# *RECENSIONES*

## Problems of Low Temperature Physics and Thermodynamics

edited by Prof. A. VAN ITTERBEEK (Belgium) published by Pergamon Press, 1962

### Volume 3

The volume contains the discussions of Commission No. 1 of the International Institute of Refrigeration. In the working sessions between September 20th and 22nd 1961 140 delegates coming from 14 countries discussed 24 papers. The first day of the session was devoted to discussing methods for the large scale production, transport and storage of liquid gases, the second and third days were assigned to the physics of very low temperatures, particularly to the attainment and measurement of temperatures below 1° K.

Various branches of industry demand large quantities of liquid gases, particularly oxygen and hydrogen, which are consumed in big steel works and chemical plants at the rate of thousands of tons a day. One report discussed the use of aluminium alloys as heat exchangers, pointing out the low specific gravity, outstanding heat conductivity and the high strength of aluminium. Cooler surfaces of various designs were shown.

Messrs. COULON, SIMONET and STOULS reported on the work of low-temperature distillation columns used in the production of deuterium.

J. W. L. KÖHLER and J. R. VAN GEUNS from the Netherland Philips Laboratories described a small liquid oxygen plant developed by them; the plant weighing three tons produces 15 kg liquid oxygen of 99,5% purity per hour after a running-in period of three hours.

Insulation techniques introduced by two American experts M. A. DUBS and L. I. DANA have brought about a small revolution in the transport of large quantities of liquid gases. The process is also suitable for the handling of liquid hydrogen and helium.

J. W. T. DABBS of the Oak Ridge National Laboratory (USA) reported on a reliable helium liquefaction plant. This plant producing 250—400 litres per month was in operation for six month attended by a single technician.

In the Clarendon Laboratory a pulsating core magnetic resonance meter was used in an investigation into the electronic structure of transition metals below 1° K temperatures.

Two papers discussed the use of $H^3$ in temperature measurement below 1° K and in specific heat determination.

One of the delegates suggested the use of a $H^3$ cooling cycle to produce temperatures below 0,2° K. To obtain a higher osmotic pressure a weak solution of $H^3$ in $H^4$ was used.

R. D. PARKS and W. A. LITTLE of the Stanford University (California) discussed cooling methods by the adiabatic demagnetization of metal alloys.

A. VAN ITTERBEEK, W. VAN DAEL and G. FORREZ (Belgium) described the measurement of sound velocities in gases and liquids at 1 Mc/s frequency at various temperatures. The results were used to investigate the pressure dependence of the quotient $C_p/C_v$ and the equation of state. A. VAN ITTERBEEK and O. VERBEKE discussed the dependence on pressure of the density of liquified gases up to pressures of 850 kg/cm² ($H_2$, $O_2$, $N_2$ and A).

The extremely interesting papers of the symposium dealt with practical problems and important results concerning the liquefaction of gases.

Z. GYULAI

## V. F. NOZDREV: The Use of Ultrasonics in Molecular Physics. (Pergamon Press. Oxford—London—Edinburgh—New York—Paris—Frankfurt. 1965, 424 pages, £ 5 net.)

Of the wide-ranging experimental techniques of investigation into the structure of materials, acoustic methods have gained considerable ground. Significant results have been obtained in the last 15 years by subjecting matter to ultrasonic high-frequencies ($10^9$ c/s) and the great number of publications on this topic demands the development of a new special field: molecular acoustics.

The increasing use of molecular acoustics involving molecular physics in the interpretation of events occurring in sound space and its major stages has been marked by the

following works: И. Михайлов: Распространение ультразвуковых волн в жидкостях (Гостехиздат, Москва 1949), Б. Кудрявцев: Применение ультраакустических методов в практике физико-химических исследований (Гостехиздат, Москва 1952) L. BERGMANN: Der Ultraschall (Hirzel, Zürich, 1954) (in some of its parts); the first Russian edition of NOZDREV's book (1958); K. F. HERZFELD, TH. A. LITOWITZ: Absorption and Dispersion of Ultrasonic Waves (Academic Press, New York—London, 1959); D. SETTE: Dispersion and Absorption of Sound by Molecular Processes (Academic Press, New York—London, 1964). The interest of the scientific world in this special field is reflected by this list of books. The English translation of NOZDREV's books is significant for making the connection between various research trends, which are often independent of each other both in the East and West. The results published in the first edition have been confirmed by recent investigations which qualify them as "classical" results in this young branch of science. One of the important advantages of the English edition is a well-compiled summary of the results obtained by Soviet scientists since the publication of the first edition. The publication of this summary as an Appendix brings the book up-to-date. It is regrettable that the restricted space (four pages) reserved for it has prevented any detailed discussion.

V. F. NOZDREV's book deals with the research work carried out in the Molecular Acoustical Laboratory of the Krupski Moscow Provincial Pedagogical Institute and in the Laboratory for Molecular Physics of the University of Moscow. From among 278 publications reviewed 21 are from the Soviet literature and works of Soviet authors. From the achievements obtained in Western countries, NOZDREV lists only the fundamental ones, whereas HERZFELD and LITOWITZ's book, published at nearly the same time almost entirely neglects any results from Eastern countries. As a result, the two books together give a comprehensive description of, and reference list to the literature of this special branch. To draw a parallel between the two books is the more interesting as NOZDREV's book is devoted to experimental work and, in addition to results, also gives full details of experimental techniques. The HERZFELD—LITOWITZ book is more theoretical in character, although the lack of a comprehensive theory is also felt here, as well as in NOZDREV's interpretation.

The monograph examines the mechanism of propagation of ultrasonic waves in saturated, overheated vapours of organic matters, in multi-component solutions and mixtures, in the frequency range from 2 to 150 Mc/s, temperature interval from $-50°$ C to $+600°$ C, under pressure varying from 0 to 400 kg/cm$^2$. The matter is discussed in six chapters.

1. Measurement of the velocity and absorption of ultrasonic waves in liquids and gases by optical methods;
2. Determination of the velocity and absorption of ultrasonic waves in liquids and gases by pulse techniques;
3. Propagation of ultrasonic waves in liquids;
4. Propagation of ultrasonic waves in some compounds and in their binary mixtures in the critical region;
5. Propagation of ultrasonic waves in saturated and overheated vapours of organic liquids;
6. Absorption of ultrasonic waves in organic liquids and their mixtures over a wide range of temperature, concentration and frequency.

The titles of the chapters give a good idea of the material discussed in the book. Two remarks should be added. Chapters 3 and 4 are completed with the discussion of relaxation processes and with the representation of a relationship between the phenomena of sound space and the kinetic theory of molecules. The absence of a comprehensive theory is again noticeable. Recent investigations discussed in the Appendix attempt to make up for this drawback. ADKHAMOV, in his works published in 1960—1961, gives an original direction based on BOGOLIUBOV's statistics, and a number of theoretical publications in the Soviet literature of these past years have approached the problem. Their results give an explanation of the anomaly of sound absorption in monoatomic and polyatomic gases in the critical zone.

Another remark relates to the experimental techniques discussed in Chapters 1 and 2. Owing to the detailed descriptions of experimental methods and apparatus close to the level of documentation these chapters gain a particular significance for the experimental physicist. The multiple difficulties inherent in investigations conducted through wide temperature and pressure ranges are too well-known. Useful, well-proved guidance is given in these chapters for many practical problems. Measurements in the vicinity of the critical point, the examination of the dynamic equilibrium of phases, a systematic check of the results demand a well-reasoned, purposeful experimental technique. To supply this was one of the aims of the book which it has done with unquestionable success.

The lucid discussion is completed by two Appendices, an Authors' Index and a Subject Index. The first Appendix lists the latest results, the second the characteristics of the materials

examined. 22 tables give the main molecular-acoustical characteristics of aliphatic and aromatic hydrocarbons, esters, alcohols and of their aqueous and nonaqueous solutions. Including these, the book gives measurement results for more than fifty organic compounds and 17 binary mixtures, in 59 tables. 125 figures illustrate the text.

Careful presentation, the annotations of a careful Editor, the listing of the Western equivalents of Soviet tubes, testify to the high standards of the Pergamon Press.

A. ILLÉNYI

## Collected Papers
## of P. L. KAPITZA (Vol. 1. Pergamon Press, 1964)

Professor P. L. KAPITZA, Member of the Academy of Sciences of the USSR, and Fellow of the Royal Society celebrated his 70th birthday not long ago. On this occasion the 1st volume of the collected works of this great scientist was published.

The volume includes the papers and studies of Prof. KAPITZA published between 1916 and 1934, written partly in Leningrad and partly in Cambridge. Originally the papers were published in Soviet, British and German periodicals. For the convenience of English speaking readers, publications first printed in an other language have been translated into English. The book includes all the figures, tables and photographs of the original publications. The papers are preceded by a short preface by D. TER HAAR, and by a six-page introductory survey of KAPITZA's activities.

33 papers make a volume of 503 pages. KAPITZA's scientific activity covers a fairly wide range including nuclear physics, the generation of strong magnetic fields, the behaviour of matter in magnetic fields, techniques for the production of low temperatures, liquid helium, and high-energy electronics.

The first six studies of this volume deal with the Leningrad period. They cover the subjects of electron inertia, the magnetic moment of atoms, X-ray reflection on crystals, and microphotometry. The Leningrad papers are followed by other publications giving an account of investigations carried out in the Cavendish Laboratory at Cambridge University under RUTHERFORD's guidance. The most important point here is the loss of energy of $\alpha$ and $\beta$ rays on passing through gases. The measurement results led to another subject — strong magnetic fields. The examination of the trajectories of patricles in strong magnetic fields raised the technical problems of the generation of such fields. The generation of strong magnetic fields rendered the approach to a number of other investigations possible. The Zeeman effect could be measured and the electric properties of a number of materials in magnetic fields examined. The problems of magnetostriction, magnetic susceptibility, superconduction have been brought forward. Investigation into superconduction has led to the physics of low temperatures which are discussed in several studies dealing with the problems of the liquefaction of hydrogen and helium.

This is contained in the first volume. Physicists of today are sure to have an interest in this book which contains the collected works of a Soviet scientist of international reputation. KAPITZA's scientific career reflects the development of the physical sciences witnessed by the generation of physicists who grew up after World War I.

J. BOROS

## J. FRIEDEL: Dislocations
## (International Series of Monographs on Solid State Physics Vol. 3. Pergamon Press, 1964. pp. XXI—491, 120s.)

Dies Buch von FRIEDEL, der bekanntlich eine der kompetentesten Autoritäten auf diesem Gebiet ist, kann sowohl dem Studenten als auch dem auf diesem Gebiet arbeitenden Physiker wärmstens empfohlen werden. Es umfasst das Gebiet der Versetzungen in 3 Teilen. Der erste Teil gibt eine allgemeine Übersicht der Eigenschaften der Versetzungen, der zweite bringt die Versetzungs-Netzwerke, die sich in Kristallen ausbilden können und behandelt plastische Eigenschaften, der dritte Teil befasst sich mit der Wechselwirkung der Versetzungen mit anderen Kristalldefekten. Es ist leicht verständlich geschrieben und mit zahlreichen Figuren illustriert. Den Schluss bildet ein sehr ausführliches Literaturverzeichnis. Das Buch kann man geradeso wie das in 1956 erschienene französische Original Les Dislocations (Gauthier—Villars, Paris), als Standardwerk auf diesem Gebiet betrachten.

P. GOMBÁS