ency that they forge ahead and develop spectacular synthetic procedures without waiting for the final word from chemical dynamics. Fortunately, the two approaches enjoy a symbiotic relationship, frequently within a single laboratory.

Various aspects of the chemistry of conjugated dienes and polyenes were expounded by Madame Mousseron (Montpellier), William Dauben (Berkeley), and Klaus Gollnick (Müllheim). These versatile molecules undergo ring-closure, ring-opening, rearrangement by hydrogen transfer, cyclodimerization, and internal cycloaddition to give fantastically distorted molecules and enter into a large number of reactions with other reactants—all under the influence of light. With this group of substrates there is often good evidence that triplet and singlet paths do not cross in many cases. Consequently, reactions effected by direct irradiation and by sensitization frequently give entirely different products.

Refreshing novelty was provided by Orville Chapman (Iowa State) and Mendel Cohen (Weizmann Institute). Chapman presented an entirely new group of photorearrangements of aromatic nitro compounds. Cohen discussed phototropism and photodimerization in crystals. The work complements studies of crystal structures by x-ray diffraction. At least within the two series of materials studied, it is possible to make unequivocal predictions concerning photochemical reactivity on the basis of intermolecular relationships within the crystals.

The symposium was sponsored by the Organic Division of the International Union of Pure and Applied Chemistry and the principal lectures will be published in a special issue of *Pure and Applied Chemistry*. The symposium and the accompanying course were supported by a grant from NATO. Financial aid from the latter organization was largely responsible for the presence of many young investigators.

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Surface Physics

Investigations of chemical and physical interactions occurring at solid surfaces were reported at the second annual Surface Physics Symposium held at Washington State University, Pull-

man, 8–9 May 1964. Most of the reported work was done under ultrahigh vacuum conditions so that a variety of spurious effects could be eliminated.

The surface ionization that takes place when a solid is evaporated from a heated metal surface has been widely used for some time in sources of charged particles and in molecular beam detectors; the efficiency of this process is predicted by the Saha-Langmuir equation. This equation, which agrees with experimental results for alkaline metal evaporation, predicts that the ratio of ions to neutrals is greatest when a material with low ionization potential is evaporated from a high work function surface.

J. F. Truhlar (Washington State University) described an experiment in which heated filament-grade tungsten was found to be a source of ions of most of the alkaline metals, alkaline earths, and other substances. Previous work has shown that the ion current is a good indicator of the rate at which the surface of a filament is etched or chemically sputtered in reactive gases.

In a report on work recently completed at the Ames Laboratory of the Atomic Energy Commission, Miles J. Dresser (Washington State University) found that the Saha-Langmuir equation is grossly inadequate to predict the surface ionization efficiency for the electronically complicated rare earth atoms. The predicted ionization efficiency is incorrect both in its absolute value and in its temperature dependence. Apparently part of the problem results from the difficulty of assigning the proper statistical weights to complex atoms.

G. A. Antypas (Washington State University) is using the positive ion currents from a high purity Fe filament to study metal defects. Even with low impurity levels, easily measured ion currents are obtained and it is found that phase transformation and plastic deformation increase the positive ion current. It appears that these positive ion currents are a much more sensitive indicator of metal structure than is electron emission and that they will yield valuable information about metal defects and impurity diffusion.

E. W. Mueller (Pennsylvania State University) outlined recent advances in field ion microscopy and described a photoelectronic image intensifier which has reduced photographic exposure time by four orders of magnitude. The improved intensity permits the ultimate flickering of the atomic images to be

observed. This flickering appears to be caused by the statistical variation in the ion current which originates at a single atomic point (about 10^{-14} amperes).

E. V. Kornelsen (National Research Council of Canada) has found that when high energy, rare gas ions impinge upon tungsten monocrystals with velocities along certain preferred directions, their penetration is much greater than when a polycrystalline tungsten target is used. One can explain this by the fact that certain directions in the crystals are more open than others or that elastic vibrations can be more easily excited by particles traveling in a preferred direction. In addition to this, a fraction of a percent of the ions exhibit unusually long paths in monocrystals. These ions do not seem to be governed by normal stopping power laws; the mechanism of penetration is unknown.

Several conjectures were made to explain this unexpected result. One possibility is that the ions create phonon waves which then carry the ions for great distances with no energy loss. Another suggestion is that the projectile ions are channeled so that they tend not to lose energy to the lattice but interact only with free electrons. When the energy of the ion has been decreased to less than 15 ev, the ion may be neutralized and energetically cannot again become charged. When the energy of the atom has further decreased to several ev, the neutral atom may then exhibit a Ramsauer interaction in which it appears almost transparent to the free electrons of the metal and travels a great distance with no further energy loss.

Investigation of the adsorption of activated gases is beginning to yield information on the activated states responsible for adsorption or pumping. Some studies have already been completed on the adsorption of gases activated by bombardment with low energy electrons. Whenever a heated filament is used as a source of bombarding electrons, an additional thermally activated absorption process, called chemical pumping, must also occur.

C. M. Bliven (General Telephone Company) has used the omegatron partial pressure analyzer to study the chemical pumping of nitrogen. Both the sticking probability and the number of molecules adsorbed depend upon the pressure. Disagreement on the measured values of these variables, which have previously been attributed to crys-

tallographic orientation, impurities, and surface preparation, may also be ascribed in part to pressure differences.

S. B. Nornes (Washington State University) was concerned with the mechanism of chemical pumping in N_2. On the basis of the measured pressure dependence, it is possible that N_2 which strikes the filament is dissociated and that the atomic nitrogen leaving the filament is adsorbed on the glass walls. Atomic nitrogen has already been found to be the important activated species when N_2 is bombarded by low energy electrons. If the precision and sensitivity of such adsorption studies can be increased, these measurements may be capable of producing fundamental data on activated states not otherwise observed.

In a public lecture Mueller described his work developing the field ionization microscope and presented a film showing electronically intensified field ion images in which the atoms of a number of metals could be seen to evaporate under the influence of high electric fields.

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Forthcoming Events

September

29–2. American **Roentgen Ray** Soc., 65th annual, Minneapolis, Minn. (C. A. Good, Mayo Clinic, Rochester, Minn.)

30–2. **American Council on Education**, 47th annual, San Francisco, Calif. (L. Wilson, ACE, 1785 Massachusetts Ave., NW, Washington, D.C. 20006)

30–2. **Earth Sciences**, intern. conf., Cambridge, Mass. (H. G. Houghton, Dept. of Meteorology, Massachusetts Inst. of Technology, Cambridge)

30–2. **Standards Engineers** Soc., 13th annual, New York, N.Y. (SES, 170 Livingston Ave., New Providence, N.J.)

30–2. **Vacuum**, 11th natl. symp., Chicago, Ill. (G. H. Bancroft, Bendix-Balzers Vacuum, Inc., 1645 St. Paul St., Rochester, N.Y. 14621)

30–4. **Spectroscopy**, 11th intern. conf., Belgrad, Yugoslavia. (Sekretarijat, Prorodno-matematicki fukultet, Fizickochemijsky zavod Belgrad, Studeniski trg., 16, Bloc C, Yugoslavia)

October

1–2. Emission of **Electrons** from Solids, conf., Univ. of Keele, Keele, England. (Inst. of Physics and the Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

1–3. American Assoc. for **Surgery of Trauma**, Chicago, Ill. (S. R. Gaston, 18 Fort Washington Ave., New York 10022)

2–3. Council for International **Organi-**