Book Reviews

Handbook of Air Pollution Analysis. Second Edition. Edited by R. M. Harrison (University of Essex) and R. Perry (Imperial College of Science and Technology). Chapman and Hall Inc.: New York. 1986. xxii + 634 pp. $79.95/cloth. ISBN 0412-24410-1.

The volume under review is the successor of a considerably successful first edition published a decade ago. The present edition is not only updated but it contains several completely new chapters that add considerably to the value of the volume as a desk reference.

The book contains fifteen chapters authored by a dozen contributors, two-thirds of whom hail from the United Kingdom. The character of the volume is thus unmistakably British. The style of presentation is consistent from one chapter to another. The content and depths of coverage vary considerably. However, most of the chapters are very good to excellent.

The beginning chapter, on General Sampling Techniques, by Pio is excellent. Aside from the minor criticism that more detailed discussion of mass-flow meters and controllers as well as non-contaminating air pumps (PTFE, metal bellows for hydrocarbon sampling) would have been desirable, it does an excellent job of acquainting the neophyte to the nuts and bolts of air-sampling equipment. Moore, an authority on the topic, gives a useful introduction to Air Pollution Meteorology. The unsuspecting reader should be prepared to digest a considerable amount of complicated equations. Winer, the sole American contributor to the enterprise, authors a 20-page chapter on Air Pollution Chemistry and does an excellent job of presenting what he chooses to. The double bias of living in Southern California and being primarily interested in gas-phase reactions guarantees that there is nothing about aqueous-phase chemistry; the entire discusstion on the atmospheric chemistry of SO_2 occupies considerably less than 1 page. Harrison does a creditable job of presenting an overview of the Analysis of Particulate Pollutants.

Throughout the book, however, the tendency of using trade names without explicit identification is disturbing; the reader is asked, for instance, to mount the sample (for subsequent microscopic examination) with a drop of solution containing 30% "Durafix" and 70% amyl acetate. Lord help the poor soul whose neighborhood hardware store is as bare of Durafix as is mine. In the next chapter, Harrison provides as good an introductory review of various methods used for Metal Analysis as can be expected to be contained in 64 pages. Among omissions worthy of note are atomic spectroscopy with plasma sources and measurement of mercury based on the surface resistance changes of a gold film. I am considerably less enamored by the next chapter, by the same author, on the measurment of nitrogen and sulfur compounds. Much of the notable new chemistry developed in recent years, e.g., use of formaldehyde solutions to collect SO_2 with subsequent analysis by the pararosaniline method, chemiluminescence measurement of NO_2 by aqueous luminol, are not mentioned. Concerning measurement of ionic species in solution, there is absolutely no mention of ion chromatography, which has become the technique of choice for performing ionic analysis. Harrison continues with a chapter on Secondary Pollutants reasonably well done, but again with notable omissions. Such examples would include the potassium iodide–bromide–thiosulfate (KIBRT) method and liquid-phase chemiluminescence techniques for ozone, spectrophotometric/fluorometric measurement of formaldehyde by the Hantzsch reaction, etc. The account of the measurement of Hydrocarbons and Carbon Monoxide by McIntyre and Lester is satisfactory for most needs. The next chapter on the determination of Halogen Compounds by Kirk and Lester is singularly unusual in that Lovelock's pioneering work is never even mentioned. Varey's presentation of Remote Monitoring Techniques is unduly long for what it is likely to be worth to the average reader. The little chapter on Physico-Chemistry Speciation Techniques would have best been left off with the material on X-ray diffraction and electron microscopy incorporated elsewhere. Speciation of sulfuric acid and its ammonium salts is largely of academic interest, few continue to believe that they exist as external mixtures. Kramer presents a succinct account of the analysis of precipitation—to his credit, he mentions ion chromatographic analysis. This reviewer would have liked greater details on pH measurement of low ionic strength samples, by no means a simple task. The account of Low-Cost Methods for Air Pollution Analysis by Koning is disappointing: there is no point recommending methods such as those involving sulfation plates that yield data of highly questionable value. Ironically, Moore states at the beginning of his excellent and very next chapter on Planning and Execution of an Air Pollution Study, "Pollution monitoring is an expensive business and it should not be undertaken lightly". The last chapter, on Quality Assurance, by Apling rounds out the volume nicely.

There is an index, not extraordinarily thorough, and the majority of chapters have references that are up to date. Despite my few reservations outlined above, it is a highly commendable volume. Although this will not replace works that are "cookbook" volumes for the practicing analyst, e.g., Methods for Air Sampling and Analysis published by the American Public Health Association, etc., it will be worth the time for anyone seriously interested in the measurement of air pollution to be acquainted with the *Handbook of Air Pollution Analysis.*

Purnendu K. Dasgupta, *Texas Tech University*

New Directions in Solid State Chemistry. By C. N. R. Rao and J. Gopalakrishnan (Solid State and Structural Chemistry Unit, Indian Institute of Science). Cambridge University Press: Cambridge, London, New York, New Rochelle, Melbournne, and Sydney. 1968. x + 516 pp. $79.50. ISBN 0-521-301920.

The field of solid-state chemistry is very much in need of monographs and texts that unite a variety of aspects of this multifaceted science. This need is particularly evident when physical solid-state chemistry and its relationship to problems of the stability, bonding, and structure in solids are considered. This book, which treats subjects in the areas of experimental and interpretive solid-state science, as well as synthetic and descriptive solid-state chemistry, therefore appears at an opportune time. The book covers a very broad range of materials, techniques, and interpretive schemes as they relate to the properties and structures of solids. The authors have brought a broad range of experience to the task of writing this book and, because of its encyclopedic character, it will be a valuable reference work for students and researchers alike. It seems unlikely that the book, because of its broad range of topics, will find use as a textbook for a course in Solid State Chemistry. Nonetheless, students who turn to this book as a supplement to such a course are certain thereby to expand their awareness of the range of topics that constitute the discipline. In short the book is inclusive as opposed to exclusive, informative as opposed to tutorial, and eclectic as opposed to selective. It will serve the chemical community well by providing a source book for information about the methods and concepts found useful by solid-state chemists.

Hugo F. Franzen, *Ames Laboratory, Iowa State University*

Inorganic Reactions and Methods. Volume 15. Electron-Transfer and Electrochemical Reactions. Photochemical and Other Energized Reactions. Edited by J. J. Zuckerman. VCH Publishers, Inc.: Deerfield Beach, FL. 1986. xxii + 399 pp. $98 ($80 by subscription). ISBN 0-89573-265-3.

Throughout this series, the Editorial Advisory Board has stressed a detailed, systematic arrangement of "all of inorganic reaction chemistry". Thus, the first nine "chapters" (Volumes 1–13 and part of 14) are entitled *Formation of Bonds to...* and contain a successively decreasing number of section headings as each family has been covered. Volume 14 also covers oxidative addition and reductive elimination reactions and insertion reactions and their reverse. Volumes 16–18 include inorganic catalysis, oligomerization and polymerization, intercalation compounds, and ceramics.

The present volume focuses on transition-metal redox chemistry, photochemistry, and reactions studied by pulse radiolysis. The contributors include N. Sutin, C. Creutz, and R. G. Linck (electron transfer); W. E. Geiger and M. J. Weaver (electrochemistry); G. L. Geoffroy, P. C. Ford, and H. B. Abrahamson (photochemistry); and M. Z. Hoffman (pulse radiolysis). The introductory and theoretical material is clearly presented and representative chemical examples are plentiful. The literature has been covered adequately, but not encyclopedically, through 1983. Although the price and limited coverage would preclude its use as a text, much of this book will be of great value to instructors of advanced courses in inorganic reaction mechanisms.

I found the hierarchical system used for section headings easy to use and so complete that the subject index seems necessary only for topics that appear in several places. To illustrate this arrangement, the running heading on page 231 is as follows:

13.2 Photosubstitution and Photoisomerization
13.2.5 with other Organometallic Complexes
13.2.5.1 containing Metal Hydrides

Each subsection is signed by its author. The Author Index (prepared by A. P. Hagen) lists literature references by subsection number, a feature that helps in finding pertinent information. The Compound Index contains molecular formulas (not names) in all their permutations with a section number and descriptor given only with the "original formula" (elements in alphabetical order preceded by C and H). Although such a presentation might make a good data base for computer searching, it requires a level of preparation by the reader that many will find overwhelming.

While the entire series, *Inorganic Reactions and Methods*, can certainly be recommended for purchase by institutional libraries, this volume stands alone and would be a welcome addition on the shelves of the specialist.

Louis J. Kirschenbaum, *University of Rhode Island*

Modelling Small Deformations of Polycrystals. Edited by John Gittus (United Kingdom Atomic Energy Authority) and Joseph Zarka (Ecole Polytechnique). Elsevier Applied Science: London and New York. 1986. xvi + 417 pp. $94.25. ISBN 0-85334-403-5.

This volume is devoted to a study of the mechanical properties of polycrystalline materials subject to small deformations. The basic question addressed is the following: suppose a material is made up of a number of homogeneous regions, each with well-characterized mechanical properties. What will be the properties of a bulk sample of this material? Examples range from polycrystalline solids composed of a large number of single crystals separated by grain boundaries, to the properties of a material like concrete containing aggregate surrounded by cement. Most of the emphasis is on the former problem, with much attention paid to plasticity and the deformation history of a sample. The techniques applied include the development of simple parametrized physical models for the role of grain boundaries in deformation, computer simulations of composite media, and effective medium and Green's function statistical theories of such materials. The emphasis is theoretical, with a small number of comparisons with experimental data.

This is a volume with nine authors (including the two editors), with individual contributions reading much like review articles and only loosely tied to one another. There is thus some duplication of material, although the authors have a variety of perspectives. This should be a useful reference for chemists and materials scientists interested in the effect of microstructure on the small deformations of heterogeneous materials. A second book is planned to deal with large deformations of solids.

David W. Oxtoby, *University of Chicago*

Trace Analysis. Spectroscopic Methods for Molecules. Edited by Gary D. Christian and James B. Callis (University of Washington). John Wiley & Sons: New York, NY. 1986. xii + 406 pp. $55.00. ISBN 0-471-875873-X.

The title can be misleading; however, the contents are most appropriate. Chapter 1, by Kenneth Ratzlaff, discusses trace analysis with ultraviolet visible spectrophotometry. Chapter 2 is on trace analysis with luminescent spectroscopy, written by Robert Hurtubise. The third chapter is about infrared spectroscopy trace analysis, written by A. Lee Smith. The fourth chapter is on nuclear magnetic resonance spectroscopy and its applications to trace analysis, written by Dallas Rabenstein and Thomas Nakashima.

The trace analysis by ultraviolet visible spectroscopy begins with the fundamentals of UV–vis, basic instrumentation, and signal-to-noise ratio theory for absorbance measurements. The second section deals with methods for increasing the absorbance of the analyte and decreasing the absorbances of interferents. And the third section deals with special instrumental techniques such as laser inner cavity absorption, photoacoustic spectroscopy, and thermal lens spectrophotometry. This chapter is more than adequate to familiarize the uninitiated in the area of UV–visible spectroscopy. The section on lowering interference absorbance and increasing analyte absorbance is well-written and very informative. The special techniques section is briefly mentioned but the pertinent references are given.

Chapter 2 on luminescence spectroscopy has extensive sections on the theory and instrumentation aspects of luminescence spectroscopy: fluorescence, chemiluminescence, phosphorescence, and bioluminescence. Some applications, discussions of limits of detection/selectivity, and future improvements are discussed briefly. The theoretical section is more than adequate to prepare an individual to learn more about this field. Instrumental considerations are complete in their coverage but not in great detail. However, the referencing is more than adequate to lead the reader to important additional information in the literature. The applications are carefully chosen to show interesting additional techniques and methods of value.

The third chapter, on infrared spectroscopy, gives a brief introduction and brief instrumentation considerations. The majority of this section deals with the techniques of trace analysis and infrared spectroscopy. A short applications section is also given. In particular, it was disappointing to see the lack of attention paid to the instrumental components section and the fact that a large and very rapidly growing area of microscope infrared measurements and techniques, both transmission and grazing angle, were not given a significant portion of this chapter.

The NMR chapter does basic theory, continuous wave and Fourier transform techniques for NMR, along with multinuclear techniques. Experimental techniques in terms of sample preparation, chemical reagents, and instrumentation currently available in the NMR field are given. Applications to trace analysis are given for environmental, biological, clinical, agricultural, and food sample.

Overall, it seems to be a worthy book to have on your shelf.

Gilbert E. Pacey, *Miami University*

Integral/Structural Polymer Foams: Technology, Properties and Applications. By Fyodor A. Shutov (Mendeleev Institute of Chemistry and Technology). Springer-Verlag: New York, Heidelberg, Berlin, Tokyo. 1986. xxii + 295 pp. $76.00. ISBN 0-387-15038-2.

Commercial cellular polymer products are produced by incorporating small amounts of inert gas or volatile liquid under pressure in molten or liquid polymer and injection-molding or extruding the mixture. The products are characterized as having near-solid surfaces and relatively uniform density cellular cores and are called "integral skin foams", "structural foams", or here *integral foams*. Integral foams can be either thermoplastic or polyurethane-thermosetting. Typically, these foams have densities 20% to 40% less than the unfoamed polymers. They are primarily used in furniture, electronic, construction, and automotive applications. In the quarter-century since their commercialization, integral foams have become an annual 500 million-kg international business.

Dr. F. A. Shutov, an international authority on cellular polymers, has written a concise and for the most part comprehensive monograph on integral foams. After comparing integral foam characteristics with those of other materials, he carefully reviews and critically compares the many processes for producing integral foams. In particular, Shutov presents an excellent overview of the many injection-molding techniques, describes succinctly the process equipment for reaction injection molding and integral foam extrusion, and presents an excellent review of commercial rotational molding techniques. He then reviews integral-foams applications for many polymers and concludes by critically reviewing design criteria. The monograph contains 23 short chapters, 483 references (including duplicates) through 1985, 127 figures, 95 tables, a list of symbols and units, a subject index, a listing of important materials and manufacturers, but no author index. A section devoted specifically to the fluid mechanics of bubble nucleation, growth, and stability would have added substantially to the comprehensiveness of the book. Recent work on structure–property–performance relationships of crystalline integral foam polymers is not discussed even though mechanical properties such as impact strength depend to a large measure on these relationships. It could be legitimately argued that this area is beyond the stated objective of the book.

The material is well-written, logically layed out, and even-handed in its treatment. The idea of placing secondary information in smaller type is welcomed for rapid skimming. Although there are occasional typographical errors, no glaring technical errors were found in a rather thorough first reading. The graphics are excellent. It is disconcerting, however, to find Dr. Shutov's given name spelled three ways in the first few pages.

The author states that his objective was to write a book that was at the same time a manual, handbook, and scientific monograph. For the most part, he has accomplished his objective. This monograph is a substantial contribution to the technical elements of the polymer industry. It is highly recommended for design, mechanical, and polymer engineers.

James L. Throne, *University of Akron*

Polymer Photophysics and Photochemistry. By James Guillet (University of Toronto). Cambridge University Press: New York. 1985. xiii + 391 pp. $79.50. ISBN 0-521-23506-5.

The use of photochemical and photophysical processes for the elucidation of the structure and dynamics of polymeric materials has blossomed into a subdiscipline of both photochemistry and polymer chemistry during the past two decades. The author of *Polymer Photophysics and Photochemistry* is one of the leaders in bringing the concepts of polymer chemistry and photochemistry into a productive partnership. This text provides the reader with a great deal of factual information and insight concerning the nature and behavior of polymer systems after they absorb light.

The initial portion of the text shuttles back and forth between fundamental principles of polymer chemistry and of photochemistry.

Chapter 2, for example, is a fine review of the important general features of polymer systems that make them qualitatively different from small molecule counterparts. Motion and shape considerations coupled with the size of macromolecules are shown to imbue them with many of their characteristic properties. This is an important and clear introduction for researchers who are unfamiliar with polymer structure physical chemistry.

Chapter 3 is concerned with macroscopic and microscopic diffusional characteristics, and Chapter 4 is a brief review of two very important and characteristic polymer reactions, namely crosslinking and scission. The remaining chapters provide an informative overview of photoprocesses in polymer systems. The use of photophysics such as photoemission, both fluorescence and phosphorescence, to probe polymer structure and dynamics is emphasized. The role of excimer and exciplex formation to probe energy transfer and polymer properties is aptly presented. In the later chapters of the book, photochemical reactions in polymers are surveyed.

Given the ever increasing application of photoprocesses to elucidate aspects of polymer physics and chemistry, this authoritative and lucidly written text is both timely and useful. It is a must for any researcher involved in photoprocesses in polymers.

Nicholas J. Turro, *Columbia University*

Personal Computers for Scientists: A Byte at a Time. By Glenn I. Ouchi (BREGO Research). American Chemical Society: Washington, D.C. 1987. x + 276 pp. $34.95. ISBN 0-8412-1000-4

This book is intended for scientists interested in using a Personal Computer (PC) in their work. Included are chapters on PC's, associated hardware, word processing, spreadsheets, data bases, graphics, communication, and interfacing. The emphasis is on applications of software in solving problems. Proper balance is maintained between what scientists are currently using PC's for and current expectations. Detail is sufficient to give an understanding of the topic without overloading the reader. The author, in a very readable manner, gives sound advice on expected problems, ease of use, care to be taken in purchasing software, benefits to be expected, and costs. Specific products mentioned at the end of each chapter are excellent examples of popular and useful products. Many excellent competitive items are missing because of space and other limitations.

This book is recommended for chemists using or considering using a PC in their work. Current PC owners interested in considering other applications of their PC's for networking, interfacing, or the use of data bases and spreadsheets will find this book useful. The book should be viewed as an introduction to the software and references given at the end of the chapter. Even the expert will find this book useful. It can be loaned to neophytes to answer their many questions efficiently. The warnings and suggestions should minimize the frustrations of a new effort with a PC.

James W. Beatty, *Ripon College*

The Encyclopedia of Polymer Science and Engineering. Second Edition. Volumes 4, 5, 6 and Index to Volumes 1 to 4. Edited by H. F. Mark (Polytechnic Institute of New York), N. M. Bikales (National Science Foundation), C. G. Overberger (The University of Michigan), G. Menges (Institut fur Kunststoffverarbeitung of the RWTH Aachen), and J. I. Kroschwitz. John Wiley and Sons, Inc.: New York. 1986. Volume 4: xxiv + 832 pp. $200.00. ISBN 0-471-88099-X. Volume 5: xxiv + 828 pp. $200.00. ISBN 0-471-88098-1. Volume 6: xxiv + 839 pp. $200.00. ISBN 0-471-80050-3. Index to Volumes 1–4: 111 pp. ISBN 0-471-80050-3.

These books are recently released volumes of the first revision of "The Encyclopedia of Polymer Science and Technology", which was originally published from 1964 to 1971 (with two later supplements). This revision has been undertaken to include new entries on relatively recent research (e.g., computer-assisted design, electrically conducting polymers, and diacetylene polymers) and to update entries of continuing importance, such as copolymerization, elasticity, and extrusion.

These three volumes alone contain 90 major topic entries—Volume 4: Composites, Fabrication to Die Design, 40 entries; Volume 5: Dielectric Heating to Embedding, 31 entries; and Volume 6: Emulsion Polymerization to Fibers, Manufacture, 19 entries. There are also numerous entries (without text) on more specific subjects that refer the reader to the major topic(s) that includes information about that particular subject. In addition to this cross-referencing, the separate index volume is extensive and presumably will be continued for the entire series.

"The Encyclopedia of Polymer Science and Engineering" is a valuable sourcebook for those wishing compact introductions to a wide variety of topics concerning polymers. Each major entry is written in the form of a review article including key references for readers who wish further information. Although the quality, scope, and depth to which each topic is treated is largely dependent upon the author(s) of the individual entries, the reviews are by and large very readable, contain generous numbers of illustrations, tables, and graphs, and should be readily understood by persons with some exposure to and interest in topics concerning polymer science and engineering. Less-technically-oriented people involved in business or administration could also benefit from use of these volumes as primers on technical aspects of specific subjects or materials.

Daniel T. Glatzhofer, *The Ohio State University*

Computer-Assisted Structure Elucidation. By N. A. B. Gray (University of Wollongong). John Wiley & Sons: New York, NY. 1986. xi + 536 pp. $54.95. ISBN 0-471-89824-4

It is now well-known that computers are an invaluable aid in the elucidation of chemical structure. Computers cannot substitute for sound chemical intuition, but they *can* greatly relieve the chemist of much of the tedium involved in the determining of molecular structure. Also, computer analysis of data often gives one a great deal of insight by suggesting structures or patterns not at first noticed or considered.

The book reviewed here does an excellent job in giving one an appreciation of the power of computers. After a brief introduction, a thoroughly worked-out example is presented. Then, after an historical review of the uses of computers in structure elucidation and as aids to synthesis, extensive discussion is devoted to the following topics: Spectrum matching approaches, pattern recognition, "knowledge-based" spectrum analysis, structure representation, canonicalization and topological symmetry, structure generation, structure evaluations, and structure transformations. Algorithms currently in use, as well as programs available at present, are discussed in elaborate detail. An extensive bibliography of the current literature is provided.

This book is an excellent addition to one's library. It is as good a compendium of computer methods applied to structural chemistry as I have seen. About the only shortcoming—which may not be so viewed by some workers—is the lack of any discussion of molecular mechanics and quantum chemical elucidation of molecular structure. Other than this, the presentation is extremely well-balanced and insightful.

Milton D. Johnston, Jr., *University of South Florida*