
BOOK REVIEWS

Tables Azéotropiques. Volume I, Second Edition, by MAURICE LECAT. Published by the Author, 29, Rue Auguste Danse, Uccle-Bruxelles, 1949.

The first edition of this work published in 1918 (see THIS JOURNAL, 43, 1745 (1921)) gave the azeotropic constants of and relevant information as to some 2,450 binary systems. The present edition includes 6,287 azeotropes and 7,003 zeotropes or a total of 13,290 systems measured at a pressure of 760 mm. of mercury. The earlier data have also in many instances been replaced by more accurate and recent data. A major part of all the data in these tables, as in the previous edition, has been obtained by the author himself.

As before, the systems have been arranged in groups, for instance, alcohols, etc., each of which is then divided into subgroups, as, for instance, with other alcohols, acids, amines, etc., depending on the second component. These groups and subgroups are listed in a Table of Contents. By this means an individual system can be quickly located.

The bibliographic references to the author's prior publications are given in an accompanying section. Reference to earlier work of others is merely to tables in an earlier published book by the author entitled "Bibliographie de l'Azéotropie" (in two volumes). This appears to be an unnecessary inconvenience, particularly as the first volume is out of print.

As in the first edition, there is here an interesting preface with lively footnotes in which the author reiterates his antipathy to militarism and accompanying mounting "dividends," decriing, in particular, the diversion of state funds from scientific research to the prosecution of and the preparation for war.

This edition, like the first, is a valuable contribution to chemical science and bears testimony to the skill, enthusiasm, and perseverance of the author.

ARTHUR B. LAMB

Acetylene and Carbon Monoxide Chemistry. By JOHN W. COPENHAVER, Petroleum and Chemical Research Laboratory, M. W. Kellogg Company, Jersey City, N. J.; formerly with Central Research Laboratory, General Aniline and Film Corporation, Easton, Pa., and MAURICE H. BIGELOW, Plaskon Division, Libbey-Owens-Ford Glass Co., Toledo, Ohio. Reinhold Publishing Corporation, 330 West 42nd Street, New York 18, N. Y., 1949. xvi + 357 pp. Illustrated. 16 × 23.5 cm. Price, \$10.00.

All who have faced the task of searching the very large number of German patents, patent proposals, FIAT, BIOS and PB reports describing the contributions to acetylene and carbon monoxide chemistry made by Julius Walter Reppe and the group associated with him at the I. G. Farbenindustrie laboratories at Ludwigshafen will appreciate the convenience of having the essential features of this chemistry collected in a single volume. The authors had available some twenty-eight tons of documents assembled from Dr. Reppe's files, and used those which appeared to be pertinent as the basis for this book. "The primary objective of this book is to trace the development of the chemistry of acetylene reactions under pressure, and to indicate the techniques employed in the safe handling of acetylene in such reactions. A secondary objective is to point out in lesser detail other important reactions and reaction products derived from acetylene in order to present a well-rounded picture of the German acetylene chemical industry." Processes and products which are described include the following: Synthesis and reactions of acetylene at atmospheric pressure (acetaldehyde, acetone, butadiene via acetaldo; hydrogenation and chlorination of

acetylene; synthesis of vinyl acetate, vinyl chloride and acrylonitrile). Vinylation (preparation and reactions of vinyl ethers, including their hydrolysis and polymerization; Koresin; vinyl esters, amides and amides, including vinylcarbazole and polyvinylcarbazole ["Luvican"], vinyl pyrrolidone and polyvinyl pyrrolidone ["Periston"]). Ethinylation of aldehydes, ketones and amines (2-butyne-1,4-diol, butan-1,4-diol, tetrahydrofuran and butadiene; propargyl alcohol). Reactions of products derived from the ethinylation reaction (acetylenic alcohols, glycols and amines). Cyclopolyolefins, principally cyclooctatetraene; its preparation from acetylene and chemical reactions. Carbon monoxide carboxylation of acetylene (synthesis of acrylates), olefins, methanol and cyclic ethers; the Oxo process; reactions of metal carbonyl hydrides. Synthesis and reactions of acetylene homologs (methylacetylene, diacetylene, vinylacetylene). Explosive decompositions of acetylene; technique and equipment for handling acetylene under pressure.

The coverage of German acetylene chemistry provided by the book appears to be excellent. Coverage of carbon monoxide chemistry is necessarily less complete, since German groups other than the one headed by Reppe were notable contributors—in particular, Dr. O. Roelen of Ruhrchemie A. G. and associates. The treatment of the German acetylene and carbon monoxide chemistry is in part critical, reflecting experience of the authors with many of the processes, and in part non-critical, apparently where they were forced to rely completely upon the German documents for information. A valuable feature is the inclusion in many instances of operating conditions and yields of chemical processes, and a summary of pilot plant and research experience with processes or modifications which did not reach full scale production. Liberal references to the original sources will be helpful to the reader who requires complete information. A welcome addition to the section on explosion hazards in handling acetylene under pressure would have been inclusion of specific safety precautions recommended for laboratory work with acetylene under pressure.

ARTHUR C. COPE

Introduction to Radiochemistry. By GERHART FRIEDLANDER, Chemist, Brookhaven National Laboratory (Visiting Lecturer, Washington University, St. Louis), and JOSEPH W. KENNEDY, Professor of Chemistry, Washington University, St. Louis. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1949. Chapman and Hall, Ltd., London. xiii + 412 pp. Illustrated. 15 × 22 cm. Price, \$5.00.

No textbook in nuclear chemistry has appeared in English in the last decade before the Friedlander and Kennedy "Introduction to Radiochemistry." This decade has, however, seen nuclear science grow from a specialty in physics to its present state of exuberant linking of physics, chemistry, the life sciences, and the atomic power industry. It is gratifying to report that this new book fills, to a surprising degree, the needs of our time for a well-balanced survey of the operational aspects of radioactivity and of the implications of radioactivity in chemistry. It is very likely that it will maintain a commanding position in the field for a long time.

The authors define nuclear chemistry as the study of nuclear reactions and of the properties of resulting nuclei, and tracer chemistry as chemical studies that can be made with the use of isotopic tracers, including studies of chemical behavior of substances at extremely low concentration. By their definition, radiochemistry is the major part of both of these fields, since it is that part dealing with radioactive products or their uses.

Both authors have had extended experience in research and teaching in radiochemistry which contributes notably to the intelligent choice of subject matter and to the clarity of exposition of their book. It is an introduction of high caliber. It gives the wide background from which the research worker can take off, or to which the teacher can add those specialties appropriate to the needs of his students and the role of his course.

The nature of the subject requires fairly extensive presentation of the physics of nuclei and of their reactions, and of the machines for producing nuclear projectiles, covered in about a third of the book. The second third deals with radioactive decay, interactions of the radiations with matter, instruments for detection, and techniques for measurements. The last third gives a broad survey of the chemical operations of tracer chemistry. Detailed amplification of this field is left to a companion volume "Radioactivity Applied to Chemistry," edited by A. C. Wahl, soon to be published. An excellent 90-page table of the properties of radioactive and stable nuclei completes the book. Each of the 13 chapters ends with a good set of problems and references.

The book is an excellent one to introduce nuclear science to workers in the many fields that are being enriched by tracer methods, and to scientists who would like to become acquainted with its exciting features. The reviewer can testify that the book is eminently useful in the teaching of radiochemistry at the senior-graduate level.

CHARLES D. CORVELL

Laboratory Fractional Distillation. By THOMAS P. CARNEY. The Macmillan Co., New York, N. Y., 1949. vii + 259 pp. Price, \$5.75.

Probably the only book extant covering the needs of the research worker to whom distillation is a necessary but secondary preoccupation, it makes a very creditable showing indeed, in spite of some weakness which will be mentioned later. Dr. Carney is head of organic research for the Eli Lilly Co., and it is easy to understand how his own needs to master the distillation of complex and labile mixtures led to an increasing preoccupation with the distiller's art. At some point he must have decided to augment his first-hand experience with the missing subjects necessary to form a well-rounded treatise, and the present work is the result. This approach will be invaluable to the organic chemist whose lack of education in practically every part of the subject has been sensed by the author's own experience. Thus, the first chapter, miscalled Theory, is a clear presentation in miniature of what is to follow. The second chapter on mathematics plunges the reader directly into advanced theory of rectifying columns with formalized presentation of Sorel's method and McCabe-Thiele diagrams for calculating plates and plate efficiencies. From there we pass to a treatment of column packings, reflux ratios and degrees of separation. Not until Chapter 5 do we find a "how to do it" approach, and it is here that we appreciate the fundamental difficulty confronting the author, namely, that most of the advances in distillation have come from the petroleum industry. The synthetic organic laboratory has had to borrow from the petroleum and commercial solvent laboratories, a transfer which is tacitly acknowledged in the preface where the author thanks Dr. Rossini and Prof. Othmer for major assistance.

The chapters on constructing and testing columns are excellent, but in the latter the odor of petroleum can scarcely be ignored. The proficient glass blower will appreciate the wealth of gadgetry illustrated under "Special Columns." The equilibrium still and the micro still are each profusely illustrated. The chapter on molecular distillation, a field of special interest to the reviewer, gives broad if superficial coverage, but here, more than anywhere in the book, the lack of specific working directions becomes evident. A steroid chemist wondering how to separate cortisone from a synthetic brew would find neither suggestions nor encouragement, nor would he learn how to char-

acterize his product if he were bold enough to try the method.

In spite of such criticisms, the book makes a notable contribution to the chemist's working bookshelf. It will be most useful to those who are already familiar with the field, less so to the tyro or the expert. The index is adequate, the bibliography and suggestions for reading, excellent. When the author prepares a second edition, as he assuredly will be asked to do, we trust he will consider making a descriptive account of the art and practice as a whole before he launches into discussions of its parts. Examples and typical uses for each kind of still and a historical summary of researches that have been resolved by distillation would greatly embellish the work. These suggestions should not discourage the acquisition of a uniquely planned and successful book on laboratory distillation.

K. C. D. HICKMAN

A General Kinetic Theory of Liquids. By M. BORN, F.R.S. and H. S. GREEN. Cambridge University Press (American Branch), 51 Madison Avenue, New York 10, N. Y., 1950. 98 pp. 17 × 26 cm. Price, \$2.25.

Significant among recent contributions to the theory of the liquid state are a series of six articles published by M. Born and H. S. Green in the Proceedings of the Royal Society during the period 1947 to 1948. The present volume is a collection of the articles of this series in which the authors develop their general kinetic theory of liquids. They derive from their equilibrium theory many results previously obtained by Mayer, Yvon and Kirkwood from the Gibbs theory of the canonical ensemble. Their theory of transport processes closely parallels the simultaneously developed theory of Kirkwood, although it differs from the latter theory in the manner in which irreversibility and thermodynamic dissipation are introduced.

In the first article, entitled "The Molecular Distribution Functions," the authors derive the basic equations of their theory, a system of integro-differential equations for distribution functions in the phase space of subsets of molecules, singlets, pairs, triplets, etc., forming a part of the large set of N molecules of a macroscopic specimen of fluid. Macroscopic observables are identified with mean values of functions of molecular variables in the ensembles represented by the set of distribution functions. A derivation of the Maxwell-Boltzmann integro-differential equation of transport for gases of low density is presented. The equilibrium distribution functions are obtained as special stationary solutions of the general system of integro-differential equations. They are found to satisfy a system of integral equations equivalent to those formulated by Mayer, Yvon and Kirkwood on the basis of the Gibbs theory of the canonical ensemble.

The second article, entitled, "Equilibrium Properties," is concerned with the details and consequences of the authors' equilibrium theory. A generalized classical H-theorem is proved and phase transitions are analysed from the standpoint of an approximate integral equation for the distribution function of molecular pairs. Transport phenomena are treated in the third article, "Dynamical Properties." The equations of hydrodynamics are derived from molecular mechanics and expressions are obtained which relate the coefficients of viscosity and heat conductivity to the potential of intermolecular force and the perturbations of the pair distribution function produced by departure from equilibrium.

In the fourth article, "Quantum Mechanics of Fluids," the quantum mechanical generalization of the theory of distribution functions is developed with the use of the density matrix. The transition to hydrodynamics leads to expressions identical with those of the classical theory for the stress tensor and heat current. The pair distribution function in configuration space appearing in these expressions is however determined by the laws of quantum mechanics instead of those of classical mechanics. The

fifth article, "Liquid Helium II," is concerned with the application of the authors' theory of the quantum liquid to the clarification of the anomalous thermodynamic and hydrodynamic behavior of helium II. While the authors' analysis of these important problems is interesting and may point the way to their ultimate solution, their distinction between thermodynamic and kinetic pressure, upon which much of their argument rests, is still open to debate.

The authors state their awareness of the fact that the six papers contain only a very general outline of the statistical theory of condensed matter. As pioneering efforts pointing the way to new methods of solution of the intricate problems of the liquid state, they are remarkable and worthy of careful study and attention.

JOHN G. KIRKWOOD

An Introduction to Luminescence of Solids. By HUMBOLDT W. LEVERENZ, Radio Corporation of America, RCA Laboratories Division, Princeton, N. J. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1950. xv + 569 pp. 15 × 23.5 cm. Price, \$12.00.

Of four books dealing exclusively with the luminescence of solids which were issued within less than two years this "Introduction" is the most voluminous as well as the most ambitious. It is an introduction not only to our present knowledge of the subject but to an expected future understanding. It begins with chapters on nuclear physics and real and ideal crystals and ends with radar screens and fluorescent lamps. In a way it does not completely correspond to its title; not all luminescent solids are treated. Organic compounds are only slightly touched upon and uranyl salts, pure rare earth compounds and cyanoplatinates are hardly mentioned. It is almost exclusively a book on commercially important phosphors, the field in which the author has himself made very valuable contributions during a period of nearly twenty years mostly spent in the research laboratories of R. C. A.

Thus the book contains an amazing wealth of experimental data to be found nowhere else. There are more than 250 photometer curves of phosphorescence spectra, about 100 phosphorescence decay curves, and numerous curves showing the luminescence yield of phosphors under various conditions of preparation, excitation and observation. Much emphasis is put on the importance of high purity and the exact definition under which the phosphors are prepared and examples are given for the influence of all the factors of importance.

Most of the data collected in the figures and in several tables were obtained by the author himself and his co-workers. Results published by other investigators, for which Leverenz does not want to take the full responsibility are cautiously introduced by "It is reported that" and it even occurs that phenomena described by some authors are characterized as not confirmed "by experiments in these laboratories." The bibliography at the end of the volume, however, enumerates practically every paper on phosphorescence published during the last ten years, including numerous patent claims. For earlier investigations reference is made in general to some other book such as Lenard, Tomaschek and Schmidt, Riehl, etc. The bibliography is followed by a formula index listing more than 300 crystal phosphors.

Making use of the rich material at his disposal, the author endeavors to ascertain general rules for the properties of certain classes of phosphors, but he emphasizes repeatedly that all such hypotheses are only tentative and that much more experimental research is needed, before a complete theoretical treatment of the subject will be possible. For this very reason it seems that the chapters and paragraphs of purely theoretical nature in the book are not quite so useful as those dealing with experimental facts. The gap between the two is too large and sometimes the impression is produced that there is no connection between them at all. Two examples may suffice.

The impossibility of quantitatively determining the light absorption coefficient of most phosphors is correctly ascribed to the light scattering by the crystalline powders. Following this statement Rayleigh's equation for light scattering is discussed, but, since this equation applies only to non-absorbing particles of diameters well below the wave length of the scattered light, it is of no use at all for calculating the light absorption in a phosphorescent screen. (While the equation is given correctly, the text says λ^4 instead of λ^{-4} .)

Several times the connection between the natural lifetime of excited states and natural line width is mentioned, but the latter is almost always hidden by Doppler broadening, Lorentz broadening, etc., and under no circumstance can one expect a general correlation between the width of the emission bands of phosphors and their times of decay. On the other hand, some more theoretical discussion would be useful, for instance in introducing terms such as "collisions of the second kind" or "oscillator strength"; as it is, the parenthesis "(high density of absorbing atoms or molecules)" following the words "oscillator strength" might mislead the reader in a sense certainly not desired by the author.

Altogether, Leverenz's book is a very valuable contribution to the ever growing literature on luminescence and its technical applications and those working in this field will find it exceedingly helpful.

PETER PRINGSHEIM

Vitamins and Hormones, Advances in Research and Applications. Vols. V and VI. Editors: R. S. HARRIS, Prof. of Biochemistry of Nutrition, Mass. Inst. of Technology, Cambridge, Mass., and KENNETH V. THIMANN, Prof. of Plant Physiology, Harvard Univ., Cambridge, Mass., Academic Press Inc., Publishers, 125 East 23rd St., New York, N. Y. Vol. V, 1947, xvi + 478 pp. Illustrated. 16 × 23.5 cm. Price, \$7.50. Vol. VI, xi + 435 pp. Illustrated with tables and figures. 16 × 23.5 cm. Price, \$7.80.

These volumes had been read by most interested persons long before the present assignment to review them was made. Yet it may be of value to some to point out the subjects covered. The chapters are written by authorities and for the specialist. In volume V the topics presented are: "Synthesis of Vitamin A" by Milas, "Physiological Availability of the Vitamins" by D. Melnick and Oser, "Thiamine and Peripheral Neurophysiology" by von Muralt, "Physiological Effects of Pteroylglutamates in Man" by Darby, "The Properties of the Growth and Adrenocorticotrophic Hormones" by Li and Evans, "The Biology of Antithyroid Agents" by Charipper and A. S. Gordon, "Effect of Estrogens on the Male Mammal" by Emmens and Parkes, "Use of Androgens in Women" by Carter, Cohen and Shorr, and "Uses of Testosterone in the Male" by Heller and Maddock. In volume VI the heterogeneous collection includes "Chemistry and Biological Action of Pteroylglutamic Acid and Related Compounds" by Hutchings and Mowat, "Vitamin K" by Dam, "Vitamins as Pharmacological Agents," Molitor and Emerson, "Assessment of Human Nutrition" by H. M. Sinclair, "Vitamins in Microorganisms" by Van Lanen and Tanner, "B Vitamins as Plant Hormones" by James and Harriet Boner, and "Influence of the Adrenal Cortex on Water and Electrolyte Metabolism" by Kendall. There are individual chapters on the vitamin requirements of mice (H. P. Morris) and chicks (H. R. Bird) in Volume V and of cotton rats and hamsters (Schweigert) in Volume VI.

All of the chapters reflect the authors' efforts to cover their specialties both completely and intensively. Most of the authors are critical but the style of at least one seems to have been inspired by Matthew 1.

The editors deserve credit for selecting several topics which are not covered in review journals or in the books which annually survey progress in various fields of biological science. More careful editing might have elimi-

nated occasional floridness such as the contradictory phrases "extensive inbreeding" and "excessively rare."

In view of the highly specialized nature of the subjects covered one wonders whether this series might not be more generally useful if vitamins and hormones were treated in alternate volumes.

H. A. LARDY

Physical Chemistry of Hydrocarbons. Volume I. Edited by ADALBERT FARKAS, Ph.D. Academic Press, Inc., Publishers, 125 East 23rd Street, New York, N. Y. 1950. x + 453 pp. 15.5 × 23.5 cm. Price, \$8.50.

This book, which is the first of two volumes covering the various aspects of the physical chemistry of hydrocarbons, contains the following chapters: The Chemical Bond in Hydrocarbon Molecules, by G. W. Wheland; The Molecular Structure of Hydrocarbons as Determined by Spectroscopy and Electron and X-Ray diffraction, by M. H. Jellinek; Mass Spectroscopy in Hydrocarbon Analysis, by J. J. Mitchell; Optical Properties of Hydrocarbons—Infrared Absorption, Raman, and Ultraviolet Absorption Spectroscopy, by N. D. Coggeshall; Optical Methods of Hydrocarbon Analysis, by N. D. Coggeshall; Electrical Properties of Hydrocarbons, by Andrew Gemant; Solvent Extraction of Hydrocarbons—Solubility Relations between Liquid Hydrocarbons and Other Liquids, by A. W. Francis; Solid-Liquid Equilibria of Hydrocarbons, by M. R. Cines; Chemical Thermodynamic Equilibria among Hydrocarbons, by F. D. Rossini.

In the foreword, Hugh S. Taylor writes ". . . he who enters the petroleum or related industries today should enter equipped with the ultimate that modern physico-chemical science can provide. He must know something of the nature of the chemical bond, . . . the thermodynamics of hydrocarbons systems, . . . how molecular structure can be explored with the tools of the physicist, . . . the young neophyte who would wish to venture into the petroleum industry today, and leave on that industry the mark of his effort must come prepared with a scientific equipment of which his parent never knew or dreamed. Sound, solid scholarship in the fields of chemistry and physics are essential."

The authors of the several chapters in this volume present the status of the development of their respective subjects through 1948, bringing into one place material that is scattered in many journals, monographs, and books. The topics are discussed in a well-rounded manner, and are suited primarily for the chemist, physicist, and engineer in the petroleum, coal-tar, rubber, and related industries.

The editor of this volume has done science and industry a good service by bringing together in one place the papers from the several contributing experts. The extent of overlapping of text among the related chapters is not large and is justified on the basis of making each chapter a complete entity in itself. The book will repay study by those scientists and engineers whose work involves hydrocarbons.

FREDERICK D. ROSSINI

The Transuranium Elements. Edited by GLENN T. SEABORG, Department of Chemistry and Radiation Laboratory, University of California, Berkeley, JOSEPH J. KATZ, Argonne National Laboratory, Chicago, Ill., and WINSTON M. MANNING, Argonne National Laboratory, Chicago, Ill. McGraw-Hill Book Company, Inc., New York, N. Y., 1949. In two parts. Part I, xxxvi + 958 pp.; Part II, xxi + pp. 861-173. Illustrated. 15 × 23 cm. Price for both parts, \$15.00. (Not sold separately.)

These two volumes of the National Nuclear Energy Series consist of obviously censored, collected reports and articles by those involved in the highly important wartime activity now known as the Plutonium Project. As the title implies, the subject matter covered is the chemistry and some of the physics of the four, newly discovered,

transuranium elements, neptunium, plutonium, americium and curium. The two books, whose total weight is 3.1 kilograms, will doubtless, in time, be collectors' items; their historical value cannot be denied. The editors and authors have performed a real service to industry and pure science alike in bringing to publication information which was, for a period, ensnared in the dank, stagnant bogs and swamps of secrecy.

Part I starts out with a fine, brief foreword by Mr. David Lilienthal, first Chairman of the Atomic Energy Commission. This is followed by a preface by the Editorial Advisory Board. Next comes a short, excellent, well considered foreword by Dr. Arthur H. Compton. Following these are an introductory note (five pages) by the Editor-in-Chief, Dr. Robert S. Mulliken, and a nine page preface by the Volume Editors. This last preface represents a brave, almost pathetic effort to make clear just who were Indians and who were chiefs, as well as to present some historical matter. The historical part is on a par with Caesar's Commentaries.

After ploughing through the preliminary material one comes to an amazing record of American ingenuity. Close on the heels of the original discovery of neptunium by McMillan and Abelson there came further explorations in the same general direction with the result that, in the end, three additional artificially created elements were brought to light. All of the scientific techniques, principles and knowledge, both humble and Brahmin, then known to man were brought to bear on the study of the properties of these elements and their compounds. Somewhere among the more than one hundred and fifty reports the reader will find descriptions and detailed results of experiments on such subjects as the yields of plutonium from uranium bombarded with cyclotron produced neutrons, the oxidation of aqueous trivalent plutonium by chlorine, the reaction kinetics of plutonium ions in hydrochloric acid solution, the heats and entropies of tri and tetravalent plutonium in solution, absorption and emission spectra, high temperature equilibria, the half life of protoactinium, a pulse analyzer for alpha-energy measurements, micro and macrochemical methods, crystal structures of plutonium, neptunium, and uranium compounds, and many other aspects of the new elements. In short, there is presented a wealth of useful factual matter and descriptions of many ingenious experimental methods.

Any effort to assess the relative values of the various reports, which vary in length from one to nearly eighty pages, will require the quiet, relaxed judgment that comes only with time and the repetition of the more significant investigations. The simple fact that the production of plutonium is now a major industry is striking evidence for the truth of much that is set forth in the collected reports.

It would have helped both the novice and the initiated if a chapter had been included which summarized, in brief form, the chemical, physical and nuclear properties of the new elements and their compounds. This would have obviated the necessity for the threatened additional "definitive" volume, and its burden on the tax payer.

To carp and cavil endlessly at the names chosen for chemical elements is bootless. America, like California, received its name somewhat by accident, but both names are colorful and euphonious; the same cannot be said for americium.

But after being carried away by the enchantment of these new elements, the reader may well pause to reflect that the books are of little use to anyone except those few having access to the materials described; there is no normal, healthy way to check the many measurements and statements made. This field of scientific endeavor is highly monopolized; and extreme monopoly, like compartmentation, is one of the sordid forms of state controlled enterprise. It is not free, and is not in the spirit of that part of the Atomic Energy Act quoted by Mr. Lilienthal in his foreword. Accordingly, the reader, after further charitable meditation, could justly class the whole content of the books along with W. C. Fields' fabulous, three legged ostrich. And if it were not for the sobering undercurrent of both pleasant and unlovely fact now enmeshed with the

new elements, which would require the deep insight of another Saint Jerome to evaluate, he, the reader, might well dismiss the whole matter from his mind and, with Shakespeare, say

Mucho Ruido y Pocas Nueces.

DON M. YOST

The Strength of Plastics and Glass. A Study of Time-Sensitive Materials. By R. N. HAWARD, Ph.D. Research Chemist, Petrocarbon, Ltd., Manchester, England. Cleaver-Hume Press, Ltd., London, 1949. viii + 245 pages. Illustrated. 14 × 23.5 cm. Price, \$5.50.

From the sub-title it is obvious that Dr. Haward's book concerns itself with the properties of matter and their experimental and mathematical evaluation. He brings the techniques of the physicist, the chemist and the mathematician into play in the fields of glass and plastics, in both of which he has acquired experience. Cases covered vary from "rigid, brittle glasses capable of only slight deformations, to tough and flexible plastics." Findings are largely factual, and theories are presented only when accompanied by experimental findings. Symbols used in the text precede the descriptive chapters, on page viii, a practice worthy of emulation. The volume is well illustrated with 108 diagrams and 16 plates.

Chapter I on "Strength Relations" considers relations between mechanical properties, comparing *similar* qualities with *similar* dimensions and postulating that "the three basic quantities involved in the theory of strength" are "static strength, deformation and energy measurements" (4 references).

Chapter II on "The Static Strength of Plastic Materials" discusses methods of testing; conditions of moulding; theoretical and real tensile strength, variation of tensile strength with chain length in straight chain polymers; chain structure and tensile strength; effect of temperature on the tensile strength of thermoplastic materials and thermosetting resins; effects of plasticisers and substituent groups; the time factor; bending, shearing and compressive strength; effect of atmospheric agencies (62 references).

Chapter III on "The Static Strength of Glass" begins with a brief consideration of statistical methods followed by studies of the fracture of glass; theory of flaws; effect of surface treatment; strength as a function of form and size; effect of composition; effect of rate of stress application on static strength; theory of static fatigue; variation of strength with temperature; the cracking of glass; toughened glass; other strength properties (77 references).

Chapter IV "The Deformation of Plastics and Glass" begins with the ordinary or Hookean deformation, followed by deformation of glass; then elastic deformation of plastic materials; non-ideal deformation of plastic materials; effect of temperature on high elasticity-mechanical measurements; time effect in retarded elasticity; effect of molecular weight on time factors in high elastic deformation; relaxation and time treatment; empirical treatment of deformation; limit of extensibility; viscous flow; molecular theory of flow; deformation of thermosetting resins; tests based on deformation (108 references and many illustrative plates of fractures and apparatus).

Chapter V on "Hardness and Related Subjects" begins with forces surrounding a spherical body in contact with a plane surface, then applies the Hertzian equations to glass and follows with measurements applicable to plastics

and glass. Next abrasion hardness of plastics and glass is considered with scratch hardness, with measurement of indentation hardness of plastics and the effects of molecular weight thereon. A theoretical approach to indentation hardness ensues (29 references are given).

Chapter VI is a comprehensive study of the "Impact Strength of Plastics and Glass." First come major theoretical factors in impact strength, such as time, adiabatic effect; bending relations, weight factors, vibrational influences and other effects follow. After impact strength tests on glass, including velocity effects, come methods for testing plastic materials with application of theories of impact strength and their relation to highly elastic deformation. There are flexibility, deformation and brittle-point tests with the influence of velocity, time, weight, friction, etc. Bullet and pendulum impacts come next and then notching influence. Repeated blows and damping effects conclude the chapter with a discussion of damping-resilience relationship (63 references).

The last Chapter, VII, is entitled "Some Characteristic Properties of Complex Materials" and deals with rigid composite beams, rigid solids and with thin adhesive binders; also expanded plastics. The directional strength of laminated materials and mechanical strength of laminated materials are given attention. There are not only the cellulose derivatives but fiber-glass laminates (35 references).

Dr. Haward has compiled a small but valuable volume on testing methods and findings for technologists in the fields of plastics and glass.

ALEXANDER SILVERMAN

BOOKS RECEIVED

June 10, 1950–July 10, 1950

L. F. AUDRIETH (Editor-in-Chief). "Inorganic Syntheses, Volume 3." McGraw-Hill Book Company, 330 West 42nd Street, New York 18, N. Y. 1950. 230 pp. \$3.75.

HANS-G. BOIT. "Fortschritte der Alkaloidchemie, Seit 1933." Scientia Chimica, Band 2. Akademie-Verlag G.M.B.H., Presseabteilung, Schiffbauerdamm 19, Berlin NW 7, Germany. 1950. 425 pp. Paper, 49 DM; bound, 53 DM.

H. MARK AND E. J. W. VERWEY (edited by). "Advances in Colloid Science, Vol. III." Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y. 1950. 384 pp. \$7.50.

METHUEN'S MONOGRAPHS ON PHYSICAL SUBJECTS. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1950. \$1.25 each: F. L. ARNOT. "Collision Processes in Gases." 104 pp. R. W. JAMES. "X-Ray Crystallography." 88 pp. R. C. JOHNSON. "Atomic Spectra." 120 pp. MARTIN KNUDSEN. "The Kinetic Theory of Gases." 64 pp. W. EWART WILLIAMS. "Applications of Interferometry." 104 pp. B. L. WORSNOP AND F. C. CHALKLIN. "X-Rays." 126 pp.

G. FREDERICK SMITH. "Analytical Applications of Periodic Acid and Iodic Acid and Their Salts." The G. Frederick Smith Chemical Company, 867 McKinley Avenue, P. O. Box 1611, Columbus, Ohio. 1950. 108 pp. \$1.00.