allows study of six different metals at both normal and grazing incidence without breaking the vacuum (Norman Milleron). Further light was shed on this subject by Robert P. Madden and Bernard Waclawski (National Bureau of Standards) who reviewed available information on the "volume" photoelectric effect in the vacuum ultraviolet. A number of similar characteristics have been determined for a variety of dissimilar metals. For photon energies above 8 ev, there is a steep rise in photoelectric yield at about 10 ev, a broad maximum around 15 ev and a gradual decrease toward higher photon energies. The yields above 10 ev approximate 10 percent and exceed by 2 to 4 orders of magnitude those at 7 ev. The yields generally decrease by factors of 2 to 5 when the samples are heat-treated in vacuo.

Measurements of direct ultraviolet photodesorption of Co from Ni, W, Pyrex, and quartz were described by William J. Lange (Westinghouse Research Laboratories). In the case of tungsten, where the surface coverage was known, the cross section was of the order of 10^{-23} cm^2. Because thermal desorption of the alpha-phase becomes dominant as maximum coverage is approached, the above cross section applied to the first adsorbed, or beta, phase.

Other surface processes which occur in plasma experiments include thermal desorption and chemisorption. Lange reported on thermal desorption experiments which yielded a value of approximately 11 k cal/mole for the binding energy of the alpha-phase of CO on tungsten.

Richard A. Strehlow (Oak Ridge National Laboratory) reported on his experimental studies of gaseous desorption at low pressures and liquid nitrogen temperatures. He presented data for the heats of desorption over the temperature range of 80°K to 115° K for CH_4, Ar, H_2, and CO from a MO vapor-deposited surface at pressures of the order of 6×10^{-9} torr. Graphical integration of the desorption peaks indicated that the amount of gas desorbed was of the order of 10^{13} molecules per square centimeter—a small fraction of a monolayer.

Measurements of chemisorption of nitrogen on molybdenum films were described by Ralph A. Pasternak (Stanford Research Institute). He found that at room temperature the sticking probability is initially high (about one half) and then drops off gradually. At liquid nitrogen temperature, additional well defined sorption occurs. The amount sorbed is of the order of magnitude of a monolayer and is independent of pressure; the sticking probability is again about one half, but remains constant to almost saturation.

Angus L. Hunt (Lawrence Radiation Laboratory) presented data on the solubility of deuterium in titanium. He found that a deuteron flux of 3×10^{13} ion per cm^2 with an energy of 15 kev is totally captured, within the precision of the measurement, by a titanium sheet at −120°C. He further reported that evolution of methane and especially carbon monoxide, induced by the bombardment, is markedly reduced at low temperatures. This experience with titanium has been applied to the termination of the 30-milliampere, 20-kev neutral atomic hydrogen beam in the ALICE plasma experiment at Livermore. A reduction of one order of magnitude in the pressure increase in the beam termination chamber has been attained during beam injection by the use of a liquid nitrogen-cooled titanium target.

A provocative paper on exothermic charge exchange reactions (for example, $O^{++} + O^0 \rightarrow O^+ + O^+ + 21.5$ ev) was offered by J. Rand McNally, Jr. (Oak Ridge National Laboratory) who speculated that such reactions might occur at surfaces (for example, if the surfaces were bombarded by electrons or quanta whose energies were comparable to the energy required for double ionization). He stated that additional onsets would be possible at energies characteristic of the binding energies of electrons in the various shells (for example, K electron removal followed by Auger ionization). McNally stressed the speculative nature of his ideas because the surface processes proposed by him were based on much simpler atomic processes.

No vacuum conference is complete without a report on research related to understanding phenomena in pressure gauges. Edward E. Donaldson (Washington State University) reported on studies of positive ions emitted by hot tungsten filaments as a function of filament temperature and environmental gas type and pressure. He found that the positive ions consisted of Na^+, K^+, and ions of almost all alkaline metals. He also indicated that two kinds of processes give rise to these positive ion currents. The first is diffusion of impurities to the surface followed by evaporation; the second (which may be much larger than the first) is an uncovering process—either chemical sputtering or direct evaporation of surface atoms.

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Rheo-optics of Polymers

A conference on rheo-optics of polymers was held at the University of Massachusetts 24 August 1963. "Rheo-optics" is a new term designating the use of optical methods to study flow. The conference dealt with the use of several such methods to study the flow and deformation of polymers.

The dynamic birefringence technique, first described in a symposium at the University of Massachusetts last year [*Chem. Eng. News*, **40**, 56 (1962)], is now being employed in Japan and England as well as in several laboratories in this country. Masao Horio (Kyoto University), a pioneer in studies of the physical properties of polymers, presented a paper, written with Ryo Yamada (Nippon Rayon Company) and Shigeharu Onogi (Kyoto University), which described changes in the double refraction of polyethylene, polypropylene, and nylon subjected to vibration. Bryan Read (National Physical Laboratories, England) discussed the use of this method for studying the behavior of amorphous polymers in the vicinity of their transition temperatures. He showed how a combination of these optical methods with mechanical studies may elucidate the kinds of molecular motions occurring when such polymers are deformed and also such phenomena as the embrittlement of plastics at low temperatures.

Rodney D. Andrews (M.I.T.) demonstrated how the birefringence of a polymer is related to the stereoregularity of polymer chains. The birefringence of stretched polymethyl methacrylate (PMMA) changes from a negative to a positive value upon heating. The temperature of reversal of sign is uniquely dependent upon the tacticity of the sample, and is about 30°C for isotactic, 100°C for atactic, and 130°C for syndyotactic PMMA.

Several studies of light scattering from flowing and deforming systems

were presented. E. E. Lindsey (University of Massachusetts), Daniel Sullivan (Shawinigan Resins), and David Chappelear (Monsanto) described how by continuously circulating an emulsion through a light scattering cell the particle size distribution in the emulsion can be continuously monitored. Donald G. LeGrand (General Electric) showed how the changes in stretched polymer films correlated with density changes can be separated from those correlated with orientation changes by studying the polarization of the scattered light. The scattering is time-dependent and reflects the changes in the crystalline superstructure accompanying the stretching.

The use of a pulsed laser for light scattering studies from polymer films was described in two papers, one by R. S. Moore and S. Matsuoka (Bell Telephone) on the crystallization of high molecular weight polyethylene, and one by P. Erhardt and R. S. Stein (University of Massachusetts) on determining the rates of deformation and recrystallization of spherulite after rapid stretching. H. Kawai (Massachusetts, on leave from Kyoto), Stein, and D. A. Keedy (Massachusetts) described a new apparatus for measuring rates of crystal orientation by dynamic x-ray diffraction studies from vibrating samples.

Papers on theories of rheo-optical properties were presented by E. H. Dill (University of Washington), C. L. Amba-Rao (Purdue), and M. Takayanagi, S. Uemure, and S. Minami (Kyushu University).

The conference was jointly sponsored by the Division of High Polymer Physics of the American Physical Society and the Polymer Research Institute of the University of Massachusetts. It preceded the fourth International Congress on Rheology, which met at Brown University 26–30 August. Papers presented at this conference will be published in series C of the *Journal of Polymer Science*.

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Forthcoming Events

June

11–13. **Manufacturing Chemists'** Assoc., 92nd annual, White Sulphur Springs, W. Va. (MCA, 1825 Connecticut Ave., NW, Washington, D.C.)

11–13. **Population** Assoc. of America, San Francisco, Calif. (P. C. Glick, Bureau of Census, Washington, D.C. 20233)

13–19. **World Medical Assoc.,** 18th general assembly, Helsinki, Finland. (H. S. Gear, 10 Columbus Circle, New York, N.Y. 10019)

14–17. American Assoc. of **Feed Microscopists,** 12th annual, Hot Springs, Ark. (G. M. Barnhart, Missouri Dept. of Agriculture, State Office Building, Jefferson City)

14–17. American **Nuclear** Soc., 10th annual, Philadelphia, Pa. (O. J. DuTemple, 244 E. Ogden Ave., Hinsdale, Ill. 60502)

14–18. **Industrial Pharmaceutical Research,** 6th natl. conf., Land O'Lakes, Wis. (L. W. Busse, 190 Pharmacy Bldg., Univ. of Wisconsin, Madison 6)

14–18. **Health Physics** Soc., 9th annual, Cincinnati, Ohio. (H. F. Kolde, Taft Sanitary Engineering Center, Cincinnati)

14–19. **Alpha Chi Sigma** Fraternity, Greenvale, L.I., N.Y. (M. L. Griffin, 5503 E. Washington St., Indianapolis, Ind.)

14–19. **Cardiology,** 7th inter-American congr., Montreal, P.Q., Canada. (The Congress, 2052 St. Catherine St., W., Montreal 25)

14–20. National **Speleological** Soc., annual conv., New Braunfels, Tex. (J. H. Estes, 2818 S. 39 St., Abilene, Tex. 79605)

15–16. Association for **Applied Gnotobiotics,** 4th symp., East Lansing, Mich. (C. K Whitehair, Dept. of Pathology, Michigan State Univ., East Lansing)

15–17. **Lattice Defects in Quenched Metals,** intern. conf., Argonne, Ill. (The Conference, Bldg. 212, Argonne Natl. Laboratory, Argonne)

15–17. Institute of **Navigation,** 20th annual, New York, N.Y. (P. Rosenberg, 330 Fifth Ave., Pelham, N.Y. 10803)

15–17. American **Neurological** Assoc., 89th annual, Atlantic City, N.J. (M. D. Yahr, 710 West 168 St., New York, N.Y.)

15–18. American Soc. of **Limnology and Oceanography,** 27th annual, Miami Beach, Fla. (G. H. Lauff, ASLO, Sapelo Island Research Foundation, Sapelo Island, Ga.)

15–18. **Materials,** 2nd intern. symp., Berkeley, Calif. (T. H. Chenoweth, 276 Hearst Mining Bldg., Univ. of California, Berkeley 94720)

15–19. **Antibiotics,** intern. congr., Prague, Czechoslovakia. (V. Vlôek, Antibiotics Research Inst., Roztoky near Prague)

15–19. **Molecular Spectroscopy,** symp., Columbus, Ohio. (H. H. Nielsen, Dept. of Physics, Ohio State Univ., 174 W. 18 Ave., Columbus 43210)

15–19. **Technical Writers,** 12th annual inst., Troy, N.Y. (J. R. Gould, Rensselaer Polytechnic Inst., Troy)

15–21. **Women Engineers and Scientists,** 1st intern. conf., New York, N.Y. (E. Eaves, 18 Third Ave., Port Washington, N.Y. 11050)

15–3. **Relativity,** teaching at undergraduate level, Arlington, Tex. (J. Ellis, Dept. of Physics, Arlington State College, Arlington)

15–4 Sept. **Gordon Research Conf.,** New Hampshire. (W. G. Parks, Dept. of Chemistry, Univ. of Rhode Island, Kingston)

16–17. **Computer Augmentation of Human Reasoning,** symp., Washington, D.C. (W. D. Orr, TRW Computer Div., 8433 Fallbrook Ave., Canoga Park, Calif.)

16–18. **Entomological** Soc. of America, Pacific Branch, annual, Long Beach, Calif. (W. W. Allen, 112 Agric. Hall, Dept. of Entomology, Univ. of California, Berkeley)

17–19. **Microscopy,** 11th intern. symp., Chicago, Ill. (MICRO-64, McCrone Research Inst., 451 E. 31 St., Chicago 60616)

17–20. American College of **Angiology,** Las Vegas, Nev. (A. Halpern, 11 Hampton Court, Great Neck, N.Y.)

17–20. International Assoc. for the Study of the **Bronchi,** 14th congr., Vienna, Austria. (Secretariat, The Congress, c/o Wiener Medizinische Akademie für Ärztliche Fortbildung, Aslerstr. 4, Vienna 9)

18–19. **Patent, Trademark, and Copyright Research** Inst., 8th annual conf., George Washington Univ., Washington, D.C. (PTCR Inst., George Washington Univ., Washington, D.C. 20006)

18–19. American **Rheumatism** Assoc., San Francisco, Calif. (J. A. Coss, Jr., 20 E. 76 St., New York, N.Y. 10021)

18–20. **Community Psychiatry,** conf., Univ. of Wisconsin, Madison. (L. M. Roberts, 1300 University Ave., Madison)

18–20. **Endocrine** Soc., San Francisco, Calif. (H. H. Turner, 200 N. Walker, Oklahoma City, Okla.)

18–20. American Assoc. of **Physics Teachers,** summer meeting, Madison, Wis. (H. R. Crane, Dept. of Physics, Univ. of Michigan, Ann Arbor)

18–20. **Space Technology,** 4th European symp., Rome, Italy. (A. Eula, Associazzione Italiana Razzi, Piazzo Santo Bernardo 101, Rome)

18–20. **Sulfite Pulping,** conf., Chicago, Ill. (Technical Assoc. of the Pulp and Paper Industry, 360 Lexington Ave., New York, N.Y. 10017)

18–22. American College of **Chest Physicians,** San Francisco, Calif. (M. Kornfeld, 112 E. Chestnut, Chicago, Ill.)

19. **Parenteral Drug** Assoc., Philadelphia, Pa. (The Association, Broad and Chestnut Sts., Philadelphia 7)

19–20. American **Geriatrics** Soc., 21st annual, San Francisco, Calif. (AGS, 10 Columbus Circle, New York, N.Y. 10019)

19–27. **Chemical Engineering,** European conv., Frankfurt am Main, Germany (Chicago Section, American Chemical Soc., 86 E. Randolph St., Chicago 1, Ill.)

21. **Surface Physics,** Providence, R.I. (W. H. Brattain, Bell Telephone Laboratories, Murray Hill, N.J. 17971)

21–23. Society for **Investigative Dermatology,** 25th annual, San Francisco, Calif. (H. Beerman, SID, 255 S. 17 St., Philadelphia, Pa. 19103)

21–24. American Soc. of **Agricultural Engineers,** Fort Collins, Colo. (J. L. Butt, ASAE, 420 Main St., St. Joseph, Mich.)

21–25. **Air Pollution Control** Assoc., 57th annual, Houston, Tex. (The Association, 4400 Fifth Ave., Pittsburgh, Pa.)

21–25. **American Medical Assoc.,** San Francisco, Calif. (F. J. L. Blasingame, N. Dearborn, Chicago, Ill. 60610)

21–26. American Soc. for **Testing and Materials,** 67th annual, Chicago, Ill. (ASTM, 1916 Race St., Philadelphia 3, Pa.)

22–24. American **Dairy Science** Assoc.,