. G. O. and G. C. Fernish
Report No. R-445
Contract No. DA 18-108-405 CML 829
"Mechanism of Coalescence of Liquid Drops"
May 1961

GC-37. Aerojet-General Corp.
Berg, T. G. O.
Report No. R-444
Contract No. DA 18-108-405 CML 829
"The Mechanism of the Tribo Effect"
April 1961

GC-38. Aerojet-General Corp.
Berg, T. G. O.
Final Report No. R-410
Contract No. DA 18-108-405 CML 829
"Investigation of Specific Tasks in Dissemination and Use of CW Agents"
March 17, 1961

GC-39. Aerojet-General Corp.
Berg, T. G. O.
Contract No. DA 18-108-405 CML 829
"Dissemination and Use of CW Agents"
Feb. 28, 1961

GC-40. Aerojet-General Corp.
Berg, T. G. O.
Bimonthly Prog. Rept. No. R-385-3 (Oct./Nov. 1960)
Contract No. DA 18-108-405 CML 829
Confidential Report
"Research Study of the Dissemination of Solid and Liquid Agents"
Dec. 16, 1960

GC-41. Aerojet-General Corp.
Zernow, et al.
Contract No. DA 18-108-405 CML 829
Title Unknown
Oct. 15, 1960

GC-42. Aerojet-General Corp.
Hendel, et al.
Progress Report No. R-391
Contract No. DA 18-108-405 CML 829
Title Unknown
Aug. 29, 1960

GC-43. Aerojet-General Corp.
Zernow, et al.
Progress Report No. R-385-1 (June/July 1960)
Contract No. DA 18-108-405 CML 829
Title Unknown
Aug. 22, 1960
GC-44. Aeroprojects, Inc.
Author Unknown
Progress Report No. 51
Contract No. DA 18-064-404 CML 94
"Electrification"
Issue date unknown.

GC-45. AFCRC, Geophysics Research Directorate
Ghosh, S. N., W. F. Sheridan, J. A. Dillon,
and H. D. Edwards
Geophysical Research Paper No. 48
Contract No. AFCRC - TR 56-205
"A Review of Charge Transfer
Processes in Gases"
July 1955

GC-46. Argonne National Laboratories
Katz, H. M.
Report No. ANL-5725
Contract No. W-31-109 eng 38
"Studies of Particle Size Distribution
in Fluidized Beds"
May 1957

GC-47. Associated Nucleonics, Inc.
AB-285 943
(TIDES/EM)
Associated Nucleonics, Inc., Garden City, N. Y.
FLUID BED COLLECTION AND DISPERATION STUDY,
in Three papers. 21 Aug 56. 16 pp., illus., tables, 8 refs.
(Rept. No. AB-159)
(Contract NA 18-064-001-2738)
Declassified report
No automatic release to foreign nationals.

DESCRIPTORS: "Aerosols," "Particles," "Collecting
methods," "Sand.

The possibility of using a fluidized sand bed
for collecting and for disseminating fine powders
was investigated. The powders studied were
Micro-Cel. Lab-209. (a) Yellow. and 18 Eimac.
The bed contained sand 20 to 30 mesh in size.
It was found that a mechanically fluidized sand
bed was unsatisfactory for collecting airborne fine
particles. In the dissemination studies per-
formed in a 3-inch diameter column. a gas flu-
idized sand bed above a permitted only partial
mixing with a large fraction of the powder feed.
'argon circulating the bed inside bubbles of the
fluidizing air. Mechanical oscillation did not help.
Exhaust mixing was obtained with the
addition of rotating mixing blades, but the gen-
eration of electrostatic charges caused immediate
re-agglomeration of the particles. Less re-ag-
glomerating was noted with electrically grounded
equipment. Relatively. the best de-agglomerating
performance was obtained with no sand present.
Dispersion is not recommended. Fine particles
with high angles of repose were shown capable of
flowing freely with gravity from flat bottomed
bins by introducing an extended nozzle at the
discharge hole, and of flowing against gravity
by piston-like movement through small diameter
pipes.

TAB U63-1-2

GC-48. AEC
Author Unknown
Report No. NYO-4615
"Mechanics in Electrostatic Filtration of
Aerosols with Fixed and Fluidized Granules"
Aug. 31, 1958

GC-49. AEC
Report No. TID-7551
"Fifth AEC Air Cleaning Conference"
Harvard Air Cleaning Laboratory,
Report Issued April 1958.

AD-337 252L Div. 3/7
(TIDES/EM)
Chemical Defence Experimental Establishment
(Gt. Brit.).
DENSITY AND STRUCTURE OF SOME PARTICULATE
AGGREGATES (U).
by P. C. Rabe and W. M. Lasco. 6 Feb 63. 220
DEEE NP644
Confidential report

Notice: Only government agencies may request
from BDC. Others request approval of British
Ministry of Aviation, via the appropriate
channels.

DESCRIPTORS: "Aerosols, Particle size," "Aerosols, Structural properties," Density,
Velocity, Electrons, Bacterial aerosols,
Electrical properties (U)

TAB U63-4-2
Burbage, ARN 
Porton Note No. 249 
"An Investigation of the Relative Mass of Charged Particles in a Thermally-Generated Sub-Micron NaCl Cloud" 
Oct. 30, 1962

Author Unknown 
Tech. Paper (R:35 
"Adhesion of Spherical Particles to Plane Surfaces" 
April 7, 1961

Gillespie, T. 
Tech. Paper 289 
"The Effect of the Electric Charge Distribution on the Ageing of an Aerosol" 
June 26, 1952

Author Unknown 
Tech. Paper 249 
"The Shatter of a Small Quantity of Liquid by Means of a Spark Discharge" 
July 19, 1951

GC-55. CRDL 
Author Unknown 
Final Tech. Rept. No. CRDL 550-Ir-5/PTR 
Contract No. DA 91-591 EIC 1664 
"Ionization Equilibrium in Heterogeneous Aerosols" 
Aug. 2, 1962

GC-56. CRDL 
AD-274 639 Div. 7 
(TIST/EUR) OTS price $2.50 
Army Chemical Research and Development Lab., Army Chemical Center, Md. 
DISPERSSION OF AEROSOLS BY ELECTROSTATICS 
by Roy E. Shaffer, Aug 62, 22p, incl. illus. 
Table, refs. [Rept. no. CRDL 3/4] 
Unclassified report


The objectives of the investigation described were (1) to study the electrostatic properties of certain powder solids to determine whether they could be used to enhance the dissemination efficiency of powdered solids, and (2) study the aerosolization of liquids by electrostatic means. Present work has been confined to preliminary studies in an attempt to ascertain the most practical and fruitful approach to the problem of electrostatic dissemination. The principle of electrostatic pre-charging as a means to increase dissemination efficiency of finely divided (presized) solids shows promise. Applications of the principle to chemical munitions is, however, limited to those compounds having high electrical resistance and by the development of techniques to eliminate or reduce electrical discharge. Although the breakup of liquids into fine aerosols by strong electrical fields is technically feasible and requires low energy input, its application to munitions is doubtful at this time because of design problems.

TAB U63-2-2

GC-57. CRDL 
Cutler, M. 
Tech. Memo 15-50 
"Second Coordinating Conference of BW-CW Dissemination Research Contracts" 
Oct. 10, 1961

GC-58. CRDL (Ft. Detrick, M. D. Division) 
Author Unknown 
Tech. Prog. Rept. (Task 4B04-14-030-03. Subtask III - I.) 
Project No. 4B04-14-030 (Jan.-June 1960) 
"New Techniques for Dissemination" 
Issue date unknown

GC-59. CRDL 
Author Unknown 
Report No. 60-21 
Contract No. CWL 550-2376 
"Soviet R/D Applicable to Aerosol and Spray Dissemination of Chemical and BW Agents" 
April 18, 1960
GC-60. CRDL
AD-309 196 Div. 3
Chemical Warfare Lab., Army Chemical Center, Md.
SYMPOSIUM VIII. VOLUME I. SPREAD DISSEMINATION OF AGENTS, CONDUCTED BY U.S. ARMY CHEMICAL WARFARE LABORATORIES 4, 5 and 6 MARCH AT ARMY CHEMICAL CENTER, MARYLAND. July 58, 1956. incl. (Sec. 305 (CWL special pub. no. 3)) Unclassified report
Contents:
Principle of balanced streams and the mechanical formation of aerosols, by W. J. Story
Breakup of liquid droplets, thickness and turbulence, by James D. Wilcoxon
The aerodynamic breakup of droplets, by John W. Converse
Impingement efficacy of aerosol particles, by J. L. Higginson
Evaporation of liquid droplets falling a cloud, by Albert Wettlin
Travel of droplets in turbulent stream, by Gabrielle Anser
Models for computing contamination expected from aircraft spray, by John Rovenkamp, Richard E. Snow, and Fred B. Ewing
Techniques for the determination of droplet shape in spray, by A. L. Wootridge
Development of a camera to photograph high-speed particles, by John A. Blount and associates
Dispersion of diffusion processes, by William G. Tinkham
(See also AD-118 939, AD-394 809)
TAB 159-8

GC-61. CRDL
Gordieeff, V. A.
Tech. Report No. CWL 2051
AD-107 915
"Adsorption of Vapors on Solid Aerosols (Dusts)"
Aug. 17, 1956

GC-62. CRDL
Author Unknown
Report No. CWL 550 H-2
"Dispersion of Liquids into Monodisperse Aerosols by Means of Electrical Atomization. I."
Jan. 1956

GC-63. CRDL
Macy, R. (Chairman)
Report No. ETF 158-29
"Report of Symposium V. Aerosols"
June 22-23, 1953

GC-64. CRDL
Author Unknown
Report No. ETF 158-24/3
"Investigation of the Aggregation of Fine Particle Matter Suspended in Air"
March 14, 1951

GC-65. CRDL
Goldenson, J. and J. D. Wilcoxon
Report No. TCR 78
"Carrier Dusts for Toxic Aerosols. II. Preliminary Dispersal Tests"
Jan. 1951

GC-66. CRDL
Wilcoxon, J. D. and J. Goldenson
Report No. TCR 66
"Carrier Dusts for Toxic Aerosols. I. Preliminary Survey of Dusts."
Oct. 1950

GC-67. Columbia University
Drozin, V. G. and D. de Deo
Report No. NYO-4657
AEC Contract No. AT (30-1) - 1434
"Size Distribution in Aerosols Determined by Settling of Charged Particles"
Aug. 31, 1955

GC-68. Cornell Aeronautical Lab., Inc.
AD-412 365; Div. 25, 9
(TISIP/STI) OTS price $2.60
Proj. NRO/68 038 Unclassified report
A shock-tube technique is used to investigate the flow conditions behind a shock wave propagating through a suspension of small solid particles in a gas. With the aid of a particle injector system, the driven section of the shock tube can be filled with a reasonably uniform suspension of known composition. The particles are rapidly accelerated behind a shock, and their motion is recorded by streak photography. In addition, the shock velocity and the pressure variations at one point of the test section are obtained. The flow conditions in the relaxation zone behind the shock wave can be derived from these measurements and the data are used to obtain the relationship between drag coefficient and particle Reynolds number. In the experiments performed so far, 20-micron particles were used, and the particle Reynolds numbers were below 3000. All data were well correlated by C sub D = 4000/Re sub 4. This relationship deviates strongly from conventionally used correlations, and it is suggested that electric charges on the particles may cause such a discrepancy. If the particles are too small when used in the present experiments. The exact mechanism of the effect has not yet been explained.

TAB U83-4-4


GC-77. General Mills Electronics Corp.
Author Unknown
Quarterly Progress Report No. 5
Contract No. DA 18-064 CHE 2745
"Dissemination of Solid and Liquid BW Agents"
Nov. 30, 1961

GC-78. General Mills Electronics Corp.
Author Unknown
Quarterly Progress Report 4 (May/June 1961)
Contract No. DA 18-064 CHE 2745
"Dissemination of Solid and Liquid BW Agents"
Aug. 10, 1961

GC-79. General Mills, Inc.
AB-415 902 Div. 4
(TIEST/AN) EST price $16.00
General Mills, Inc., Minneapolis, Minn.
FUNDAMENTAL STUDIES OF THE DISPERSIBILITY OF
POWDERED MATERIALS.
Final rep. 2 June 60-31 June 63
by J. E. Nash, G. C. Leiter, A. F. Johnson,
E. Steiner and K. W. Zeller. 15 Mar 63, 1v.
Rept. DA-1391
Contract DA-13-106-9589-3512
Declassified report

Descriptive: (Powders, Organic materials),
(Chemical, Organic materials),

This is a fundamental study of factors affecting the flow and dispersibility of finely divided
organic powders. Most of the investigations pertained to three broad powders: saccharin, Carbomax
<000, and Span 60. These powders were chosen to represent crystalline, wax, and powdery types of
powders, respectively. In the program, a fourth powder (egg albumin) was added to the list of powders to be investigated. The preparation of powders including grinding, deagglomeration, blending,
coating with surface active agents, etc. is discussed. The various tests for measuring physical
properties of powders including particle size distribution, shear strength, bulk tensile
strength, bulk density, dynamic angle of repose, dispersibility, and electrostatic charge are described.
The major studies are: (1) bulk tensile strength tests, (2) effects of humidity on powder
properties, (3) effects of antisolvent agents on powder properties, (4) evaluation of a
(001) function, (5) effects of surface active agents on powder properties, (6) effects of ad-
sorbed foreign vapors on powder properties, (7) effects of renewal of adsorbed gases and vapors,
(8) energy required to disperse a powder sample, (9) properties of compacted powders, and (10) egg
albumin studies.

TAB U63-4-6

GC-80. General Mills, Inc.
AB-288 219 Div. 4
(TIEST/BN)
General Mills, Inc., Minneapolis, Minn.
FUNDAMENTAL STUDIES OF THE DISPERSIBILITY OF
POWDERED MATERIALS.
Quarterly progress rep. no. 9, 1 July-30 Oct 62,
by J. E. Nash, G. C. Leiter and A. F. Johnson,
31 Oct 62, 47p. incl. Illus. tables (DA report,
no. 2352)
Contract DA-13-106-9589-3512
Unclassified report

No automatic release to foreign nationals.


Samples of finely ground Carbomax 6000 treated
with 20 surface active agents representing the 4 main types (non-ionic, anionic, cationic and
ampholytic) were tested for shear strength, dis-
perbility, and electrostatic charge. Shear
strength tests indicate all samples, except those
treated with Span 60 (non-ionic agent), have
lower shear strength than the control. The 8 samples with lowest shear strength were treated with
cationic-type agents. Disperability tests indicate
ampholytic agents have little or no effect,
non-ionic agents a beneficial one, and
anionic and cationic agents detrimental effects.
Electrostatic charge tests indicate no change in
samples treated with non-ionic agents.
Samples treated with cationic agents were
negatively charged than the control, and samples treated
with cationic agents were about equally divided
between positively and negatively charged. Ef-
teffects of absorbed acetone and propanol-2-dodehyde
vapors on the rate of saccharin, Carbomax 6000,
and Span 60 were investigated. Acetone vapors
caused saccharin and Span 60 samples to agglomerate
into hard balls. Propanol-2-dodehyde vapors had
similar effect on saccharin. Samples ag-
glomerated were tested for shear strength, dis-
perbility and electrostatic charge. The most
significant finding was that the dispersibility
characteristics of Span 60 are improved by
propanol-2-dodehyde vapors.

TAB U63-1-4
GC-81. General Mills, Inc.

AB-281 922 Div. 3

(TISP/GRC)

General Mills, Inc., Minneapolis, Minn.

FUNDAMENTAL STUDIES OF THE DISPERSIBILITY OF POWDERED MATERIALS


No automatic release to foreign nations.


An investigation was made of effects of surface active agents and adsorbed foreign vapors on properties of fine organic powders. Twenty surface-active agents representing the four main types (non-ionic, anionic, cationic and amphoteric) were tested to determine their effects on finely ground saccharides. Powder samples treated with various agents were tested for shear strength, dispersibility and electrostatic charge. The most significant finding was the fact that saccharide agents definitely improve the dispersibility characteristics of saccharides. The effects of adsorbed physical vapors on properties of three base powders (saccharin, Carbowax 6000 and Span 60) were investigated. Results indicated that adsorbed physical vapors have no marked beneficial effects on powder properties. A technique for standardizing the light source on the aerosol decay chamber is described. Particle size analyses using the Whirlwyndic technique were made on samples of the original batch and the new batch of finely ground saccharin.

TAB U52-4-5

GC-82. General Mills, Inc.

AB-271 264 Div. 3

(TISP/GRC)

General Mills, Inc., Minneapolis, Minn.

FUNDAMENTAL STUDIES OF THE DISPERSIBILITY OF POWDERED MATERIALS

Quarterly progress rept. no. 7, 3 Jan-3 Apr 62 by J. H. Mark, G. G. Leiter, and A. P. Johnson. 3 May 62. 66p. incl. illus. tables (Sept. no. 2276) (Contract DA 18-1066-405-cm-824) Unclassified report

No automatic release to foreign nations.


Electrostatic charge analyses were made on samples of the three base powders (saccharin, Carbowax 6000 and Span 60) which had been pre-conditioned at various relative humidities ranging from less than 1 to 75%. A study was made using an electron microscope of the effects of the addition of a small amount of Carbowax 6000 to the properties of Carbowax 6000. The effect of concentration of Carbowax 6000 on properties of the three base powders was investigated by performing bulk density tests and dispersibility investigations, Decay, Pressure, Temperature.) (Organic compounds, Saccharides, Beaches, Sulfitolides and Polymers, Ethylenes, Glycols and Steranes.) Additives, Adhesion.

The investigations reported deal mainly with the measurement of physical properties of three base powders (saccharin, Carbowax 6000 and Span 60) containing various amounts of selected anti-agglomeration agents (Carb-O-Sil, Alcoa-C, P-25 and tri-alkyl phosphates). Results indicated that Carb-O-Sil is the most effective anti-agglomeration agent. Investigations were also conducted to determine effect of rate of force application and effect of powder bed thickness on powder shear strength. Results indicated that powder shear is independent of rate of force application over the range 4,740 - 142,000 dynes/sec and is nearly independent of powder bed thickness over the range 1.7 - 3.3 mm. Electrostatic change tests were made on samples of saccharin and Carbowax 6000 treated with eleven different surface active agents. Results were inconclusive.

TAB U52-3-3

GC-83. General Mills, Inc.

AB-271 722 Div. 3

(TISP/GRC)

General Mills, Inc., Minneapolis, Minn.

FUNDAMENTAL STUDIES OF THE DISPERSIBILITY OF POWDERED MATERIALS

Quarterly progress rept. no. 6, 3 Sep 61-3 Jan 62 by J. H. Mark, G. G. Leiter and A. P. Johnson. 15 Feb 62. 58p. incl. illus. tables (GNI rept. no. 2256) (Contract DA 18-1066-405-cm-824) Unclassified report

No automatic release to Foreign Nations.

tests. A group of 13 different anti-see agents was evaluated by conducting shear strength, debris, and electrical tests on samples of the three base powders containing 15% by weight of each of the agents. The most promising agents were Carb-Nil 61, Amin-O, F-35 and Tri-Calcium Phosphate. The effect of aluminina vapors adsorbed on the surface of Carbon 6000 particles was investigated. It was found that in a high voltage field an electric field can be completely eliminated by an adsorbed layer of n-butylamine.

TAB D52-2-3

GC-84. General Mills, Inc.
Author Unknown
Letter Progress Report
Contract No. DA 18-108-405 CM 324
"Fundamental Studies of the Dispersibility of Powdered Material" December 1981

GC-85. General Mills, Inc.
Author Unknown
Letter Progress Report
Contract No. DA 18-108-405 CM 324
"Fundamental Studies of the Dispersibility of Powdered Material"
November 1981

GC-86. General Mills, Inc.
AB-26L 370 Div. 3
(TTSEP/520) GTS series 85-60
General Mills Inc., Minneapolis, Minn.
FUNDAMENTAL STUDIES OF THE DISPERSIBILITY OF POWDERED MATERIALS.
Quarterly progress rept. no. 5, 3 June 3 Sep 61, by J. M. Nash, C. E. Weller, and A. P. Johnson. 30 Sep 61, 45p. incl. illus. tables (GTS rpt. no. 2259) (Contract BA 18-108-405-cmc-324) Unclassified report

DESCRIPTION: [Various powders, including cornstarch, sugar, and tapioca, were studied. A technique involving the use of a 2-in., 3-ton, 18,000 lb hydraulic ram was devised for blending and dispensing powders. A study of average bulk density as a function of plug length and compressive load was made on each of the 3 base powders (carbopol, Span 80, and Carbopol 6000). The effect of removal of adsorbed gases and vapors was investigated by a collecting test on samples of the 3 base powders under normal laboratory conditions and under high vacuum conditions (0.0002 mm Hg). A technique involving the use of a modified test apparatus was devised for the purpose of testing powders for their ability to withstand high vacuum conditions. A comparison of test results indicates that there is little correlation. A theoretical study was made to determine energy expended in dispersing an aerosol. Electrostatic charge analysis was made on aerosols of Span 80 and Carbopol 6000.]

TAB D55-1-1

GC-87. General Mills, Inc.
AB-26L 370 Div. 3
(8 Aug 61) GTS price $6.60
General Mills Inc., Minneapolis, Minn.
FUNDAMENTAL STUDIES OF THE DISPERSIBILITY OF POWDERED MATERIALS.
Quarterly progress rept. no. 5, 3 June 61, by J. M. Nash, C. E. Weller, and A. P. Johnson. 30 Sep 61, 45p. incl. illus. tables (Contract BA 18-108-405-cmc-324) Unclassified report

DESCRIPTION: [Various powders, including cornstarch, sugar, and tapioca, were studied. A technique involving the use of a 2-in., 3-ton, 18,000 lb hydraulic ram was devised for blending and dispensing powders. A study of average bulk density as a function of plug length and compressive load was made on each of the 3 base powders (carbopol, Span 80, and Carbopol 6000). The effect of removal of adsorbed gases and vapors was investigated by a collecting test on samples of the 3 base powders under normal laboratory conditions and under high vacuum conditions (0.0002 mm Hg). A technique involving the use of a modified test apparatus was devised for the purpose of testing powders for their ability to withstand high vacuum conditions. A comparison of test results indicates that there is little correlation. A theoretical study was made to determine energy expended in dispersing an aerosol. Electrostatic charge analysis was made on aerosols of Span 80 and Carbopol 6000.]

TAB D55-1-1
GC-88. General Mills, Inc.

AD-491 41 Div. 3
(2 May 61) 87 r. price $5.60.

General Mills, Inc., Minneapolis, Minn.

DESIGN SPECIFICATIONS FOR POWDERED MATERIALS

Unclassified report

DESCRIPTIONS: Powders, Particles, Aerogels, Organic compounds, Epidemiology, Scattering, Textile properties, Mechanical properties, Electrostatics, Tests, Diffusion, Vapors, Additives, Adsorption, Retention, Glasses, Polymers, Ethylene, Stearate, Fluid flow, Fociers affecting the flow and dispersibility of organic powders in the 2 - 5 micron size range have been the subject of investigation of this study. The tests reported herein were conducted on samples of finely ground saran, Carbosil 6000 and Span 60 or on samples of these powders containing various additives. Several different types of tests were conducted including the following: bulk tensile strength tests, shear strength tests, etc. Tests were conducted under high vacuum conditions and under laboratory conditions to study the effect of removal of adsorbed vapors on the tests to determine energy required to disperse an aerosol and electrical charge on analysis. TAB U61-31

GC-89. General Mills, Inc.

AD-249 913 Div. 3
(31 Jan 61)

General Mills, Inc., Minneapolis, Minn.

DESIGN SPECIFICATIONS FOR POWDERED MATERIALS

Unclassified report

DESCRIPTIONS: Powders, Particles, Aerogels, Textile properties, Biological warfare agents, Tests, Diffusion, Scattering.

Tests were made on samples of finely ground saran and Carbosil 6000 and samples of these materials containing various disengagement agents. A technique is described for measuring the true bulk tensile strength of powders at various degrees of compression. The technique allows it to determine the distribution of bulk tensile strength throughout the length of a column of compressed powder. It was found that the bulk tensile strength of a powder is an exponential function of the distance from the piston to the fracture plane. The bulk tensile strength of a thin layer of powder immediately below the piston is proportional to the compression load applied to the piston. For a given compressive load, the bulk tensile strength of Carbosil 6000 was highest, followed by Silica and then by the additive mixtures. Disc-stirring measurements were made at three different speeds and three different levels of humidity. As the humidity decreases, greater and greater forces are required to lift the discs out of the powders. Equations relating force to disc diameter and powder depth were developed for each powder and for each humidity. TAB U60-4-5

GC-90. General Mills, Inc.

AD-249 917 Div. 13
(20 Oct 60)

General Mills, Inc., Minneapolis, Minn.

DESIGN SPECIFICATIONS FOR POWDERED MATERIALS

Unclassified report

DESCRIPTIONS: Powders, Particles, Aerogels, Field, Adsorption, Friction, Textile properties, Biological warfare agents, Scattering.

Research is in progress to develop new powders that can be dispersed in water. These powders can be dispersed in water and can be used as a dispersing agent for other powders. The new powders are being tested in various laboratory conditions to study the effect of removal of adsorbed vapors on the tests to determine energy required to disperse an aerosol and electrical charge on analysis. The studies are being conducted on samples of finely ground saran and Carbosil 6000 and samples of these materials containing various disengagement agents. A technique is described for measuring the true bulk tensile strength of powders at various degrees of compression. The technique allows it to determine the distribution of bulk tensile strength throughout the length of a column of compressed powder. It was found that the bulk tensile strength of a powder is an exponential function of the distance from the piston to the fracture plane. The bulk tensile strength of a thin layer of powder immediately below the piston is proportional to the compression load applied to the piston. For a given compressive load, the bulk tensile strength of Carbosil 6000 was highest, followed by Silica and then by the additive mixtures. Disc-stirring measurements were made at three different speeds and three different levels of humidity. As the humidity decreases, greater and greater forces are required to lift the discs out of the powders. Equations relating force to disc diameter and powder depth were developed for each powder and for each humidity. TAB U60-4-5

GC-91. Geophysics Corp. of America

Doyle, A. W., et al.
9th Monthly Letter Progress Report
Contract No. DA 18-106 AMC 242(A)

"New Techniques for Dissemination of Chemical Agents"

April 17, 1964
GC-92. Geophysics Corp. of America
Doyle, A. W., et al.
5th Monthly Letter Progress Report
Contract No. DA 18-108 AMC 249(A)
"New Techniques for Dissemination of
Chemical Agents"
Dec. 19, 1963

GC-93. Geophysics Corp. of America
Doyle, A. W., et al.
4th Monthly Letter Progress Report
Contract No. DA 18-108 AMC 249(A)
"New Techniques for Dissemination of
Chemical Agents"
Nov. 27, 1963

GC-94. Georgia Institute of Technology
Burson, J. H., L. Masironi, and C. Orr
Annual Report, Project A-763 (March 15, 1964-
March 14, 1965)
Contract No. DA AMC 18-035-74A
"The Influence of Electrostatic Effects on
the Properties of Organic Powders"
April 1, 1965

GC-95. Georgia Institute of Technology
Author Unknown
Final Report
Contract No. DA 18-064-404 CML 88
"Studies and Investigations of Agglomeration
and Deagglomeration of Solid Particles"
June 1957

GC-96. Georgia Institute of Technology
Author Unknown
Semifinal Report, Project No. A-233
Contract No. DA 18-064-404 CML 88
"Studies and Investigations of Agglomeration
and Deagglomeration of Solid Particles"
June 1956

GC-97. Georgia Institute of Technology
Orr, C., et al.
Quarterly Report No. 2
Contract No. DA 18-064 CML 2570
AD-89 188
"Investigations on the Relation, if any, between
Viability and Electric Charges on Airborne
Microorganisms or Particles Containing Such
Microorganisms."
Dec. 31, 1954

GC-98. Georgia Institute of Technology
Orr, C., et al.
Quarterly Report No. 1
Contract No. DA 18-064 CML 2570
AD-89 187
"Investigations on the Relation, if any, between
Viability and Electric Charges on Airborne
Microorganisms or Particles Containing Such
Microorganisms."
Sept. 30, 1954

GC-99. Georgia Institute of Technology
Orr, C., et al.
Final Report
Contract No. DA 18-064 CML 2379
AD-38 787
"An Investigation of Factors Determining
Aggregation of Fine Particle Matter"
June 14, 1954

GC-100. Georgia Institute of Technology
Orr, C., et al.
Quarterly Report No. 3
Contract No. DA 18-064 CML 2379
AD-44 577
"An Investigation of Factors Determining
Aggregation of Fine Particle Matter"
March 14, 1954
GC-101. Georgia Institute of Technology
Off, C., et al.
Quarterly Report No. 2
Contract No. DA 18-064 CHL 2379
AD-25 249
"An Investigation of Factors Determining
Aggregation of Fine Particle Matter"
Dec. 14, 1953

GC-102. Georgia Institute of Technology
Dallavalle, J. M., C. Orr, and B. Hinkle
Quarterly Report No. 7
Contract No. DA 18-064 CHL 490
AD-6 020
"Investigation of Aggregation of Fine
Particle Matter Suspended in Air"
March 14, 1953

GC-103. Georgia Institute of Technology
Dallavalle, J. M., C. Orr, and B. Hinkle
Quarterly Report No. 6
Contract No. DA 18-064 CHL 490
AD-766
"Investigation of Aggregation of Fine
Particle Matter Suspended in Air"
Dec. 14, 1952

GC-104. Georgia Institute of Technology
Author Unknown
Final Report No. ETF 158-24
Contract No. DA 18-064 CHL 402
"Investigation of Aggregation of Fine
Particle Matter Suspended in Air"
June, 1951

GC-105. Harvard School of Public Health
Dennis, R., et al.
Proj. Rept. No. NYO-4810 (July 1, 1956-
June 30, 1957
Contract No. AT(30-1)-841
"Air Cleaning Studies"
June 30, 1959

GC-106. Harvard School of Public Health
Dennis, R., et al.
Proj. Rept. No. NYO-4809 (July 1, 1955-
June 30, 1956
Contract No. AT(30-1)-841
"Air Cleaning Studies"
March 16, 1959

GC-107. Harvard School of Public Health
Anderson, D. M. and L. Silverman
Report No. NYO-4615
Contract No. AT(30-1)-841
"Mechanisms in Electrostatic Filtration of
Aerosols with Fixed and Fluidized Granules"
Aug. 31, 1958

GC-108. Harvard School of Public Health
Dennis, R.; E. Kristal, and L. Silverman
Report No. NYO-4614
Contract No. AT(30-1)-841
"Evaluation of the Electro-PL and
Electro-Klean Dust Collectors"
July 21, 1958

GC-109. Harvard School of Public Health
Dennis, R., et al.
Progress Rept. No. NYO-4611 (July 1 1954-
June 30, 1955)
Contract No. AT(30-1)-841
"Air Cleaning Studies"
Oct. 15, 1956

GC-110. Harvard School of Public Health
Silverman, L., E. W. Connors, and D. A. Anderson
Report No. NYO-4610
Contract No. AT(30-1)-841
"Electrostatic Mechanisms in Aerosol Filtration by
Mechanically Charged Fabric Media and Related Studies"
Sept. 4, 1956
GC-111. Harvard School of Public Health
Dennis, R., et al.
Prog. Rept. No. NTO-4608 (July 1, 1953-
June 30, 1954)
Contract No. AT(30-1)-841
"Air Cleaning Studies"
Jan. 15, 1956

GC-112. Harvard School of Public Health
Rossano, A. T. and L. Silverman
Report No. NTO-1984
Contract No. AT(30-1)-841
"Electrostatic Mechanisms in Fiber
Filtration of Aerosols"
May 11, 1955

GC-113. Hughes Research Labs.
AR-406-666 Div. 27
(TISTA/LRS)
Hughes Research Labs., Malibu, Calif.
CHARGING AND REMOVAL OF SURFACE-CONDUCTED
PARTICLES FOR COLUMN PROPULSION,
by Douglas H. Jamba and Bernard Herstein,
1965, 4p.
Unclassified report
Presented at AIIE Electric Propulsion Conference,
In cooperation with Thiokol Chemical Corp.,
Huntington, N. J.

Descriptions: Ion engines, Acceleration, Particles, Charged

Work has concentrated on the charging and removal of particles formed by condensing metal vapor
on surfaces in vacuum. The necessary apparatus was designed and constructed for charging, accelerat-
ing and measuring the electrical properties of charged particles using any charge-to-
mass ratio. The apparatus is based on the measurement of the time of flight of charged particles
where the flight is initiated by the application of a high-voltage pulse and completed at a charge
detecting device. Maximum detector sensitivity was obtained with an electron multiplier structure at the target. Tests were begun using thin film surfaces on which known particulate deposits (50 A to 500 A
size range) were grown. The objective is to determine which conditions of particle formation
and of particle removal will tend to the reflection formation of a uniform particle beam
within the desired Q/W range of 1000 to 10,000 coulombs per kilogram. Initial electrical tests
have indicated particle removal at 500-2000 coulombs per kilogram.

scope examination indicated extensive removal
of the particulate deposit from the substrate.
TAB B63-3-6

GC-114. IIT Research Institute
AD-J14-168 Div. 3/7
IIT Research Inst., Chicago, Ill.
NONHAZARDOUS DISINTEGRATION AND DELIVERY CONCEPTS
(0)
Quarterly rept. no. 1, 10 Apr-10 July 63,
by D. K. Work, July 63, 53p.
Contract DNB 108BAC1729
Confidential report

Descriptions: Aerosols, Chemical warfare
agents, Distribution, Effectiveness, Laboratory
equipment, Particle spectra, Toxicity, Chromatographic analysis, Storage, Electro-
statics, Powders, (0)

A comprehensive literature search has shown
that practically all Ballistic-deliverable (non-
aircraft) nonhazardous dissipation devices are
based on pyrotechnic or thermal principles.
However, work at CRDL has shown that explosive
charges as large as 210 g of PETN can be non-
haZarDOUS in a powder-fill device. Therefore it
is now contended that explosive dissipation
may be both nonhazardous and effective provided
a powdered free-flowing powder is used. It will
be necessary to provide containment, free-flowing
BZ powder 1 to 10 mm in diameter. Therefore
means of measuring and reducing the scaling
or Tsunam effect in BZ are being examined. Also,
experiments for measuring the reducing BZ aggre-
cation are planned. Explosive dissipation of
simulants will be tested experimentally.
TAB B63-4-5

GC-115. IIT Research Institute
Langer, G.
Prog. Rept. No. ARF-3187-10 (Oct. 1-
Dec. 1, 1962)
Contract No. AF (11-1)-578
"Progress Report of Electrostatic Classification
of Submicron Airborne Particles"
Dec. 1, 1962

GC-116. IIT Research Institute
Langer, G.
Final Report
Contract No. AF 19(604)-2411
"Particle Size Classification by
Electrostatic Precipitation"
July 15, 1959
GC-117. University of Illinois
Author Unknown
Contract No. AT(11-1)-276
"Factors in the Agglomeration of Solid Aerosol Particles"
Sept. 1, 1962

GC-118. University of Illinois
Johnstone, H. F.
Tech. Rept. No. 16 (COO-1018)
Contract No. AT(11-1)-276
"Factors in the Agglomeration of Solid Aerosol Particles"
March 1, 1959

GC-119. University of Illinois
Dawkins, G. B.
Tech. Rept. No. 15 (COO-1017)
Contract No. AT(11-1)-276
"Electrostatic Effects in the Deposition of Aerosols on Cylindrical Shapes"
March 15, 1958

GC-120. University of Illinois
Krammer, H. F.
Tech. Rept. No. 12 (COO-1013)
Contract No. AT(11-1)-276
"Properties of Electrically Charged Aerosols"
March 31, 1954

GC-121. University of Illinois
Krammer, H. F. and W. E. Ranz
Tech. Rept. No. 7 (SO-1008)
Contract No. AT(30-3)-28
39 pp.
"Homopolar Electrification of Aerosols"
Sept. 30, 1952

GC-122. University of Illinois
Ranz, W. E.
Tech. Rept. No. 3 (SO-1004)
Contract No. AT(30-3)-28
"The Impaction of Aerosol Particles on Cylindrical and Spherical Collectors"
March 31, 1951

GC-123. Marks Polarized Corp.
AD-403 536 Div. 7
(TI/TE/200) 015 price $7.60
Marks Polarized Corp., Whitehouse, N. J.
THE CONVERSION OF HEAT TO ELECTRICAL POWER BY MEANS OF A CHARGED AEROSOL.
Final rept., 1 Feb 62-4 Aug 62.
Contract NNM62 0644
Unclassified Report

Descriptive: Electric power production, energy conversion, effectiveness, missiles, air, gas flow, electrical fields, theory, condensation, aerosols, charged particles.
A new process called the condensation aerosol method for the production of small, charged aerosol particles has been developed for use in the electrohydrodynamic energy conversion process. Using this concept, several generators may be placed in series, each one using the same vapor for aerosol formation as the previous unit. Power densities as high as 30 watts/sq. cm. of nozzle throat area have been obtained with a single stage condensation aerosol type EHD generator. Studies of the aerodynamic behavior of the EHD generator with and without energy extraction were made on a fully instrumented test bench. Measurements of the overall efficiency of the generator, including frictional losses were made and are reported herein. The kinetic to electric power conversion efficiency of the generator itself was as high as eighty-five percent. Efforts were made toward designing and building a closed loop system for the generator. A small compressor system for circulating a gas in a closed loop was tested. Calculations were made for the design of a small boiler system for operating a closed loop steam cycle at a few atmospheres pressure.
TAB U83-3-4

GC-124. University of Minnesota
Whitby, K. T., et al.
Final Report
Contract No. USPHS AP00136-02
"Charging and Decay of Monodispersed Aerosols in the Presence of a Unipolar Ion Source."
Sept. 1, 1963
GC-126. University of Minnesota
Whitby, K. T., A. R. McParland and D. A. Lundgren
Tech. Report No. 18
UNRPS Grant No. 5-23 "Generator for Producing High Concentrations of Small Ions"
July 1960

GC-128. Oak Ridge National Laboratories
Saunders, B. G. and R. L. Quinn
ONRL Report No. 1656
AEC Contract No. W-7405-eng-26
"Electrostatic Precipitator for Measuring Particle Size Distribution in Aerosols"
Feb. 8, 1954

GC-130. Rand Corp.
AD-254 862  Div. 25, 2
(26 Apr 61)
Rand Corp., Santa Monica, Calif.
THE FORCES BETWEEN CONDUCTING SPHERES IN A UNIFORM ELECTRIC FIELD,
by R. H. Davis, 26 Jan 61, 45p. incl. illus. tables. (Research mono. no. RM-2607)
(Contract AF 49(638)700, Proj. Rand)

GC-131. Rochester University
Mercer, T. T.
Report No. UR-475
AEC Contract No. W-7401-eng-49
48 pp.
"Charging and Precipitation Characteristics of Submicron Particles in the Rohm and Haas Electrostatic Particle Separator"

Feb. 14, 1957

GC-152. Rocketdyne

AD-407 766 Div. 27, 25

(Rocketdyne, Canoga Park, Calif.)

SURFACE IONIZATION OF CARBON WITH FORBIDDEN TUNGSTEN IONIZERS

by A. G. Milson, G. D. Sears and J. F. Hsu,

1963, 130p, 50017 Unclassified report


Descriptors: Electrostatics, Ionization, Tungsten, Surface properties, Gas flow, Analysis, Electrostatics, Electric fields, Electric potentials, Particles, Data, Symposium, Fax engine.

The surface ionization properties of porous tungsten ionizers which have been sintered from powders with diameters of 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, and 0.8 microns have been determined experimentally with a neutral atom and ion detector for through-flow conditions.

TAB U61-3-1

GC-133. Stanford Research Inst.

AD-475 010 Div. 3, 14, 26

(1 May 61) 97p price $4.60


DECAPOLATION OF AEROSOLS

by Robert C. Babcock, Final report, 1 Apr 60-31 Mar 61, 17 Apr 61, 38p, incl. Illus., tables

Contract NA 16-1084-001-574c, Proj. No. 31101 Unclassified report

Descriptors: Aerosols, Condensation, Films, Ions, Ionization, Dense, Solid, Taper, Compaction, Phosphates, Liquids, Phosphates, Phosphonates, Phosphoric acids, Chlorides, Ammonia, salts, Sulphides, Sulphate compounds, Sulphides, Polymers, Solids, Chemical vapor deposition, Polymer solutions, Electrostatics, Polymers, Various methods of aerosol encapsulation were studied: (1) liquid phase microencapsulation, (2) condensation, and (3) coagulation. Aerosol encapsulation by condensation, using the core particles or droplets as condensation nuclei, proved to be a generally successful technique. Condensation with inertial force, using simple low-powered devices, showed little promise as a practical aerosol encapsulation method. Condensation with electrosung or charging of the particles was only partially successful in solid or liquid aerosol systems, but worked quite well in encapsulating solid cores with liquid films. Liquid phase microencapsulation was quite successful, when applicable. A number of liquid cores were successfully polymer encapsulated, isolated, dried, and dispersed.

TAB U53-4-2