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 BOOK REVIEWS
 

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**Chemistry of Carbon Compounds. Volume III. Part A. Aromatic Compounds.** Edited by E. H. RODD, D.Sc., F.C.G.I., F.R.I.C., Elsevier Press, 402 Lovett Boulevard, Houston, Texas. 1954. xxiv + 685 pp. 16.5 × 23 cm. Price, single volume \$17.50, subscr. \$15.00.

This volume is another in the excellent series edited by Dr. Rodd. The burden of its preparation, at least in the descriptive portions, appears to have fallen largely to Dr. W. J. Hickinbottom, although other chapters have been prepared by J. Chatt, Z. E. Jolles and particularly, an excellent introductory and theoretical chapter by C. K. Ingold, D. H. Hey and G. H. Williams. The book is warmly recommended.

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MARSHALL GATES

**Hydrogen Peroxide.** American Chemical Society Monograph. No. 128. By WALTER C. SCHUMB, Professor of Inorganic Chemistry, CHARLES N. SATTERFIELD, Associate Professor of Chemical Engineering, and RALPH L. WENTWORTH, Industrial Liaison Officer, Massachusetts Institute of Technology. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N.Y. 1955. xiii + 759 pp. 16 × 23.5 cm. Price, \$16.50.

This long awaited monograph on hydrogen peroxide is actually the first book-length treatment of the subject in English. Even after closely following the progress of this work, first circulated in report form, this reviewer could not help but wax enthusiastic over the final presentation. The collective effort of three authors actively engaged in research on hydrogen peroxide, the new book is the outcome of a long-term program of study sponsored by the Office of Naval Research. That it embraces all aspects of the chemistry and technology of hydrogen peroxide may be gathered from its size and the extensive bibliography—more than 2,500 literature references.

By way of introduction the history of hydrogen peroxide is traced back to the days of its discovery by the French chemist Thenard, whose work is duly appraised. Then the slow progress throughout the last century and the rapid development, following the advent of the electrolytic manufacturing process in the late twenties, are broadly outlined. One thus learns from Fig. 3, that the volume of production of the chemical in the United States has more than doubled during each of the last three decades.

Chapters 2 and 3 deal with the formation and manufacture, first from water or oxygen, then from peroxy compounds. A valuable feature of the treatment is the inclusion here and there of related topics such as, for instance, the oxygen-hydrogen reaction summarized, adequately for the purpose, in about a dozen pages. The electric discharge and irradiation methods are considered next, followed by the various oxidation processes which are fast gaining importance in the industry.

The electrochemical persulfate processes, on which the bulk of the world production of hydrogen peroxide still depends, are then presented in as much detail as trade secrets would allow. Incidentally, an amusing consequence of this problem of industrial secrecy may be seen here as the 15 figures representing process flow-sheets or actual photographs of plant equipment were all taken from German plants. . . just after the last war, to be sure. Thus the unaware reader might well reach the conclusion that hydrogen peroxide is manufactured only in Germany. Chapter 4, titled Processing, deals with purification, concentration and handling of hydrogen peroxide. A survey of suitable structural materials and a discussion of the explosive characteristics of concentrated peroxide will, no doubt, prove of great practical value.

The next four chapters are devoted to the purely scientific aspects of the subject. First, there is an extensive as well as critical account of the various physical properties which

takes up more than 100 pages. As a rule the authors sum up their discussion of the data in the literature by selecting a set of recommended values for each property. Chapter 6, devoted entirely to the question of molecular structure, provides some most instructive reading, even for those only casually interested in hydrogen peroxide. The chemical properties are considered in the next chapter mostly from the stand-point of reaction mechanisms and solvent character. Reactions with inorganic, organic and biological substances are dealt with in turn.

The decomposition processes, of foremost importance in peroxide chemistry, form the subject of Chapter 8. Here the profuse literature on this much studied phenomenon had to be condensed drastically, greater emphasis being given to the more recent work. Then the practical aspect of decomposition is considered in Chapter 9, on stabilization. Analysis and uses each take up one chapter and the text ends with a classification of peroxy compounds and 6 pages on notation and symbols alone. Both the name and subject indexes are well detailed, which increases considerably the usefulness of this excellent book.

The physical presentation is first rate, as is customary for this series of ACS Monographs. The price may appear rather high at first sight, although considering the scope of the project and the vast amount of work that went into its realization, it is by no means unreasonable.

LAVAL UNIVERSITY, QUEBEC, CANADA      PAUL A. GIGUÈRE

**Diffusion and Heat Exchange in Chemical Kinetics.** By D. A. FRANK-KAMENETSKIĬ. Translated from the Russian edition by N. Thon. Princeton University Press, Princeton, New Jersey. 1955. xii + 370 pp. 15 × 23 cm. Price \$6.00.

This book on "Diffusion and Heat Exchange in Chemical Kinetics" by D. A. Frank-Kamenetskii brings up to 1947 the Russian developments in the fields of mass and heat transfer as applied to chemical reactions uncatylyzed by solid surfaces. The counterpart developments in these same areas in the United States are scarcely mentioned. This text has been well translated by N. Thon into an easily readable style.

The first five chapters deal with diffusional problems associated with chemical reactions. Attention is concentrated on combustion in both homogeneous and heterogeneous systems with particular attention to the combustion of carbon. The author gives little or no reference to the extensive developments in the United States, brief mention is made of the work of Hottel, of King, and of Rice, but no mention is made of the five great symposia on combustion, flame and explosion phenomena held in the United States from 1928 on, nor of the readily available publications of the Bureau of Mines, and of Lewis and von Elbe. The subject of surface reactions catalyzed by solids and the associated phenomena of activated adsorption and desorption are ignored. The extensive work of mass and heat transfer to granular beds developed in the United States is not mentioned. Apparently no extensive work in these latter areas had been conducted in Russia up to 1947.

The scope of this text covered by ten chapters is briefly outlined herewith.

1. Principles of diffusion and the transfer of heat, mass, and momentum in laminar and turbulent flow are presented in elementary terms.

2. Diffusional kinetics are developed for non-catalytic heterogeneous systems with reactions taking place in the diffusional range and with the solid reactant. An excellent summary is given of Russian experiments on the combustion of carbon and on the dissolving of metals. The termination of chain reactions on the walls of reactor vessels is discussed. Diffusional kinetics of complex reactions with several diffusing substances for parallel and consecutive reactions are presented. A mathematical treatment is given for diffusion and non-catalytic reaction in porous solids without any

evaluation of the effective diffusion coefficients and effective rate constants.

3. This chapter deals with the Stephan flow which is mass flow perpendicular to a surface resulting from non-equi-volume counter diffusion in a heterogeneous reaction.

4. The theory of simultaneous heat and mass transfer is presented for conditions of non-isothermal diffusion.

5. After four chapters devoted to diffusion and heat transfer these phenomena are combined with the chemical kinetics of non-catalytic heterogeneous reactions. Dimensional analysis is applied to the rate of transfer in turbulent and laminar layers for both gases and liquids. The alternate theory of Landau and Levich is presented. These latter investigators deny the presence of a laminar layer in turbulent flow. A comparison is given of the different assumptions made in calculating velocity distributions in turbulent flow by the methods of Prandtl, Frank-Kamenetskii, and Karman. Diffusional equations are extended to fluidized solids, that is, to suspended particles moving with the fluid stream.

6. Several theories of combustion, thermal ignition, thermal explosion and flame propagation are developed by the methods of dimensional similitude. The theories of Darnell and of Zeldovich are included.

7. Methods of calculating temperature distribution in thermal explosions taking place in differently shaped reaction vessels are presented and supported by experimental evidence.

8. The rate of flame propagation under still conditions is developed with discussion of the effect of mixing of combustible gases with air. The propagation of flame by shock waves is not presented.

9. The dependence of the rate of non-catalytic heterogeneous exothermal reactions upon simultaneous diffusion and heat transfer is present from the phenomena of ignition and extinction with correction for Stephan flow and thermal diffusion.

10. In the final chapter periodic processes and transient phenomena in chemical kinetics are introduced without elaboration.

This text is an excellent review of the developments in Russia to 1947 of diffusional phenomena associated with the kinetics of reactions uncatalyzed by solid catalysts.

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#### Determination of Organic Structures by Physical Methods.

By E. A. BRAUDE, Imperial College of Science and Technology, London, England, and F. C. НАСНОД, Sterling-Winthrop Research Institute, Rensselaer, New York, Editors. Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1955. xiii + 810 pp. 16 X 23.5 cm. Price, \$15.00.

Modern organic chemists are very alert to the possibilities of using physical methods to aid solution of their structural and analytical problems. Almost all active organic research groups are now equipped with accurate and efficient recording ultraviolet and infrared spectrophotometers which will probably be generally implemented by Raman and nuclear magnetic resonance spectrometers within the next few years. In active use, such instruments quickly repay their large initial investment through savings of time and materials and, in combination with the more traditional arsenal of physical methods, have facilitated syntheses and structure determinations of extraordinary difficulty. Unfortunately, a practicing chemist often has trouble in learning about the capabilities of the various physical methods as well as where and how a given technique can be applied to his research. The present volume is almost ideally set up to enable an organic researcher or student with a modicum of physical theory to locate illustrative examples and references for the

application of some thirty physical methods to the determination of organic structures.

The work has twenty-two authors in all but nonetheless the style is pleasingly uniform and the degree of duplication small. The fifteen chapters range from 18-88 pages and are generally organized so as to have a brief introduction followed by some description of experimental procedures and finally by theory and examples. The level of presentation is uniformly high but, in the opinion of the reviewer, not unduly so. The only exception is the chapter on magnetic susceptibility (and nuclear magnetic resonance absorption) which is almost wholly theoretical and will be largely incomprehensible to anyone who lacks the equivalent of an advanced course in electricity and magnetism. This is quite unfortunate in view of the current rapid development of high-resolution nuclear magnetic resonance spectroscopy as applied to organic compounds. Many interesting subjects are covered which are relatively unusual to a book of this character such as selection rules in Raman spectroscopy, structure determinations from heat capacity and entropy measurements, microwave spectroscopy, properties of surface films, and the use of dissociation constants for determination of structures of natural products. Each chapter is very thoroughly documented and, in all, some 1800 literature citations are given.

The book is attractively printed except for a number of needlessly distorted typeset formulas as on pp. 359, 386, 397, 408, 629, 641, 653, and 701. Few typographical errors were encountered.

This volume is warmly recommended to both students and organic research workers as a useful and informative reference book.

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**Handbook of Hydrocarbons.** By S. W. FERRIS, Chief, Industrial Products Section, Research and Development Department, Sun Oil Company, Marcus Hook, Pennsylvania. Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1955. ix + 324 pp. 16 X 23.5 cm. Price, \$8.50.

This excellent summary of hydrocarbons is not recommended for an afternoon of light reading. The introduction, covering 17 pages is a most informative and instructive dissertation on chemical nomenclature. Anyone at all interested in this subject should certainly read Mr. Ferris' introductory remarks.

The remainder of the book is an excellent compilation of data on physical properties of hydrocarbons. It should prove to be invaluable to those needing information either about a specific hydrocarbon or about compounds present in a cut of known boiling range. The properties covered are boiling point, melting point, index of refraction and density. Data available in the literature up through the early part of 1954 are included. The information is presented by means of four tables. Table A lists hydrocarbons in the order of their boiling points at 760 mm. Methods of correcting boiling points to other pressures are given in the Appendix. Table B arranges hydrocarbons in groups of the same molecular weight and type, *i.e.*, alkanes, alkenes, cyclanes, aromatics, etc. This table is useful when either a systematic name, structural formula or empirical formula is known. Table C lists alternate names for the compounds listed in the previous Table. Table D gives names, carbon-hydrogen numbers, and numbered structural formulas for representative cyclic hydrocarbons.

The book is extremely simple to use and Mr. Ferris is to be congratulated for making it available to other workers in the field of hydrocarbon chemistry.

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