

BOOK REVIEWS

Organophosphorus Monomers and Polymers. By YE. L. GEFTER, Institute of Element-Organic Compounds, Academy of Sciences of the U. S. S. R. Translated from the Russian by J. BURDON, Ph.D. Pergamon Press Ltd., Headington Hill Hall, Oxford, England. 1962. vii + 302 pp. 17.5 × 25.5 cm. Price, \$12.50.

This monograph illustrates the extent to which the research amongst organophosphorus compounds has progressed in the past decade. The few of us who have been "in the game" since the pre-World War II days have expected a proliferation of research in this area of chemistry, but, I dare say, few of us were expecting quite such a flood of published matter during the past several years as has been realized.

The 300-odd pages of this book provide a coverage of organic compounds of phosphorus which may be defined either as raw materials or monomers or as phosphorus-containing polymers. A small part of the book is devoted to general matters of nomenclature and some of the basic facts of phosphorus chemistry. The main bulk of material is very aptly described by the title.

The material dealing with monomers and polymers is arranged mainly in the form of tables which, in turn, are arranged according to the structural types of substances included. Thus, the search for specific substances is relatively facile, although the formal index is rather meager by current American standards. The literature coverage appears to be quite adequate, the general descriptions of the products found in the tabulated part of the book are sufficient for survey purposes and the physical make-up of the book is good. The Western price of the book is, of course, many times that of the Russian original.

However, there are some drawbacks both in the original edition and in the translation, when these are judged by current American standards. The theoretical discussion of matters on hand is totally lacking; that is to say, a good number of equations are given in order that the reactions be properly illustrated. Beyond this, however, no truly theoretical summarization is provided at any significant level. Thus the book presents and digests published facts, but goes no further than published material. The areas of physical applications are shown in purely illustrative manner, again without any substantial theoretical back-up. Much of this information is taken directly from patent claims without critique.

The translator, as expected, uses the English idiom which might trouble some American readers. However a more serious difficulty arises in the translated nomenclature since at times the translator does not follow the English-American agreement which has existed for a decade in the area of phosphorus nomenclature and which has been adopted by the English speaking scientists (or perhaps: English and American scientists). Hence occasional use of "old fashioned" names of phosphorus compounds appears in the book; these are readily understood by the old-timers like the reviewer, but may cause difficulty amongst the late-comers.

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Small Particle Statistics. An Account of Statistical Method for the Investigation of Finely Divided Materials. Second Revised Edition. By G. HERDAN, M.Sc., Ph.D., LL.D., Lecturer in Statistics, University of Bristol. With a Guide to the Experimental Design of Particle Size Determinations. By M. L. SMITH, Ph.D., F.R.I.C., W. H. Hardwick, M. A., B.Sc., and P. CONNOR, A. R. I. C., Atomic Energy Research Establishment, Harwell. Academic Press Inc., 11 Fifth Avenue, New York 3, N. Y. 1960. xxiii + 418 pp. 16 × 25.5 cm. Price, \$14.50.

The first Edition of 1952 treated the theory of both the number and physical statistics of particles in the sieve and subsieve size range; it was well received. The revisions of the general section in the second Edition are primarily in the form of additions, notably in the chapters on mixing, theory and practice, molecular weight distribution of polymers, analysis of variance and graphical representation of distributions of particulate matter. Under Experimental Procedures more attention is now paid to the size range below 2 microns, the application of centrifuge methods, use of automatic counting procedures. A new chapter on the application of radio-isotopes as tracers for the sedimentation method has been added. Most of these additions have been well

treated and indexed. Unfortunately, when they turn to physical methods and theories, the authors are on less certain ground.

The new chapter on aerosols and particularly the treatment under light scattering is disappointing. The statement (p. 377) "that the "Owl," the Slope-O-Meter... although of proven worth for the comparative assessment of liquid monodisperse aerosols containing spherical particles, they are of little value for solid aerosols, which are generally polydisperse etc." is no longer correct in the light of recent extensions of the light scattering methods presented at the Potsdam, N. Y., Interdisciplinary Conference on Electromagnetic Scattering (August, 1962). Both solid and irregularly shaped are now yielding to the basic methods developed for these two elementary instruments.

The authors have missed a long series of papers, published mostly in the *Journal of Colloid Science* (1946 to date), and as A. E. C. reports, dealing with the applications of light scattering to aerosols and hydrosols which are pertinent to this chapter; also papers of this reviewer and his collaborators; viz., V. Drozin on Filtration Solid Aerosols (2nd. Int. Cong. Surface Activity, III, 601), and on Particle Size Distribution by Precipitation of Charged Particles (*J. Colloid Sci.*, 14, 74 (1959); P. K. Lee, Forward Angle Light Scattering for Determining Size of Individual Aerosol Particles and their Size Distribution, *Rev. Sci. Instr.*, 24, 104 (1954); R. Gruen and P. Gendron, The Growth Method, (*Trans. Faraday Soc.*, 48, 410 (1952); I. W. Plesner, Polymers by H.O.T.S., (*J. Polymer Sci.*, 24, 147 (1957)).

The very useful and important Coulter Counter which measures accurately and rapidly, by electrical conductance, particle size distributions in hydrosols has been on the market for some years, but is not mentioned (R. E. Wachtel and V. K. La Mer, *J. Colloid Sci.*, 6, 531 (1962)).

(P. 1) Light scattering does not always increase with fineness. The scatter decrease with increase in size in the range 0.3 to 0.8 micron range depending upon the index of refraction with the result that red is scattered better than blue light contrary to the Rayleigh law (V. K. La Mer, *J. Phys. Chem.*, 52, 65 (1947)).

Omissions and minor errors of this type are counterbalanced by an authoritative presentation of statistical methods, so that the book can be warmly recommended to all interested in this growing field.

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Process in Dielectrics. Volume 4. By J. G. BIRKS, Ph.D., D.Sc., F. Inst. P., General Editor. Professor J. HART, Ph.D., American Editor. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1962. vii + 311 pp. 16 × 25 cm. Price, \$12.00.

This volume contains review articles on six special topics selected from the general field of dielectrics; five of these cover subjects which have not been treated in the previous three volumes of the series. The subjects and authors are as follows: Microwave Spectroscopy of Gases, J. Sheridan (The University of Birmingham), pp. 1-36, 149 references; Dispersion and Absorption of Microwaves in Gases and Liquids, K. H. Illinger (Princeton University), pp. 37-100, 367 references; Ferroelectricity, W. J. Merz (Laboratories RCA Ltd., Zürich), pp. 101-149, 212 references; Theory of Gas Breakdown, T. W. Dakin and D. Berg (Westinghouse Central Laboratory, Pittsburgh), pp. 151-198, 160 references; Conduction and Breakdown in Liquid Dielectrics, A. H. Sharbaugh and P. K. Watson (General Electric Research Laboratory, Schenectady), pp. 199-248, 89 references; Static Electrification, Part I, L. B. Loeb (University of California, Berkeley), pp. 249-309, 37 references.

In the first article, Sheridan briefly reviews the present status of experimental methods in this relatively new field of spectroscopy and then outlines the analysis of the spectra (rotation bands, inversion spectra, nuclear quadrupole hyperfine structure and Stark effects). The chapter concludes with a discussion with examples of the information which can be derived from microwave spectra (internuclear distances and angles, dipole moments, and molecular force fields). Illinger discusses the transition from resonant to non-resonant absorption which occurs as the pressure is increased, giving a review of the various theoretical treatments of pressure broadening. Next, the liquid state is considered, and the correlations between the macroscopic delay time and the molecular relaxation time are discussed. Numerous examples of

recently measured relaxation times are included. The chapter closes with a brief mention of several other effects which involve rotational relaxation: structure of the scattered Rayleigh line, nuclear spin-lattice relaxation and ultrasonic relaxation.

Merz describes the structures which are characteristic of soft and hard ferroelectric materials and then reviews recent research on the various properties of ferroelectrics. Domain formation and domain wall motion are presented in considerable detail. This section closes with a catalog (5 pages) of ferroelectric materials, many of them discovered only recently.

The basic processes (impact ionization, electron capture, photoionization and cathode emission) involved in gas breakdown are discussed by Dakin and Berg. Breakdown in uniform fields, with a detailed presentation of the Townsend mechanism and then breakdown in non-uniform fields are next presented. Selected experimental results are used to illustrate the discussion. This chapter closes with a discussion of the statistical and the formative time lags involved in gas breakdown. Sharbaugh and Watson then present a review of breakdown in liquids, after an introductory section on the conductance of "insulating" liquids. Experimental work on breakdown in liquids since the review by T. J. Lewis on the same subject in the first volume of this series is summarized, and finally several hypotheses regarding the mechanism of breakdown in liquids are critically considered.

The final paper considers "all processes for producing the segregation of positive and negative electrical charges by mechanical actions which operate by contact or impact between solid surfaces, solid and liquid surfaces, or in the rupture or separation of solid or liquid surfaces by gases or otherwise, including also the action of ionized gases. These processes may involve frictional, contact or tribo electrification, spray electrification and electrification in dust, snow or thunderstorms." A wide variety of phenomena are discussed; this review will be continued in the next volume of the series.

The book is well written and contains excellent bibliographies for the special fields covered. It is, however, a book written by experts for experts and is not intended for the general reader. It is recommended to libraries and to specialists in dielectrics.

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Molekulverbindungen und Koordinationsverbindungen in Einzeldarstellungen. Elektronen-Donator-Acceptor-Komplexe. By GUNTHER BRIEGLEB, o. Professor der Physikalischen Chemie an der Universität Würzburg. Springer-Verlag, Heidelberger Platz 3, Berlin-Wilmersdorf, Germany. 1961. x + 279 pp. 16 × 23.5 cm. Price, DM. 48--.

This is an authoritative account written by one whose own contribution to the study of molecular complexes has been outstanding during the last decade. No other work even approximates the very thorough coverage of Dr. Briegleb's book which is a "must" for everyone interested not only in molecular complexes themselves but also in the more general area of solution spectroscopy, solvent effects, equilibria in solution, etc.

It excludes in its coverage only the complexes of metal ions with electron pair donors, complexes involving "biochemical" molecules, and the study of situations in which complex formation is rapidly followed by chemical reaction. The omissions are probably justified, since these areas are either insufficiently studied, or have developed along lines rather different from those around which Dr. Briegleb's work is focused.

The subject is treated primarily for the spectroscopic standpoint. This is inevitable since the study of charge-transfer spectra has been the most useful single tool, and has been the authors own special field. Other areas of study are not neglected, however. A fairly complete account is given of the investigation of dipole moments of complexes, another subject to which the author is a distinguished contributor, the determination of equilibrium constants, and thermodynamic properties. The scanty X-ray data on the geometry of charge-transfer complexes are also reviewed. The spectroscopic coverage is not entirely restricted to charge-transfer spectra. Shifts in infrared frequencies observed on complexing are well covered, as is the rather less extensive work on changes in the higher-energy absorption bands of the components on complex formation.

Useful tables of charge-transfer band positions and intensities are included. The range of donor molecules covered is very wide. That of the acceptors is more limited, but includes as well as the halogen, chloranil and trinitrobenzene "old stagers" a good deal of more recent work on such substances as tetrachlorophthalic anhydride and tetracyanoethylene.

Theoretical aspects of the subject are fairly well dealt with—essentially from the standpoint developed by Mulliken. In the interest of consistency in his own treatment, however, the author has re-formulated several of the well-known approaches in his own terms. For the reviewer at least this made, for example, the Mulliken-Orgel treatment of contact charge transfer, or of

the equilibrium between several isomeric C.T. complexes seem rather unfamiliar. Even the Benesi-Hildebrand treatment of simple charge-transfer equilibria suffers some inversions and changes of notation. Nevertheless it must be admitted that Briegleb's approach may make easier reading for the student entering the field than are the original materials.

On the negative side, a good many interesting phenomena are presented without much attempt at interpretation, either in terms of more sophisticated quantum theory than that presented in the theoretical section, or even in terms of precise assignments of energy levels involved. Thus, for example, although several general reasons are given for the appearance of more than one charge-transfer band in certain complexes, none of the several examples quoted is assigned precisely to a specific cause. The question of the symmetry of components and complex also receives scant treatment.

A brief section at the end deals with the rapidly developing area of semiconductivity, photoconductivity, E.S.R. spectra and the general "solid state" approach to the study of donor-acceptor complexes. One gets the impression that this material has been added as an afterthought and that it is less complete and perhaps less well-organized than the rest of the book.

Nevertheless there are few serious criticisms that can be made of such an admirable work and the above remarks refer to what are relatively minor defects.

References are included up to the middle of 1960 and form the most comprehensive collection of donor-acceptor studies available for those wishing to survey the field.

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Kern- und Radiochemie. Grundlagen. Praktische Methoden und Technische Anwendung. By ROLAND LINDNER, Lehrstuhl und Institut für Kernchemie der Technischen Hochschule Göteborg/Schweden. Springer-Verlag, Heidelberger Platz 3, Berlin-Wilmersdorf, Germany. 1961. xii + 369 pp. 16.5 × 24 cm. Price, DM. 49.80.

Lectures in a two-semester course in Nuclear and Radiochemistry at Göteborg led to a manuscript written in Swedish and later translated into the German for this book. The text is designed primarily for chemists, physicists and engineers, though it is admitted that the chapters on nuclear theory may seem elementary to the physicist.

After an introductory chapter on the structure and properties of the atomic nucleus there are chapters dealing with radioactivity, nuclear reactions, nuclear chain reactions and reactors, radiation danger and protection, determination of radioactivity, radiochemical separation of the important, commonly used radioisotopes, reactor chemistry, and finally a discussion of numerous scientific and technical applications. Topics which are generally regarded as falling within the compass of nuclear chemistry comprise approximately forty per cent of the book.

The topics that are covered have been done well. The text is up-to-date as indicated by the inclusion of such material as the discovery of elements 102 and 103, the Mössbauer effect and the selection of applications of radioactivity. With a number of good texts published in English available there will be little appeal of "Kern- und Radiochemie" to those who prefer not to do their reading in a foreign language.

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High Polymers. Volume XV. Radiation Chemistry of Polymeric Systems. By ADOLPHE CHAPIRO, Laboratoire de Chimie Physique de la Faculté des Sciences de Paris, Paris, France, and Laboratoire de Chimie des Radiations du Centre National de la Recherche Scientifique, Bellevue (S. et O.), France. Interscience Division, John Wiley and Sons, Inc., 440 Park Avenue South, New York 16, N. Y. 1962. xvi + 712 pp. 16 × 23.5 cm. Price, \$21.00.

Over the past ten years radiation chemistry of polymeric systems has been one of the most actively studied fields of science and technology. In earlier years anyone could stay abreast of the entire field of radiation chemistry and polymers by reading a small number of papers. Now, with a plethora of theoretical and applied publications in this field, anyone desiring full information would have difficulty keeping abreast of publication abstracts much less complete articles. Dr. Chapiro's book fills the need for a comprehensive and up-to-date review of the subject matter. The text gives a comprehensive survey of polymerization initiated by ionizing radiation followed by a detailed discussion of radiation effects in natural and synthetic polymers.

The author's prose style is clear and incisive and makes the book a pleasure to read.