ture and frequency dependence of dynamic mechanical properties. Papers followed by T. W. De Witt on dynamic studies on polyisobutylene, using vibrating crystals to determine rigidity and internal friction as a function of frequency; by R. S. Marvin on the results of a cooperative program of 20 different laboratories on the temperature and frequency effects on dynamic properties of standard samples of polyisobutylene over the range from 10^{-2} to 10^{7} cycles per second; and by A. W. Nolle on ultrasonic measurements on swollen and unswollen rubber to determine the three-dimensional diagrams of modulus, temperature, and frequency. H. S. Sack, in summary, pointed out that recovery of deformation has received an alternative treatment by Debye and Kirkwood as a diffusion process and considered that measurements were not yet sufficiently good to determine whether the glass temperature is only a rate process or a real thermodynamic transition.

An invited paper by B. A. Mrowca, reporting on the progress of the study of nuclear magnetic absorption of rubbers and polystyrene, opened the Friday morning session. Other papers dealt with the nuclear magnetic resonance absorption in proteins as a function of moisture content, the dynamic shear properties of polyisobutylenes as a function of crosslinking by means of an electrically driven tuning fork, a theoretical treatment of energy dissipation in vibrating fibers, the use of Nutting's equation to determine a material constant related to the time dependence of the deformation process for plasticized polyvinyl chloride, flow behavior of concentrated polymer solutions, sedimentation and diffusion behavior of polyelectrolytes, and a successful attempt to calculate densities, refractive indices, and optical dispersions on the basis of colligative properties of the groups making up the polymers.

In the final session, apparatus was described for determining the dielectric behavior of liquids, gels and solids over the audiofrequency range and a wide temperature range. A coaxial cylindrical rheometer for measuring dynamic viscosity and rigidities through the application of low frequency oscillations was described. The internal energy and entropy was estimated from a stress-temperature study of polyethylene. The remaining eight papers were on the general subject of biophysics and dealt, for the most part, with particle bombardment of biological material.

The next meeting of the Division will be held at Columbus, with the parent society, in March, 1952. The program committee for this meeting will be headed by R. Buchdahl.

Finally, we wish to express the appreciation of the Division to the retiring Program Committee: L. A. Wood, Chairman, J. H. Wakelin, R. S. Marvin, and H. S. Sack, who arranged the program for the Washington meeting; also, to the National Bureau of Standards for their kindness in providing the facilities for our meeting, in connection with their Semicentennial Celebration.

J. B. Nichols
E. I. duPont de Nemours and Co.

LOW-TEMPERATURE PHYSICS

WASHINGTON SYMPOSIUM REPORTED

More than 200 leading low-temperature physicists from this country and abroad attended a symposium on low-temperature physics held at the National Bureau of Standards in Washington, D. C., on March 27, 28, and 29, 1951. The low-temperature meeting, described here in a report prepared by the Bureau staff, was the first of 12 symposia scheduled for the year 1951, which marks the fiftieth anniversary of the Bureau's establishment. Sponsored by the NBS in cooperation with the Office of Naval Research, the program was under the joint chairmanship of Emanuel Maxwell and John R. Pellam of the NBS low-temperature laboratory.

Because of the many remarkable phenomena that occur at temperatures near absolute zero, and the insight they give into the ultimate nature of matter, low-temperature research is today one of the most challenging fields of pure physics. Two subjects of particular interest are superconductivity—the loss of electrical resistance at very low temperatures—and the properties of liquid helium II, a form of helium existing at low temperatures which seems to constitute a fourth state of matter. While these subjects received major emphasis at the conference, a wide variety of other topics was covered, including low-temperature magnetism, calorimetry, chemical physics, and the design of low-temperature equipment. As low-temperature physics is still in an early stage of development, the 55 technical papers were chiefly concerned with current problems.

The first day was devoted to superconductivity, and the isotope effect, which relates superconductivity to the atomic mass, was the topic of much of the discussion. The recent discovery of this phenomenon at NBS, in combination with independent results obtained almost simultaneously at Rutgers University, revealed the role of lattice vibrations in superconductivity, providing a basic concept for current theories. Results of superconductivity measurements on isotopes at Oxford, Cambridge, Rutgers, and NBS were presented, compared, and discussed. The symposium thus provided a useful orientation for mapping future research in this field.

One of the highlights of the first day was a panel discussion on the theory of superconductivity, which was conducted by John Bardeen (Bell Telephone Laboratories), Hans Frolich (University of Liverpool), and L. Tisza (Massachusetts Institute of Technology), exponents of the more important theories contending for recognition today. All three theories incorporate the concept of interaction between lattice vibrations and electrons as a fundamental building block. It was agreed that although superconductivity theory is still in a rudimentary stage, the recognition of the importance of lattice vibrations is a significant advance.

Other interesting topics in superconductivity included the superconducting properties of thin films and alloys, thermal conductivity, specific heats, high-frequency behavior of superconductors, and the discovery of new superconductors. The demonstration of a substantially complete Meissner effect in single-phase alloy systems, reported by J. V. Stout and L. Guttman of the Institute for the Study of Metals, University of Chicago, was of considerable interest. D. Shoenberg (Mond Laboratory), in a discussion of recent work on superconductivity at Cambridge University, reported the discovery that the elements osmium and ruthenium are superconducting. Since these elements are transition metals, the discovery of their superconducting properties disproves the previously suggested viewpoint that superconductivity is a property of only two groups of elements in the periodic table. Another report from the Mond Laboratory dealt with the work of Faber on supercooling effects and the growth of superconducting nuclei in superconductors.

Results on the anomalous heat conduction of some superconducting alloys were presented by K. Mendelssohn of Oxford and by J. K. Hulm of the Institute of Metals, Chicago. Prof. Mendelssohn suggests that the results imply a circulation process in superconductors not unlike that occurring in He II, but there is no general agreement on this point as yet. Rudolf Hilsch, University of Erlangen, described experiments on superconducting thin films in which it was possible to control the transition temperature over wide limits by varying the experimental conditions during deposition.

The second day of the symposium was spent on the properties of liquid helium II. The session began with a group of papers on liquid mixtures of He^3 and He^4. John Daunt and C. V. Heer (Ohio State University) reviewed measurements of the depression of lambda temperatures in solutions containing up to 89 percent of He^3. Transition temperatures as low as 0.2°K in the presence of He^3 were described, and agreement was shown with theory based on London's Bose-Einstein hypothesis. The phase diagram for dilute solutions of He^3 in He^4 was reported by Henry S. Somers (Los Alamos Scientific Laboratory) and a theoretical interpretation was given by W. Goad (Los Alamos), also on the basis of a London statistical model.

Of special interest was the announcement by D. W. Osborne, B. M. Abraham, and B. Weinstock (Argonne National Laboratory) that they had succeeded in solidifying He^3. Their results indicate that He^3, like He^4, probably does not have a triple point and that the liquid is the stable condensed phase at absolute zero.

Interesting experimental developments were discussed in the field of "second sound", a wavelike method of heat transfer occurring only in helium II. D. V. Osborne (Institute for the Study of Metals) reported the measurement of second sound velocities at temperatures as low as 0.10°K, attained at Mond Laboratory by means of adiabatic demagnetization. This work verified the results of an earlier experiment of the same nature performed at NBS, which showed that the velocity of second sound increases drastically below 1°K. The more recent experiments, however, have been carried to much lower temperatures, and the velocity of second sound has been found to approach about $1/\sqrt{3}$ that of the estimated velocity of ordinary sound at these temperatures, in good agreement with Landou's theoretical prediction. A continuation of work on the mechanical detection of second sound was reported by J. R. Pellam and W. B. Hanson (NBS). Their measurements now appear to have fully verified the generalized form of Bernoulli's principle which they previously proposed for liquid helium II to take account of second sound.

Several papers dealt with superfluid flow in helium II and the helium II film. John E. Robinson (Duke University) presented a theoretical paper in which he suggested that the entropy of helium II might be measured mechanically by means of adiabatic oscillations in communicating vessels. Super-flow experiments described by K. Mendelssohn (Clarendon Laboratory) show new effects which indicate "that a determination of pressure in super-flow requires additional knowledge to the definition of this quantity under classical conditions." D. C. Henshaw and L. C. Jackson (University of Bristol) described thickness measurements of the stationary helium II film on solids by an optical method which has now been extended to permit measurements as much as 7 cm above the liquid helium surface. J. G. Dash and H. A. Boorse (Columbia University) reported film thickness measurements by means of a capacitor depth gauge operated at radio frequencies. Heat capacity measurements on adsorbed films of helium below the lambda point were described by J. G. Aston and S. V. R. Mastrangelo (Pennsylvania State College).

An important development in the field of practical apparatus was a new storage container for liquid helium with an evaporation loss of only 1 percent per day. This container, described by Aaron Wexler (Westinghouse Research Laboratories), should go far in relieving some of the technical problems in the operation of a low-temperature laboratory. W. E. Henry of the Naval Research Laboratory described some laboratory aids to cryomagnetic research.

The National Bureau of Standards has been active in low-temperature physics since its founding in 1901 and, until World War II, was one of the few laboratories in this country in which low-temperature research was carried on. Over the past 50 years, NBS contributions to the field have included the first successful liquefaction of helium in this country, basic work on the theory of superconductivity, the first separation of heavy hydrogen, and pioneering research on second sound. Under the sponsorship of the Office of Naval Research, the Bureau is now carrying on a broad program of research on the properties of liquid helium, superconductivity, low-temperature calorimetry and thermometry, and liquefier development.

PHOTO PROCESSING

FIRST RESEARCH AND DEVELOPMENT CONFERENCE

The first annual Photographic Research and Development Conference to be held in this country met in Asbury Park, New Jersey, on May 23 and 24, 1951, under the auspices of the Signal Corps Engineering Laboratories and the Society of Photographic Engineers.