

tronic conductivity will show that these deal primarily with a description of the chemico-physical properties of simple compounds and the elements. Comments of a similar nature apply to the remainder of the papers contained in this volume. I am sure that this book will fill an embarrassing gap in the library of many a chemist.

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International Committee of Electrochemical Thermodynamics and Kinetics. (C.I.T.C.E.) Proceedings of the Ninth Meeting, Paris, 1957. Edited by T. P. HOAR. Butterworth and Co. (Canada) Ltd., 1367 Danforth Avenue, Toronto 5, Ontario, Canada. 1959. ix + 489 pp. 16.5 × 25 cm. Price, \$24.00.

In accordance with the general program of C.I.T.C.E. the content of the volume is divided into the following main sections: (1) Potential-pH Diagrams; (2) Electrochemical Definitions; (3) Experimental Methods; (4) Batteries and Accumulators; (5) Corrosion; (6) Electrochemical Kinetics; (7) Semiconductor Electrochemistry.

Section (1) contains a thorough treatise by Pourbaix and co-workers of the pH-potential diagrams of each of the elements arsenic, antimony, bismuth, technetium, rhenium, niobium, tantalum, zirconium, boron, aluminum and chlorine in equilibrium with water, as well as a discussion by Valensi, *et al.*, of the thermodynamic standard functions of sulfide and polysulfide ions. These papers bring the survey of the equilibrium conditions in systems of single elements and water, to which C.I.T.C.E. has devoted a considerable attention, to a certain completion.

Section (2) consists of a report on the extensive work which the subcommittee on electrochemical nomenclature has performed under the chairmanship of Van Rysselberghe in cooperation with the International Union of Pure and Applied Chemistry. Definitions of basic electrochemical entities are presented and suggested for general use.

Section (3) contains a number of papers of great interest, among which should be particularly mentioned a description by Chauvin, Coriou, *et al.*, of a high vacuum cell for electrolytic preparation of pure metals up to 1000°, a brief survey by Gerischer of electronic potentiostats, a study by H. Fischer, *et al.*, of the mechanism of inhibitors by means of cathodic polarization curves, a paper by Lewartowicz on the standardization of overpotential measurements in oxidation-reduction systems, and a discussion by Ibl of the mechanism of electrolytic deposition of metal powders.

Section (4) is introduced by a survey of general scientific problems in primary and secondary cells, prepared by the subcommittee on cells and batteries. In the same section H. Winkler presents a contribution to the mechanism of the processes in sealed nickel-cadmium cells, and U. Tragardh a thorough study of the effect of hydroxide concentration on the capacity of the nickel oxide electrode.

Section (5) is limited to a paper by Schwabe on the passivity of nickel and cobalt, whereas Section (6) contains contributions from various countries among which are particularly to be mentioned those on the Ag/Ag⁺ electrode (Gerischer), the electrolytic reduction of persulfates and the electrolytic oxidation and reduction of chlorites (Rius, *et al.*), the electrolytic separation of hafnium and zirconium in molten media (Chauvin, Coriou, *et al.*), the application of O₂ for the study of anodic processes (Frumkin), and the effect of specific anion adsorption on hydrogen evolution kinetics (Kolotyrkin).

In Section (7) are found papers by Francois on electric conductivity of vacuum deposited germanium films, by Holmes on the correlation between orientation and etch patterns at germanium and silicon, and by Epelboin, *et al.*, on electrolytic polishing of germanium and silicon in non-aqueous media. Included in this section is also a paper by Llopis, *et al.*, on the sulfuration of metals by thiourea.

The volume also contains the addresses of T. P. Hoar and I. M. Kolthoff to the Colloquium on Modern Electrochemical Methods in Analytical Chemistry which was held in conjunction with the Meeting; and an abstract of the Symposium by Gauguin. The full texts of the papers at the Colloquium are published in *Anal. Chim. Acta*.

As can be seen from above, the Proceedings contain papers and surveys of interest to practically every electrochemist.

In addition, there are a number of shorter communications and notes of specific interest to specialists in the various areas of Electrochemistry. Although some of the papers are of a controversial content and some papers—particularly by Russian contributors—are lacking in experimental detail, the majority of the contributions are of the very highest standard and form important additions to the electrochemical literature. The topics are further illuminated by discussions at the end of the papers.

The contributions are in English, French and German, with English dominating. The volume is well edited and well printed and illustrated. It is understood that the present volume is the last of the Proceedings published separately by C.I.T.C.E. and that the proceedings of the following Meetings are to appear in the new periodical *Electrochim. Acta*. It can, indeed, be said that the volume concludes in a most worthy way a series of publications which have both presented a wealth of new knowledge and served as a mirror of the present tendencies of development of Electrochemistry. Like the previous ones, the "Proceedings of the Ninth Meeting" deserve a place on the bookshelf of the electrochemist.

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Encyclopedia of Physics. Volume XII. Thermodynamics of Gases. Edited by S. FLÜGGE. Springer-Verlag, Heidelberg Platz 3, Berlin-Wilmersdorf, Germany. 1958. vi + 686 pp. 17.5 × 25 cm. Ganzleinen, DM 154.—; Subskriptionspreis, DM 123.20.

The third edition of "Handbuch der Physik" also bears the title "Encyclopedia of Physics," reflecting the bilingual character of its articles. (The reviewer recalls at least three articles in other volumes in French.) There are Deutsch-English and English-German subject indices. This new edition comes a quarter of a century after the one edited by Geiger and Scheel and promises to be a worthy successor.

This monumental encyclopedia of 48 volumes, like its predecessors, seeks to capture the current critical view of physics in the compass of several bookshelves in short monographs each written by a specialist. Editorial problems of overlapping and dove-tailing of subject matter, as well as of finding the right place for each aspect, must be exceedingly complex.

In the present volume the six articles deal with different aspects of the physics of gases with no unnecessary overlapping. They are indeed somewhat diverse. One may question the appropriateness of the title since the longest article deals with transport phenomena in gases of moderate pressure. Many aspects of kinetic theory and statistical mechanics have been assimilated into the fold of (equilibrium) thermodynamics under the heading of statistical thermodynamics, but in this instance thermodynamics seems to have had other eggs put into her nest.

The first article on the Properties of Real Gases (72 pages) is by J. S. Rowlinson of the University of Manchester. The chapters are entitled: perfect gases and real gases, the thermodynamic properties of real gases, experimental methods, the critical region, empirical equations of state, and gas mixtures. It is well written and is illustrated by 40 figures. Inclusion of plots of isotherms of f/p , C_p , and of $C_p - C_v$ versus p for typical gases, as well as Obert's generalized compressibility charts, would have been welcome. It is regretted that no notice was taken of two significant contributions of recent decades, namely, the Redlich-Kwong equation of state and Bartlett's modification of the law of partial pressures to mixtures of real gases.

In the Theory of Real Gases (132 pages), by J. E. Mayer of the University of Chicago, the chapters are entitled: general methods, the internal partition function, classical imperfect gases and quantum gases. One is struck by how much is new in the areas of the last two sections since the publication in 1940 of "Statistical Mechanics" by Mayer and Mayer. The author's summaries and transitions are well done and keep the perspective of the reader in focus.

Principles of the Kinetic Theory of Gases (90 pages), by Harold Grad of the Institute of Mathematical Sciences of New York University, is a survey of recent theoretical studies of the Boltzmann equation. Chapters I and II are entitled: the place of the Boltzmann equation in kinetic

theory and elementary properties of Boltzmann equation. In the remaining chapters the author reviews attempts to reach mathematically rigorous solutions of the Boltzmann equation from the viewpoint of existence theory (III), by normal solutions following Hilbert, Enskog, and Chapman (IV) and by other general techniques (V).

Transport Phenomena in Gases at Moderate Pressure (220 pages) was written by Ludwig Waldmann of the Max Planck Institute for Chemistry in Mainz. Moderate pressure in this connection requires that the dimensions of the vessel be much larger than the mean free path, thus excluding the Knudsen region of highly dilute gases as well as highly compressed gases. The chapters are entitled: the phenomenology of transport processes, methods of measurement, the fundamentals of the kinetic theory of monatomic gases, heat conductivity and viscosity of simple gases and mixtures, diffusion, quantum mechanical effects, and applications to polyatomic molecules.

The remaining two articles: General Vacuum Physics (94 pages), by Rudolf Jaekel of the University of Bonn, and Production and Measurement of Ultrahigh Vacuum (55 pages), by Daniel Alpert of the University of Illinois, are excellent summaries of the experimental methods of obtaining and measuring low pressures; 10^{-8} mm. is taken to be the upper limit of very low pressures. Both authors appear to have written very careful treatments of these important experimental techniques and the articles are copiously illustrated.

There seem to be extremely few misprints. The traditionally high quality of book production of the Springer-Verlag has been maintained as well as the price.

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Solid State Physics. Advances in Research and Applications. VOLUME 7. FREDERICK SEITZ, Department of Physics, University of Illinois, Urbana, Illinois, and DAVID TURNBULL, General Electric Research Laboratory, Schenectady, New York, Editors. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1958. xiv + 525 pp. 15.5×23.5 cm. Price, \$12.00.

Solid State Physics. Advances in Research and Applications. VOLUME 8. FREDERICK S. SEITZ, Department of Physics, University of Illinois, Urbana, Illinois, and DAVID TURNBULL, General Electric Research Laboratory, Schenectady, New York, Editors. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1959. xiv + 519 pp. 15.5×23.5 cm. Price, \$13.50.

These volumes continue the extensive review of the field of solid state physics begun in earlier volumes. They are extremely comprehensive and authoritative. Space permits only a brief description of the contents of each.

In Volume seven the following articles appear: 1, "Thermal Conductivity and Lattice Vibrational Modes" by P. G. Klemens; 2, "Electron Energy Bands in Solids" by J. Callaway; 3, "The Elastic Constants of Crystals" by H. B. Huntington; 4, "Wave Packets in Metals" by H. W. Lewis; 5, "The Study of Surfaces by Using New Tools" by J. A. Becker; 6, "The Structure of Crystals" by A. F. Wells.

Article 1 deals with the theory of heat transport by lattice vibrations, the thermoconductivity of non-metals and the thermal conductivity of metals, alloys and semiconductors.

Article 2 includes a discussion of the general theory of energy bands and an application of this theory to many particular types of solids. The different solids are grouped in the following way: 1, the alkali metals; 2, metals of

group II and III (which includes solid helium); 3, elements of group IV and the related semiconductors indium antimonide, indium arsenide and gallium arsenide; 4, the transition metals and other substances.

Article 3 includes a section on theory and one on experimental techniques for measuring elastic constants. Another section is devoted to presentation of elastic data for various pure materials. These data are organized into tables according to crystal symmetry. The article also includes a section on the variation of the elastic constants with temperature and pressure, and a section on the influence of composition phase changes, dislocation motion and radiation damage.

Article 4 is a theoretical discussion of electron-impurity scattering, phonon interactions and transport phenomena.

Article 5 describes experiments on absorption and desorption of gases by solid surfaces and the surface migration of atoms. The new tools discussed are the fast responding ion gauge and the field emission and field ion microscopes.

In Article 6, Dr. Wells treats the structure of crystals from the standpoint of topology rather than the conventional one of lattices and symmetry. That is, he considers ways of connecting atoms together rather than ways of placing them in symmetrical groups.

Volume 8 of the series contains five papers: 1, "Electron Spectra of Molecules and Ions 'in Crystals,'" Part I, by D. S. McClure; 2, "Photo Conductivity in Germanium" by R. Newman and W. W. Tyler; 3, "Interaction of Thermal Neutrons with Solids" by L. S. Kothari and K. S. Singwi; 4, "Electronic Processes in Zinc Oxide" by G. Heiland, E. Mollwo and F. Stöckmann; and 5, "The Structure and Properties of Grain Boundaries" by S. Amelinckx and W. Dekeyser.

Article 1 is concerned with molecular crystals. A theoretical treatment of the electronic absorption spectrum of such crystals is given and available experimental data are discussed. Fluorescence and energy migration in molecular crystals is also included in the article.

Article 2 is an exhaustive review of photoconductivity in germanium. Sections on the preparation and electrical properties of doped germanium crystals and germanium as an infrared detector are included as well as a discussion of photoconductivity theory and experimental studies of photoconductivity.

Article 3 includes sections on: the general theory of neutron scattering, cold neutron scattering, crystal dynamics and inelastic scattering of neutrons, and the slowing down of neutrons near thermal equilibrium.

Article 4 is a very complete review of the electronic properties of zinc oxide. There are sections on preparation of samples; diffusion of defects; optical properties, absorption and catalysis; conductivity in thermal equilibrium; the variation of conductivity as the result of various influences such as field effects and irradiation with light and electrons; and a discussion of electron mobility, thermoelectric power and surface conductivity.

Article 5 is a review of dislocation theory and experiment and a discussion of grain boundaries as arrays of dislocations. The work includes many photographs of dislocation nets in various materials. The section headings are: "The Geometry of Grain Boundaries as Arrays of Dislocations"; "Observations Concerning the Geometry of Grain Boundaries"; "Mechanics of Grain Boundaries as Arrays of Dislocations"; "Energy Measurements"; "The Generation of Sub-Boundaries"; "Diffusion along Grain Boundaries"; "Segregation and Precipitation of Solute at Grain Boundaries"; "Melting at Grain Boundaries"; "Boundary Migration" and "Electrical Properties of Grain Boundaries."

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