

## Book Reviews\*

**Chemical and Catalytic Reaction Engineering.** By James J. Carberry (University of Notre Dame). McGraw-Hill Book Co., New York. 1976. xxi + 642 pp. \$22.50.

The first five chapters contain most of the standard material of a fourth year undergraduate chemical engineering course in kinetics and reactor design. A few additional topics can be chosen by the instructor from the remaining chapters, which cover gas-liquid, liquid-liquid, and fluid-solid noncatalytic reactors, and heterogeneous catalysis and appropriate reactors for them. A graduate course might begin at Chapter 4. The examples chosen are appropriate and the text is nicely written. It is also useful as a reference work, but chemists will have difficulty with most of the material, unless they are willing to learn heat and mass transfer and the mathematical language of chemical engineers. This large volume is packed with useful information, problems, references and additional references, and quotations. It is a bargain at \$22.50!

The industrial reactor is wonderfully complex with the kinetics complicated by transport processes and deactivating catalysts. These problems have been met directly without simplifying the situation unrealistically. The last three chapters describing the author's specialty are a substantial review of present knowledge of catalysis. The account of rate equations may seem overly pessimistic, but really is not. The Founder and Diabolic Delegate of the mythical Lucrezia Borgia Catalysis Society<sup>1</sup> is at home describing the mortality of catalysts. The last chapter discusses commercial catalytic reactors of fixed-bed, fluid-bed, transport-line, slurry, catalytic gauze, and trickle-bed types.

The combined author and subject index is not as useful as it might be, because it contains only part of the names mentioned; e.g., I had to thumb through Chapter 8 to find Lucrezia Borgia. The part on physical adsorption could be improved. The derivation of the B.E.T. equation seems superfluous in view of its unrealistic premises. More realistic graphs of isotherms would improve this section.

(1) Carberry, J. J. *CHEMTECH* 1974, 4, 124.

Robert B. Anderson, *McMaster University*

**Unconfined Vapor Cloud Explosions.** By Keith Gugan. Gulf Publishing Co., Houston, Texas. 1979. 168 pp. \$22.95.

Explosions of flammable gases mixed with air have caused damage, both to industrial plants and to the public at large (as encountered in explosions arising from ruptures of gas pipelines). The phenomenon has been known for a long time, but has only in the last decade received significant attention from a formally scientific standpoint. This situation is a direct result of the great theoretical complexity of this manifestation of reaction kinetics. This book results from an investigation initiated by The Institution of Chemical Engineers. It reviews major industrial accidents, presents a mathematical analysis of the phenomenon, and illustrates the results with some spectacular photographs, some of which are reproduced in color.

**The Particle Atlas. Edition Two. Volume V.** By Walter C. McCrone, John G. Delly, and Samuel J. Palenik. **Volume VI.** Edited by Walter C. E. McCrone. Ann Arbor Science Publishers, Inc., Ann Arbor, Mich. 1980. Vol. V, 310 pp. \$90.00. Vol. VI, 247 pp. \$90.00.

These two books are concerned with identification of fine particles of substances by means of microscopy, including traditional optical methods and scanning electron microscopy. The books are stated in the foreword to "bring particle analysis techniques up to date"; they are thus supplements to the four volumes published in 1973, and the page numbering continues from them. These volumes include many new substances, and two techniques new to the field: Hoffman modulation contrast, and laser Raman microprobe.

Volume V is subtitled "Light Microscopy Atlas and Techniques". About one-half of it is textual material, and the other half is a collection of beautifully presented color photomicrographs of specific substances, each with detailed annotation. There are chapters on the two new techniques mentioned above, and on dispersion staining, refractive index liquids, and microchemical reactions, and another group of chapters devoted to specific applications, such as Geographical Origin of Dust Samples, Air Pollutants, Particle Analysis in The Crime Laboratory, and Art and Archaeology. This volume closes with a literature survey and a cumulative index for Vol. I-V.

Volume VI, subtitled "Electron Optical Atlas and Techniques", is

similarly arranged. It includes chapters on improved electron optical techniques, methods of handling, and instrumentation. The advances over the past decade are impressive, and it is now possible to identify particles as small as  $1 \mu\text{m}$  in length. The illustrations, which constitute the major part of this volume, are fascinating and include a large variety of pollens, minerals, industrial chemicals, corrosion products, explosives, fibers, foods, pesticides, pigments, combustion products, etc. The book closes with a chapter on automation, a literature survey, and a cumulative index for Vol. I-VI. The wide application of these volumes is obvious. They are beautifully produced.

**Ammonia.** By Subcommittee on Ammonia, National Research Council. University Park Press, Baltimore, Md. 1979. xiv + 384 pp. \$22.50.

This is a work commissioned by a Division of Medical Sciences, NRC, in 1975, and undertaken by a committee of twelve, headed by Henry Kamin. The treatment of the subject is oriented about the role of ammonia as an environmental pollutant, but the coverage is broad enough to include a substantial coverage of physical, chemical, and analytical properties. Transportation, toxicology, effects on materials, etc., are systematically taken up, with thorough documentation (1109 references). The Subcommittee was charged with developing recommendations, which constitute the final chapter. They are somewhat detailed and make interesting reading, but can be summarized by the statement that, although ammonia can be both an industrial and agricultural hazard, it is not a major pollutant of the environment. Its manufacture, however, requires feedstocks that can be polluting (natural gas as a hydrogen and heat source, for example), and the Subcommittee emphasizes the importance of the search for alternative feedstocks and the breeding of plants for improved capacity for fixing nitrogen.

**Thiazole and its Derivatives. Part 3.** Edited by Jacques V. Metzger. John Wiley & Sons, New York. 1979. xii + 407 pp. \$70.00.

This completion of the three-part set on thiazoles, a part of the series *The Chemistry of Heterocyclic Compounds* under the over-editorship of A. Weissberger and E. C. Taylor, follows closely on the heels of the two earlier parts. Like them, this part reviews the subject up to December 1976. It contains three chapters: Mesoionic Thiazoles, by M. Begtrup and C. Roussel; Cyanine Dyes Derived from Thiazolium Salts, by Larivé and R. Dennilauler, and Selenazole and Derivatives, by R. Guglielmetti. Of these, the cyanine chapter is by far the biggest, being enough for a book in its own right.

This part has its own subject index, as do the other parts. It also carries an author index cumulative over all three parts. It is interesting to note with respect to the first and third chapters of this part that the completely unsubstituted parent nuclei, the triazole analogue of sydnone and selenazole, respectively, have not yet been prepared.

**Cumulative Index to the Mössbauer Effect Data Indexes.** Edited by J. G. Stevens, V. E. Stevens, and W. Gettys. IFI/Plenum Publishing Co., New York. 1979. vii + 358 pp. \$75.00.

A series of nine volumes of index was published over the period 1966-1976 and provides an exhaustive coverage of the literature of that period. The series is now capped with this Cumulative Index, which provides access to the approximately 10 000 refs in the nine volumes. There are three parts: isotope index, subject index, and author index. Everything is presented in computer printout form, and the entries give only the reference codes, which must then be looked up in the appropriate earlier volume. The short isotope index is in alphabetical order by element symbol. The subject index is according to a set of 500 key words used by the compilers of the bibliography, such as "dysprosium", "cryostats", "fine art", "magnetic moments", etc. The author index, which is by far the largest part, has each set of author entries broken down into the element and isotope concerned.

**Mass Spectrometry. Volume 5.** Edited by R. A. W. Johnstone. The Chemical Society, London. 1979. xii + 450 pp. \$55.00.

This volume is a selective review of the literature on mass spectroscopy published in the two-year interval from July 1976 to June 1978, and contains the work of 14 contributors in 13 chapters. These include, in addition to the expected standard topics, new chapters on photoelectron-photoion coincidence spectroscopy, organic geochemistry, and mass spectrometry in food science and in environmental sciences. These chapters are meant to review subjects of developing importance that have

\*Unsigned book reviews are by the Book Review Editor.

heretofore been either inadequately or diffusely treated. Further ad hoc chapters of this nature are promised for future volumes.

The Senior Reporter's foreword is engagingly written and records or implies the effort and the problems associated with keeping these Reports going. Furthermore, this volume contains a cumulative subject index for Volumes 1 to 5, a feature that must have required a great deal of work, but which is especially appreciated because the individual volumes do not have subject indexes at all.

**Indoles. Part Three.** Edited by W. J. Houlihan. John Wiley & Sons, New York. 1979. x + 586 pp. \$70.00.

This volume in the series "The Chemistry of Heterocyclic Compounds" consists of two large chapters: Hydroxyindoles, Indole Alcohols, and Indolethiols, by Thomas F. Spande, and Indole Aldehydes and Ketones, by William A. Remers. The subject of indoles will be completed by a fourth part, yet to come.

The treatment of the subjects is thorough and virtually encyclopedic, as is customary in this series. Tables of physical properties are both numerous and extensive, and the bibliographies are more than substantial (1062 and 596 refs, respectively) and include the patent literature. The closing date for literature search is in 1977. It is easy to find what one wants in this work, for the tables of contents are quite detailed, and there are both author and subject indexes, and the numerous and clear structures make scanning the text easy. The labor that the authors have put into producing this important work of reference deserves appreciation, and it will save others much time and exertion.

**An Infrared Spectroscopy Atlas for the Coatings Industry.** By a committee chaired by J. T. Vandenberg. Federation of Societies for Coating Technology, 1315 Walnut Street, Philadelphia, PA 19107. 1980. xi + 896 pp. \$100.00 (\$75.00 to Federation members).

Eleven years ago, the Federation of Societies for Coating Technology published a similar book to this one, which included 740 infrared spectra of reference value to the industry. In the intervening years, water-based coatings have been displacing alkyd resins in importance, and infrared instrumentation has improved. These developments and the impetus given to the subject by the 1969 book have led to a large amount of publication. As a result, a new, expanded book became desirable. There are now almost twice as many spectra, which have been made with high-resolution extended-range instruments (range 4000–200  $\text{cm}^{-1}$ ). The types of materials considered include polymers, pigments, sensitizers, solvents, additives of various kinds, etc.

The first hundred pages of the Atlas is text, with chapters on theory, instrumentation, sample preparation, analytical methods, applications, and bibliography. The spectra occupy most of the rest of the volume, except for indexes. The spectra are clearly presented, two to a large page, and because of their large size are particularly useful. Although this work has been prepared specifically for the coatings chemist, it will clearly have a more general use, particularly among polymer chemists.

**Models of Disorder: The Theoretical Physics of Homogeneously Disordered Systems.** By J. M. Ziman. Cambridge University Press, New York. 1979. xiii + 525 pp. \$59.50 (hardcover), \$19.95 (paperback).

"Models of Disorder" is an attempt to explore the common conceptual schemes and mathematical methods that link together the study of widely different kinds of disordered systems. It is an overview of a variety of problems in condensed matter chemistry and physics emphasizing an understanding of the basic physical models introduced in each area. The mathematical formulations of the models are illustrated by simple and sound derivations of the basic results. The limitations of the models and the mathematics are pointed out as are the interrelations with other areas.

Although it is a book which emphasizes physical understanding and not mathematical sophistication it is a work of theoretical physics. The basic experimental facts are discussed as the theoretical models are introduced, but reference to detailed experimental results and the comparison of experiment with theory are excluded. A rather extensive background in quantum mechanics and statistical mechanics plus an acquaintance with some solid state physics are necessary to make the book comfortable reading. A well-prepared graduate student in physical chemistry, however, could profit from reading many of the chapters.

About half of the topics covered in "Models of Disorder" are of direct interest to chemists. There is a long chapter on substitutional disorder which introduces the principal models used to study phase transitions: the Ising model and the Heisenberg model. The chapter concludes with a brief discussion of scaling and renormalization group methods. The modern theory of liquid structure receives an extensive and excellent overview. There is a short chapter on macromolecules which introduces a number of important concepts, models, and problems in that field. The final chapters on electrons in disordered systems and excitation in disordered lattices would be of more interest to the solid state physicist who

studies amorphous semiconductors and the like.

John Ziman has written this book in the same clear prose that characterizes his earlier works. The arguments are clearly laid out in words and equations and are well illustrated by diagrams and graphs. The references are carefully chosen to direct the reader into the important primary literature where each individual topic can be studied in greater depth. One might complain that in one area an important idea has been left out or that in another the emphasis is misplaced but such complaints merely obscure the value of the book. Ziman has done an excellent job of synthesizing and interrelating the different problems in condensed-matter physics. His book provides a good introduction for the newcomer as well as a source of new insights for the specialist who all too rarely has an opportunity to step back and view his work in broad perspective.

Jeffrey Kovac, *University of Tennessee, Knoxville*

**Geochemistry of Organic Molecules.** Edited by K. A. Kvenvolden. Dowden, Hutchinson & Ross, Inc.; distributed by Academic Press, Inc., New York. 1980. xvi + 358 pp. \$34.00.

This is an interesting and timely subject, and one in which most of the understanding has developed in the last 25 years. The earliest paper reproduced in this volume of the series "Benchmark Papers in Geology" is one by Trask and Wu, "Does Petroleum Form in Sediments at Times of Deposition", published in 1930. The only other prewar paper is that by Treibs on "Chlorophyll and Hemin Derivatives in Organic-Mineral Substances" (1936). As is customary in this series, the papers selected by the editor as being of special significance in the advancement of the field are reproduced in their entirety; there are 42 such papers.

The pervading theme is petroleum and the development of man's understanding of its origin and its chemical nature. At the time the earliest of the selected papers appeared, it was still widely believed that petroleum might have a purely inorganic origin. Some consideration of fossils appears, and oil shales and related bitumens are discussed, but not one of the selected papers deals specifically with coal, which is surely the most massive, if not the most important, geological occurrence of organic material. This is the major shortcoming of this book, which might better have been titled "Geochemistry of Petroleum", and as a result, there is still room for a "Benchmark" volume on geochemistry of coal.

The papers selected occurred in widely diverse publications, and it is a great convenience to have them brought together. In addition, related groups of papers are briefly placed in perspective by "Editor's Comments" sections, which include short biographies of the principal scientists whose papers are reproduced. This book also includes an author citation index and a subject index.

**A Treatise on Dinitrogen Fixation. Sections I and II. Inorganic and Physical Chemistry and Biochemistry.** Edited by R. W. F. Hardy, F. Bottomley, and R. C. Burns. John Wiley & Sons, New York. 1979. xiv + 812 pp.

The present Sections I and II complete "A Treatise on Dinitrogen Fixation". The book consists of 16 chapters by 15 different groups of contributors. A wide range of topics is included: chapters as diverse as "High-Pressure Ammonia Synthesis and Plant Operation" to "Integration of Nitrogenase in Cellular Metabolism"; details as varied as the biosynthesis of leghemoglobin to design of ammonia converters. It is doubtful if any one reader will be interested in all of the topics. Indeed, the reader may be discouraged by the breadth of coverage, the perfunctory subject index, and some editorial deficiencies. Chapters are poorly cross-referenced, material is often repeated from chapter to chapter, and no consistent set of units is used. There is no author index, which is a pity, although its existence would have emphasized the out-of-date nature of some of the chapters. While some appear to cover the literature through late 1976, others stop at 1974, and one contributor states, "More recent reviews by the author can be found in *Ann. Rev. Microbiol.*, 29, 109 (1976)..." In summary, the book is not up to date enough for the expert and is too diverse for the casual reader. Section II on biochemistry may be helpful to the inorganic or physical chemist interested in dinitrogen fixation and Section I on inorganic and physical chemistry similarly may be helpful to the biochemist.

James A. Ibers, *Northwestern University*

**Chemistry of the O-Glycosidic Bond: Formation and Cleavage.** By A. F. Bochkov and G. E. Zaikov. Pergamon Press, Oxford, England. 1979. ix and 210 pp. \$30.00.

Studies of formation and cleavage of the O-glycosidic bond are not only one of the most important areas of carbohydrate chemistry but also occupy a paramount position in biochemistry dealing with carbohydrate-containing substances. For this reason, the authors take a viewpoint of bioorganic chemistry in selecting the materials for this book, and they are largely successful. More than three-quarters of the book deals with the topic of O-glycoside synthesis, which is where the activities are the

most vigorous. General discussion on formation of the *O*-glycosidic bond (80 pp) is the most delightful chapter, but other chapters are also of very high quality. Considering that it is a translation, the book is highly readable and has relatively few mistakes. The translation editor (C. Schuerch) should be commended for his excellent work. The literatures cited cover up to 1977. Although they are not meant to be comprehensive, they are extensive enough to make this book a useful source of reference. Chemists, biochemists, and biologists who have interests in the areas of carbohydrates will find this book interesting and valuable. Rapid progress made in this area since the book was written may encourage the authors to consider a second edition in the near future. In such an event, inclusion of *S*-glycoside and *N*-glycoside is strongly recommended, for obvious reasons of appealing to wider audience.

Y. C. Lee, *Johns Hopkins University*

**X-Ray Analysis and the Structure of Organic Molecules.** By Jack D. Dunitz. Cornell University Press, Ithaca and London. 1979. 514 pp. \$55.00.

This book consists of two parts. Part One, Crystal Structure Analysis, contains chapters on diffraction of X-rays by crystals, the internal symmetry of crystals, methods of crystal structure analysis and of structure refinement, treatment of results, and a chapter on experimental aspects of X-ray analysis. Part Two, Molecular Structure, covers crystal structure analysis and chemistry, electron density distributions in molecules, geometric constraints in cyclic molecules, and conformational maps and space groups. The bibliography of over 500 references extends into 1978.

Part One is essentially a textbook of X-ray crystallography, somewhat light on the practical side, but otherwise complete; the treatment will appeal to serious students without prior exposure to the subject. Among trained crystallographers the entire book is certain to become a favorite. Lucid explanations of complicated topics, numerous instructive case histories, and fascinating analyses of sequences of events in the development and application of crystallography are some of the outstanding features.

Part Two has as its main theme structural correlation, that is, obtaining information about reaction paths from correlations among structural parameters within groups of related molecules. This is an area specifically developed by the author and his colleagues. The account given here is the most comprehensive and up-to-date available; previously unpublished material is included in the last chapter.

Part Two should be of particular interest to physical-organic and other chemists interested in reaction pathways and related topics. No background or even interest in crystallography is required of the reader. It is to be hoped that the packaging of this material in a volume otherwise devoted to X-ray crystallography will not deter the many noncrystallographers who along with their crystallographer colleagues will find this book a most valuable resource.

Christer E. Nordman, *The University of Michigan*

**Thiazole and its Derivatives. Part 2.** Edited by J. V. Metzger. John Wiley & Sons, Inc., New York. 1979. xii + 590 pp. \$80.00.

This is Volume 34 of the series "The Chemistry of Heterocyclic Compounds", under the overall editorship of Arnold Weissenberger and Edward C. Taylor, and it is the second of three parts devoted to thiazole. It consists of three chapters: General Introduction to Protomeric Thiazoles (M. Chanon); Aminothiazoles and Their Derivatives (R. Barone, M. Chanon, and R. Gallo), and Mercaptothiazoles, Hydroxythiazoles, and Their Derivatives (C. Roussel, M. Chanon, and R. Barone). The first of these is not formally a chapter, but serves to set in perspective the general phenomenon exemplified in the two formal chapters, of tautomerism in thiazoles carrying an -XH substituent, which may equilibrate with tautomers having an exocyclic double bond to X (as  $\rightleftharpoons$ X).

Part 2 is provided with its own index and shows the high degree of thoroughness characteristic of previous volumes in this series.

**Statistical Thermodynamics of Simple Liquids and Their Mixtures.** By Tomas Boublík, Ivo Nezbeda, and Karel Hlavaty. Elsevier Scientific, Amsterdam. 1980. 145 pp. \$41.50.

This volume describes systematically the major results which have been obtained from the application of equilibrium statistical mechanics to the theory of simple liquids. Major topics surveyed include integral equation methods and perturbation theories of pure liquids and solutions; appendices outline some mathematical results. One-hundred and sixty-two references supplement the text.

The treatment of integral equation methods is at roughly the same depth (and pace) as that of Rice and Gray "The Statistical Mechanics of Simple Liquids". Derivations are generally omitted; difficult points are sometimes avoided. For example, the discussion of the Ornstein-Zernike equation essentially assumes that particle correlations are correctly described entirely in terms of the direct and total correlation functions without questioning the validity of the assumption. The examination of recent work on perturbation theories is much more compressed, being essentially a summary of the assumptions and conclusions of various investigators. This part of the volume is valuable as a summary of what has been done in the field. The stress is on mathematical results; readers looking for physical insight or for caveats on the range of validity of approximations may be less than satisfied. Persons interested in how the calculations were done will need to examine the original papers.

In 145 pp only a survey of modern results is possible. This work was written to outline these results and to lead the advanced graduate student or researcher directly to the primary literature. The authors have met this objective in a clearly written book.

George D. J. Phillies, *The University of Michigan*

**Annual Reports on the Progress of Chemistry. Section A. Physical and Inorganic Chemistry.** Senior Reporters: P. A. H. Wyatt and M. F. Lappert. The Chemical Society, London. 1978. xiv + 289 pp.

Part I of this volume reviews recent results in the field of physical chemistry, with chapters on electrolyte solutions (by A. K. Covington and A. D. Pethybridge), solid electrolytes (i.e., superionic conductors) (by M. D. Ingram and C. A. Vincent), luminescence of organic solids (by J. O. Williams), and low-frequency motions in liquids (by G. Williams and J. Crossley). Part II of the volume covers inorganic chemistry, organized largely along the form of the periodic table, with separate treatment of organometallic compounds (by C. J. Cardin, D. J. Cardin, R. J. Norton, and K. R. Dixon). Reviewers and their domains of coverage include R. H. Cragg (groups 1, 2, 6-8), G. E. Toogood (group 3), J. D. Smith (groups 4 and 5), J. R. Dilworth, G. J. Leigh, and R. L. Richards (transition elements), and K. W. Bagnall (scandium and the rare earths).

The authors have done a fine job of organizing results from more than 1300 references into a coherent text. Unlike most other works, references appear as proper footnotes, on the page of text to which they apply; this markedly increases the ease of reading. By comparison with other review volumes, the authors have put a relatively large amount of effort into emphasizing the overall gaps and weaknesses in current lines of research, in addition to noting which experiments and calculations have actually been done. The section on electrolyte solutions is especially strong in this respect.

George D. J. Phillies, *The University of Michigan*

**Topics in Current Chemistry. 87. Micelles.** By Bjorn Lindman, Hakan Wennerstrom, and Hans-Fredrich Eicke. Springer-Verlag, New York. 1980. iv + 154 pp. \$47.30.

In this volume, B. Lindman and H. Wennerstrom treat surfactant aggregation (micelles and their formation) in water solution, while H. F. Eicke discusses aggregation and micelle formation by surfactants in nonaqueous media. The emphasis is on physicochemical properties of micelles, with representative results on specific systems being presented. Lindman and Wennerstrom begin with a descriptive treatment of surfactant solutions and their phase diagrams, followed by a more formal thermodynamic analysis. Other topics covered in their review include micelle size and organization, dynamic processes in micelles (formation kinetics, internal motions), and specific electrostatic effects on other micellar phenomena. The discussion of hydrodynamic and spectroscopic data (viscosity, diffusion, light scattering) is incisively critical, especially when emphasizing the contribution of intermicellar interactions to measured experimental parameters.

H. F. Eicke presents a similar discussion of results on the reversed (inverted) micelles formed by surfactants in nonaqueous solvents. Major topics are formal models for micelles, experimental results on micelle size and shapes, and experimental techniques, including the classical (light scattering, ultracentrifugation) and the more modern (position annihilation).

The reviews in this volume are well-written and clearly presented, at a level appropriate for advanced graduate students and researchers in the field. The references, including a few to preprints and papers in press, number more than 500 (including two-dozen other reviews) and are current through early 1979.

George D. J. Phillies, *The University of Michigan*