

Book Reviews*

Chemical Evolution and the Origin of Life. Edited by R. BUVET (Faculté des Sciences de Paris) and C. PONNAMPERUMA (NASA Ames Research Center). American Elsevier, New York, N. Y. 1971. xi + 560 pp. \$25.50.

This book contains the proceedings of the Third International Conference on the Origin of Life, held at an undisclosed date and place. After introductory addresses by two pioneers in the field, A. I. Oparin and M. Florkin, there follow 58 papers, with illustrations and references, classified into the following sections: General and Theoretical Problems; Synthesis of Small Molecules; Oligomers and Polymers; Photochemical Processes; Origin of Biological Structures, Primitive Biochemistry and Biology, and Exobiology. A list of participants (numbering no more than the number of papers) and a subject index conclude the book.

Rodd's Chemistry of Carbon Compounds. Second Edition Volume III. Part A. Edited by S. COFFEY. Elsevier, Amsterdam, London, New York. 1971. xx + 559 pp. \$33.75.

Volume III of this familiar series deals with aromatic compounds, and Part A of this new edition covers mononuclear hydrocarbons, their halogeno derivatives, and derivatives with substituents attached through O, S, Se, and Te. The entire text has been rewritten thoroughly, and the references are drawn heavily from the two decades since the appearance of the first edition. Unhappily, no statement is made of the date at which the literature coverage stopped, but a casual survey did not turn up any references dated later than 1969.

Particular attention has been given to revising the introductory chapter, in which aromatic character and aromatic substitution are taken up. A superbly detailed index (55 pp) augments the usefulness of this important work.

The Organic Chemistry of Tin. By WILHELM P. NEUMANN (University of Dortmund). John Wiley & Sons, Inc., New York, N. Y. 1970. xiii + 282 pp. \$15.50.

Professor Neumann's monograph of 1967 has been translated into English and extended to cover the literature up to the beginning of 1969. More than 1000 references are cited which cover most of the aspects of interest to the practicing chemist. The broad field of organotin chemistry is presented in 25 chapters including three chapters on the organotin hydrides. A brief chapter describes nonspectral methods of analysis including references to various chromatographic techniques. The chapter on spectral methods includes tables containing extensive listings of infrared and Raman values including assignments and nmr (both proton and tin) data for many classes of tin compounds including some hydrides. Mössbauer spectroscopy is also covered but in less detail.

A. A. Reidlinger, *Long Island University*

Advances in Electrochemistry and Electrochemical Engineering. Volume 8. Edited by P. DELAHAY and C. W. TOBIAS. Wiley-Interscience, New York, N. Y. 1971. xi + 406 pp. \$24.95.

This series of "Advances" generally alternates volumes devoted to electrochemistry and those devoted to electrochemical engineering. Volume 8, edited by C. W. Tobias, is devoted to electrochemical engineering, but deals exclusively with energy conversion, not necessarily limiting itself to engineering aspects. Generally, the chapters are written by individuals who have intimate knowledge of their areas as a result of long-range experimental research and development involvement.

The first chapter by B. B. Owens gives an excellent review of the entire area of solid electrolyte research, beginning with pioneering work of Takahashi and Yamamoto. It covers the thermodynamic basis of cells and mechanisms of reactions which are the basis of instability of solid electrolytes. The chapter concentrates on the isostructural group of compounds, $M\text{Ag}_3\text{I}_3$, whose comparatively high conductivity (in relation to previously known solid ionic conductors) has provided a breakthrough in the area of solid electrolyte batteries.

The interesting chapter on thermal phenomena in fuel cells (by Baker, Gidaspow, and Wasan) is, however, devoted too much to the thermodynamic aspects. The heat-transfer analysis is more

relevant to fuel cells than to batteries and does not offer to the battery-design engineer readily adaptable methods for heat-removal design from high-rate batteries.

The third chapter (by Burbank, Simon, and Willihnganz) is a very comprehensive and timely review of the nature of electrode materials and processes occurring in the lead-acid cell. The discussions of crystallographic and morphological aspects will be appreciated by those who seek a deeper understanding of this whole system.

The fourth chapter, entitled "Electrochemistry and Application of Propylene Carbonate" (by R. Jasinski), is, in reality, limited to applications in batteries and represents an effort to abstract various experimental findings, principally from government contract reports. The limitation to propylene carbonate is perhaps unfortunate since an emphasis on electrochemical galvanic systems, rather than on the solvent, would have been more useful. Another difficulty is that much of the cited data have not been critically evaluated or compared.

The final chapter (by E. J. Cairns) reviews a decade of research on the anodic oxidation of hydrocarbons in fuel cells. It deals with the adsorption, surface reaction, rate-determining steps, and overall reaction schemes. Finally, as should be expected in a volume concerned with chemical engineering aspects, it discusses complete hydrocarbon fuel-cell systems. The chapter represents an excellent background review, particularly for those interested in Teflon-bonded electrodes operating in phosphoric acid electrolytes.

M. Eisenberg, *Electrochimica Corporation*

Stability Constants. Supplement No. 1 (Special Publication No. 25). By L. G. SILLÉN and A. E. MARTELL. The Chemical Society, London. 1971. xii + 860 pp. £20 (\$50), post free.

In 1964, the original volume (Chemical Society Special Publication No. 17) was published in agreement with IUPAC and included a substantial compilation of stability constants of metal-ion complexes covering the literature through 1962. Supplement No. 1 attempts to cover the literature from 1963 to 1968, and also includes data published before completion of the original work but omitted from it. Corrections to entries in the original work are also listed.

The format for Supplement No. 1 corresponds to that of the original work, dividing the tables into parts covering inorganic ligands, organic ligands, and macromolecule ligands. Indexes appear for each of these three categories and also for metals and functional groups.

John M. Sullivan, *Eastern Michigan University*

Permselective Membranes. By C. E. ROGERS (Case Western Reserve University). Marcel Dekker, New York, N. Y. 1971. xi + 206 pp. \$14.50.

The volume consists of a collection of 13 select papers presented at the September 1969, ACS Division of Polymer Chemistry and Division of Colloid and Surface Symposium on Permselective Membranes in New York City. The transport of gases, vapors, electrolytes, and nonelectrolytes through permselective membranes is reviewed by experts in the field. Emphasis is on the relationship between membrane morphology and transport properties. Most authors present semiempirical or theoretical models to interrelate the data for various types of transport in terms of known membrane parameters and compare the calculated permeabilities with experimentally measured data. It is also demonstrated that permeability data can be used to elucidate the structure of certain polymeric films.

The general organization of the volume is good, and the chapters are logically arranged as to subject matter. The first five chapters investigate the transport of gases (dissolved and in the gas phase) through homogeneous and heterogeneous polymers. The effect on membrane permeability properties by temperature, pressure, and irradiation are considered. Membrane properties such as crystallinity, cross-linking, chain scission, segmentation, steric arrangement, and thickness are investigated. Chapter 6 examines the permeation of two closely related binary liquid mixtures (*n*-hexane and benzene) through polymer films and the effect of one component of the mixture on the diffusion of the other component. Chap-

* Unsigned book reviews are by the Book Review Editor.

ters 7 through 10 are basically concerned with transport of ionic and nonionic penetrants in H₂O-swollen uncharged and charged membranes. Asymmetric and homogeneous cellulosic membranes as well as ion exchangers are discussed. Diffusive, piezometric, and electroosmotic permeabilities and ion-exchange selectivity data are presented. The last chapter considers some of the factors that affect transport phenomena in homogeneous and heterogeneous membranes.

The volume furnishes a broad spectrum of current and pertinent information on permselective membranes and the factors that control their permeability properties. It will be useful to new and experienced workers in the membrane field.

Anthony B. LaConti, *General Electric Company*

Essays in Structural Chemistry. Edited by D. A. LONG (University of Bradford), A. J. DOWNS (University of Oxford), and L. A. K. STAVELEY (University of Oxford). Plenum Press, Inc., New York, N. Y. 1971. xxiv + 479 pp. \$27.50.

This book is dedicated to Professor Leonard A. Woodward upon the occasion of his retirement from the University of Oxford after nearly four decades and more than 100 publications, primarily in the field of Raman spectroscopy. The essays in this volume, written by his colleagues and former pupils, reflect his interest in spectroscopy and structural chemistry.

The eighteen chapters are independent reviews of topics in structural chemistry, of which eleven are written in terms of the kind of information obtained by infrared or Raman spectroscopy. The essays are all about the same length averaging 26 pages and are generally well documented, averaging 49 references. Without sacrificing accuracy or completeness, each author has succeeded in writing at about the same sophisticated level.

In the first chapter, J. W. Linnett discusses the correlation between force constants (stretching, bending, and interaction) and the structure and nature of bonding in many small inorganic molecules.

Chapter 2 (D. A. Long) is primarily a theoretical summary of the hyper-Raman effect, an approach to obtaining vibrational energy levels by "second order" Raman spectroscopy, when the transitions are normally observable only in the infrared. Outside of water and methanol, no interesting applications are described for this very recent technique.

W. H. Fletcher in Chapter 3 describes, about as clearly and compactly as can be possible, how vibrational assignments are made in small molecules through the use of molecular symmetry, characteristic group frequencies, electron rules, and band shapes. Many examples—inorganic and organic—are described.

Normal vibration frequencies for most pairs of heavy elements lie so far in the far-infrared that few measurements have been reported. G. W. Chantry describes in Chapter 4 how infrared interferometry, by avoiding the usual low-energy detector problems, permits measurements down to 2 cm⁻¹. Many inorganic examples are described.

Two topics are handled by I. R. Beatie in Chapter 5. First, he describes how small inorganic molecules may be studied in the vapor

phase at elevated temperatures by Raman spectroscopy, not only to establish structures, but also to characterize equilibria. In addition, the use of single-crystal Raman spectroscopy in making unambiguous vibrational assignments is described.

H. G. M. Edwards traces the history of Raman spectroscopy of gases in Chapter 6 and shows how the laser as a Raman source has solved many of the difficulties inherent in the use of low-intensity sources. Several interesting examples are described in detail, O₂, N₂, F₂, etc.

The effect of intermolecular forces between molecules at high pressures on the Raman spectra of simple gases is the subject of Chapter 7 (C. G. Gray and H. L. Welsh).

In Chapter 8, R. S. Krishnan compares the present state of development of lattice dynamical theories in predicting parameters obtained from Raman spectra of alkali halides.

In Chapter 9, S. Mizushima and I. Ichishima review the nature of atomic interactions in molecular, covalent, atomic, and metallic crystals.

Structural aspects of the Mössbauer effect are reviewed by J. F. Duncan in Chapter 10. Particular attention is given to chemical applications: valence states, symmetry of electron environment, magnetic interactions, single crystals, and reaction rates.

Chapter 11 (L. E. J. Roberts) is the only chapter not dealing at all with application of spectroscopy to chemistry. Rather it is concerned with nonstoichiometry in fluorite structures, especially of oxides and fluorides of selected lanthanides and actinides.

Chapters 12 (H. J. V. Tyrrell) and 13 (D. N. Waters) form a pair of essays concerned with solutions. The first is a phenomenological examination of solutions. The second essay describes infrared and Raman studies of solutions leading to understanding solvation and ionic interaction phenomena.

The application of infrared and Raman spectroscopy to the study of the Jahn-Teller effect is the subject of Chapter 14 (J. A. Creighton). Special attention is given to vibrational studies of molecules and ions in the gaseous state or in solution.

R. F. Barrow's contribution (Chapter 15) reviews the spectroscopic properties of diatomic oxides of the transition elements. Ground-state configurations, electronic transition, intermolecular distances, force constants, and dissociation energies are collected together for many metal oxides.

The first observation of a metal-metal stretching frequency was made by Dr. L. A. Woodward (Hg₂²⁺, 1934) to whom this book is dedicated. Most of the vibrational studies of metal-metal bonds, however, have been made in the past 10 years. Many of these are summarized in Chapter 16 by M. J. Ware.

Similarly, the structures and vibrational assignments for a large collection of organometallic compounds are reviewed in Chapter 17 by J. R. Hall, while H. L. Roberts summarizes the structural aspects of sulfur-fluorine chemistry in the final chapter.

In summary, "Essays in Structural Chemistry" provides in one volume a compact review of applications of infrared and Raman spectroscopy to structure and bonding in inorganic molecules. It is a readable source of recent developments and future trends.

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