Book Reviews*

Secondary Ion Mass Spectrometry: Basic Concepts, Instrumental Aspects, Applications and Trends. By A. Benninghoven, F. G. Rudenauer, and H. W. Werner (University of Munster (A.B.), Technical University of Vienna (F.G.R.), and Philips Research Laboratories (H.W.W.)). John Wiley and Sons: New York. 1987. xxxv + 1227 pp. $150.00. ISBN 0471-01056-1

In their preface, the authors note that no comprehensive treatment of secondary-ion mass spectrometry exists and that this book was written to correct the omission. Drawing on a total of over 75 years of experience with the method, these three authors have assembled a monumental work that belongs on the desk of every mass spectroscopist and every surface scientist. The retail price is inconsequential compared to the wealth of information assembled in this large (1216 pages) volume.

After a brief introductory chapter, the second chapter provides an extensive review of the ion–solid interactions, beginning with processes induced in the solid target by energetic primary ion impact, including discussions of ion stopping powers, ion trajectories, and damage and mixing phenomena. The chapter continues with a discussion of emission processes, including backscattering of the primary ions, electron emission, photon emission, and finally sputtering of secondary ions. The third chapter provides an in-depth overview of quantitative analysis with secondary-ion mass spectrometry. Both surface effect and thermodynamic models of quantitation are described, with a frank assessment of the merits and limitations of both.

The longest chapter in the book (335 pages) deals with the various aspects of instrumentation, including imaging properties of ion optical elements (electric and magnetic sectors, and quadrupole mass analyzers), primary ion sources, focussing systems, detection systems, and instrument descriptions. This is a particularly valuable chapter: the discussion of ion optics is clear, coherent, and applies to all mass spectrometers and not just secondary-ion instruments. There are few other sources with as concise a discussion of instrumental figures of merit such as source brightness, instrument acceptance parameters, and emittance matching. The descriptive summary of secondary ion mass spectrometers is unique in that it includes both commercial instrumentation as well as custom-built, laboratory-specific installations. Commercial instruments for secondary ion mass spectrometry are not revised with each model year as are most instruments for organic mass spectrometry, and the descriptions are likely to remain useful for some years to come. The inclusion of custom instrumentation is particularly helpful, since much of the original literature that describes these systems is not readily accessible.

The operational modes of secondary ion mass spectrometry are discussed in the next chapter, including surface analyses, depth-profile analyses, lateral imaging, and sputtered neutral mass spectrometry. The discussion of depth profiling is especially valuable and covers time/depth calibration procedures, ion current/atom concentration conversions, and artifacts due to both instrumental and matrix effects. A chapter on applications of secondary-ion mass spectrometry to electronics materials, geology, metallurgy, and surface science follows. The penultimate chapter describes the combination of secondary-ion mass spectrometry with other analytical techniques in both surface analysis and depth-profile experiments. The final chapter is a short preview of future developments in secondary-ion mass spectrometry, concentrating on ion transmission, ultimate spatial resolutions, and limitations to depth-profile accuracy.

This book is the culmination of the past 30 years of development and refinement of secondary ion mass spectrometry, specifically in the elemental analyses of solid surfaces. Much of the impetus in research, and most of the commercial market, is gravitating to organic analysis with secondary-ion mass spectrometry: this work appears in the literature as both fast atom bombardment and secondary ion mass spectrometry. It is often characterized by a tendency to "reinvent the wheel"—careful study of the concepts in this book by the new users of organic secondary ion mass spectrometry would be well worthwhile. However, the section on organic applications is short and consists of a near-exclusive review of Benninghoven's extensive work in this field. A small effort is made to evaluate the experiments of organic secondary-ion mass spectrometry in light of experience with elemental analyses, but the topic is not covered rigorously.

Two conventions detract from the overall utility of the book. The first is the abbreviated index; the reader in search of a particular topic is better directed to the table of contents, itself comprehensive in description. In fact, at 13 pages in length, the table of contents is longer than the 11-page index. The second difficulty encountered in using the text is the alphabetical listing of the 1900 or so references. Those familiar with specific scientists or specific literature citations will find it impossible to find the text passages that discuss particular work, a task made especially difficult in a book of this length.

In summary, this is a well-conceived, well-executed book. My copy has already disappeared from my desk several times, having been borrowed by students seeking a general introduction to secondary-ion mass spectrometry, or a discussion of ion optics, or a review of instrumentation.

Kenneth L. Busch, *Indiana University*

Topics in Current Chemistry. Number 131. Structural Chemistry of Boron and Silicon. Edited by F. L. Boschke (Springer-Verlag). Springer-Verlag: Berlin, Heidelberg, New York, Tokyo. 1986. 195 pp. $56.00. ISBN 3-540-15811-1

This volume contains three reviews: Pyrazole Derivatives of Boron by K. Niedenzu (University of Kentucky) and S. Trofimenko (E. I. Du Pont de Nemours), A Survey of Structural Types of Borates and Polyborates by G. Heller (Free University of Berlin), and Molecular and Electronic Structure of Penta- and Hexacoordinate Silicon Compounds by S. N. Tandura (Ministry of Chemical Industry, USSR), M. G. Voronkov (Institute of Organic Chemistry, Academy of Sciences, USSR) and N. V. Alekseev (Ministry of Chemical Industry, USSR). It concludes with a cumulative Author Index for Volumes 101–130.

The contents of this monograph are comprehensive specialist reports which deal with selected small areas of boron and silicon chemistry rather than the broad overviews that seem to be implied by the volume title. The final cutoff date for the references appears to have been early in 1985.

The first chapter (37 pp, 203 references), by Niedenzu and Trofimenko, reviews the chemistry of the pyrazolyl-substituted borates and boranes. The initial portion of the manuscript focuses upon the preparation and the properties of the monomeric pyrazolyl boranes, then describes their interactions with Lewis bases. The reactions that lead to the dimeric "pyrazaboles", compounds containing B_2N_4 rings, are next discussed. The second half of the article reviews the preparations, properties, and coordination chemistry of the poly(1-pyrazolyl)borates, $[R_nB(pz)_{4-n}]^-$ where pz is c-$N_2C_3H_3$. Included among the topics are the available structural data, the variable denticity that NMR indicates for some of the ligand systems, and the spin equilibria that are implied by the temperature dependencies of the magnetic moments obtained from some of the complexes.

The second chapter (59 pp, 568 references) is a complete listing of the borate and polyborate anions that have been characterized by X-ray crystallographic means. Heller has first subdivided the oxoborates into one of two categories—hydrated or anhydrous borates—then further classified them into increasingly complex structural types, as indexed by the "fundamental building block" found in the anion.

Initially, the third chapter (90 pp, 1008 references), by Tandura, Voronkov, and Alexeev, reviews the differences between carbon and silicon and then discusses the compounds in which the coordination number of silicon is greater than four. The body of the review contains a discussion of the bonding in 5- and 6-coordinate silicon compounds, first from the perspective of Si 3d orbital participation, then from the context of hypervalent (3c/4e) bonding. Additionally, there are very complete coverages of the molecular orbital calculations that have been reported, the X-ray crystallographic data that is in the literature, and the results of the many NMR studies that have been carried out in this chemical system.

This chapter must be read with care as there are several misstatements of fact. Some appear to arise from translational difficulties. For example, the statement that "...multiple bonds involving silicon have long been sought in vain" is followed almost immediately by a discussion of, inter alia, West's tetramesityldisilene work. It is somewhat disconcerting to see Linus Pauling's name misspelled. However, it should be emphasized that, on balance, this is a well-written and interesting report that covers a topic of considerable importance in silicon chemistry. In particular, the collation of the results obtained from the silatranes is most welcome.

*Unsigned book reviews are by the Book Review Editor.

Although somewhat marred by a hasty update of the literature coverage, Volume 131 of *Topics in Current Chemistry* will be of considerable utility to those who have an interest in the chemical areas examined. This volume will not be useful for those who desire a general introduction to the area of boron and silicon structural chemistry.

John A. Morrison, *University of Illinois at Chicago*

Chemometrics. By M. A. Sharaf, D. L. Illman, and B. R. Kowalski. John Wiley & Sons: New York. 1986. xiv + 332 pp. $49.95. ISBN 0471-83106-9

This book is intended to summarize the current state of the art for gleaning as much information as possible from data as typically generated by things that chemists do. It attempts first to bring the reader up to speed for the field and then delves deeply several areas of data analysis that have been the focus of extensive recent research. Building from the early chapters to a unified presentation of recent research conducted by the authors, it is an excellent exposition of that work.

The proclaimed intention of the authors is to eschew mathematical derivation or development, and to present mathematical and statistical results. This approach has, of course, the inherent weakness of giving only a shallow understanding of what is being discussed when deeper understanding may be very valuable, or even essential. To deal adequately with the recent work described in this book, the reader must pick up the book with a moderate background in mathematics and statistics, and will use the early chapters to refresh or organize existing knowledge.

The first chapter is a good, but very brief, discussion of elementary probability theory and statistics to create a basis for the rest of the book. In the second chapter there is presentation of the elementary principals of factorial design and optimization. As with the first chapter, the treatment is brief and expository rather than analytical and developmental. The optimization material, for example, is certainly not an in-depth treatment of the field. Rather it presents a few methods and techniques which the authors have found useful in dealing with problems to be studied in the latter part of the book. To appreciate the value and the significance of the topics so briefly covered, the reader really needs to have prior acquaintance with the material.

Chapter 3 gives a discussion of applying the methods of the first two chapters to processing of signals. This chapter gives an introduction to some of the ideas and problems of signal detection and discrimination. As with the previous two chapters, the material in this chapter is aimed at giving the nonexpert enough knowledge to understand the issues and some of the solutions in this vast field. As before, however, if the reader is not previously knowledgeable in the area, the material can become very heavy going. Some sharp study is required to understand some of these sections. And yet, when the chapter is over (along with almost half of the text of this book), the reader may well feel that the book has served the purpose only to point out areas where study and knowledge will be necessary to understand the work to come. This book would not serve very well to introduce these topics to students not having prerequisites in these fields.

Chapter 4 deals with calibration, and with correlation of calibration data. It is the bridge chapter leading to the research area of the authors. The early part of the chapter gives the equations for finding a linear fit to calibration data and the equations that are needed to calculate the variance of the parameters. The review is necessarily brief with the unfortunate result that recent solutions to vexing problems are not included. Such an example is the general solution for fitting models (linear and nonlinear) when more than one of the measured variables is subject to error.

Toward the end of this chapter, a research area of the authors is reached, i.e., construction of calibration curves when the matrix, or medium in which the unknown substance is contained, is itself complex and cannot be duplicated for preparation of standards. The "Standard Addition Method" is described in which the standard unknown is added to the solution and the original concentration is found by extrapolation back to zero addition. This is extended to multicomponent analysis where matrices are used to extrapolate back to an analyte vector, and where more sensors than analytes may be included. This latter is the "Generalized Standard Addition Method". The authors have worked in this area.

In Chapter 5, the important problem of resolution of analytical peaks is discussed. A review-like summary gives forms of equations commonly associated with signal output curves and then several methods of attempting to separate them are discussed. Someone needing to resolve this problem would have to closely study this chapter, along with the source material, and try various methods. No one method is cited as being the most generally applicable.

It is in Chapter 6 that we finally reach the cutting edge of technology and the real objective of the text. And it is heavy going. The problem described in this chapter is how to extract knowledge of the system from information about the system, but in the most general sense. Given an n-dimensional data set, the goal is simply to learn something about a property or behavior of the system. Data may be continuous, or it may be in categories. This long chapter is an excellent introduction and summary of the state of this art. It covers applications of pattern recognition with supervised and unsupervised learning. Preprocessing is discussed for missing data, redundant variables, translation, normalization, scaling, weighting, and rotation of axes. These types of preprocessing can be used to find patterns in data which may appear superficially to be random. The best rotation may combine several discrimination factors into one, thus reducing the dimension of the problem. It is also used in rating the discriminating power of a given variable. This material seems to have great potential use, but be prepared to do some supplementary reading in pattern recognition.

Chapter 7 is about control and optimization, and it seems strangely out of place. While it is true that some analytical instruments used by the chemist may contain a controller, it is not at all clear that a treatment of 15 pages, including multivariable systems and optimization, will give much practical help to the uninitiated.

In summary, this is a specialty book on the specialty area. Its principal use is probably as an introduction to the research area, but it could certainly be a useful tool for a mathematically and statistically inclined chemist to learn how to optimally process laboratory data. It would make a difficult text for any instructor not well versed in the field.

Richard H. Luecke, *University of Missouri/Columbia*

Charge-Transfer Reactions in Electrochemical and Chemical Processes. By L. I. Krishtalik. Consultants Bureau: New York. 1986. xvii + 326 pp. $65.00. ISBN 0-306-10986-7

This book has an interesting-sounding title, especially in view of the broadbased significance of charge-transfer processes in chemical phenomena. Not surprisingly, perhaps, the treatment of the topics covered is slanted heavily toward Soviet contributions. This emphasis does not in itself detract from the value of the book because substantial contributions have been made over the years, especially in theoretical electrochemical aspects, by the Moscow school, and this perspective complements those available in several recent reviews by Western authors.

Less appealing, however, are the choice of topics and detailed discussion, which largely reflect the author's often-controversial published work, rather than providing a balanced treatment more in tune with the book's title. In particular, the author devotes two entire chapters and portions of the remaining five to the interpretation of electrode reactions in terms of so-called "barrierless" and "activationless" processes. Electrochemical hydrogen evolution is also given a disproportionately heavy emphasis. By contrast, discussion of outer-sphere electron transfer, either at electrodes or in homogeneous solution, is given surprisingly little attention. Indeed, homogeneous-phase electron-transfer processes receive only a passing mention, and the seminal contributions of the Taube school in this important area are entirely ignored.

As a consequence, the book is of primary interest to electrochemists, even though some of the discussion of electron-transfer theory is of broader significance. Several arguments made in the text appear to be misleading if not incorrect. For example, in Chapter 1 the author simply rehashes the original arguments of Temkin regarding the supposed difficulties of interpreting activation parameters associated with control of the temperature-dependent potential, even though more recent published discussions have demonstrated these "difficulties" to be illusory. Also, in Chapter 3 the Marcus equation for the intrinsic solvent reorganization energy is perceived to "suffer the same drawbacks as the Born theory of solvation". This is incorrect since the former deals with nonequilibrium solvent polarization and hence is dominated by optical, rather than static, solvent dielectric properties.

Overall, the book does offer some interesting and somewhat unusual perspectives, although it is doubtful that it is of sufficiently broad interest to become an important source text in the area of charge-transfer processes.

Michael J. Weaver, *Purdue University*

The Biochemistry of the Nucleic Acids. Tenth Edition. By Roger L. P. Adams, John T. Knowler, and David P. Leader (University of Glasgow). Chapman and Hall: London and New York. 1986. xviii + 526 pp. $59.95 ($33.00/paper). ISBN 0-412-27270-9

This is the tenth edition of the textbook originally written by J. N. Davidson. This volume provides a good reference source and survey of nucleic acid biochemistry; it is appropriate for a one-semester advanced undergraduate course or a graduate-level course in nucleic acid biochemistry. It is written descriptively; the strongest chapters are those on replication, transcription, and processing. The text is well-referenced, so that the serious student can locate the source material easily.

The text begins with a brief historical introduction, followed by a

chapter on the basics of DNA structure, and then goes into the major subject area, the biochemistry and molecular biology of DNA and RNA. Chapter 3 is entitled "Chromosome Organization" and covers the various forms of DNA in eukaryotes, bacteria, and viruses. Chapter 4, entitled "Degradation and Modification of Nucleic Acids", contains a good description and discussion of the numerous enzymes which interact with DNA and RNA. In Chapter 5, the authors review the basics of nucleotide metabolism and catabolism. Chapter 6 is a lengthy chapter on the replication of DNA, starting with the description of the classic Meselson and Stahl experiments demonstrating semiconservative replication and continuing to a description of the current understanding of this process and the various enzymes involved. Chapter 7 discusses repair, recombination, and DNA rearrangement beginning with a brief discussion of mutagenesis, followed by a discussion of repair mechanisms. This is followed by sections on recombination, tranposition, conversion, and rearrangement.

The subject changes to RNA in Chapter 8, entitled "RNA Biosynthesis", a brief discussion on RNA polymerase and RNA viruses. Chapter 9 is a lengthy discussion of gene transcription and processing, primarily centered on eukaryotes. Control of transcription and mRNA processing is covered in Chapter 10 with descriptions of the *lac* and *trp* operons, and phage lambda in prokaryotes, followed by cis- and trans-acting factors in eukaryotes, methylation, and other factors involved in eukaryotic transcription. The final chapter of the text discusses the translation of mRNA into proteins, including t-RNA and ribosome structure.

The appendix briefly describes several laboratory methods used in nucleic acid biochemistry. The physical biochemistry (in particular, spectroscopy, thermodynamics, and crystallography) of the nucleic acids is *not* covered; there are brief discussions on Z-DNA, autocatalytic splicing in *Tetrahymena*, and DNA–ligand interactions. The text is updated to December 1985, at which time the HIV virus was not yet worthy of mention in the index, but it was allocated one sentence as an example of a retrovirus! Keeping a nucleic acid biochemistry text current is not an easy task; the authors of this text have done an excellent job.

Michael P. Stone, *Vanderbilt University*

Food Flavours. Part B. The Flavour of Beverages. Edited by I. D. Morton and A. J. MacLeod (King's College London). Elsevier Science Publishers: Amsterdam and New York. 1986. x + 379 pp. $98.00. ISBN 0-444-42599-3

This work, which forms part of the series "Developments in Food Science", provides concentrated information on the flavors of some of the more important beverages. It will be a useful reference for food scientists.

The seven chapters discuss flavor and aroma research relating to respectively coffee, tea, fermented cider, beer, wines (including vermouth and fortified wines), distilled alcoholic beverages, and non-alcoholic fruit beverages. Each of these areas has been the subject of extensive research; this work cites a total of some 1100 references mostly to the original literature.

Flavor is a composite of odor and taste, and therefore both aspects are discussed. The contributors have generally chosen the more accessible approach of summarizing the original data (for example, by listing identified odor compounds in tabular form), rather than merely citing references. A majority of analytical information is obtained solely by GC–MS studies, and exact quantitation is not always possible, but the importance of identified components to perceived flavor is generally indicated, and threshold odor-detection levels of many compounds are given.

Some of the methodology of flavor research is described. There is an extensive discussion of flavor panelling and prediction of flavor character from analytical data in Chapter IV. Also considered are factors such as flavor biosynthesis and storage and processing conditions that are responsible for development of some flavors.

Keith T. Buck, *Fries and Fries Division, Mallinckrodt, Inc.*

Modern Techniques in High-Resolution FT-NMR. By N. Chandrakumar (Central Leather Research Institute) and S. Subramanian (Indian Institute of Chemistry). Springer-Verlag: New York and Heidelberg. 1987. vii + 388 pp. $59.00. ISBN 0-387-96327-8

This is an interesting text, intended for those users of NMR spectroscopy who are intent on obtaining a detailed understanding of the quantum mechanical basis for a pulse sequence and its consequences on the nuclear spins. In the authors own words, they "...attempt in this book to capture the spirit of NMR as it is practiced today, by presenting a coherent view of the fundamentals on which it rests". The book is composed of seven chapters and six useful appendices. the coverage of topics is impressive, from virtually any aspect of one-dimensional liquid state NMR to high-resolution solid-state NMR. In between these "extremes", the authors present a lucid description of two-dimensional NMR and multiple quantum implications in NMR spectroscopy.

The authors can accomplish this because of the careful presentation of the materials in chapters one and three. In these chapters the authors give a lucid introduction to the theory of the NMR experiment and lay down the principles of coherence-transfer experiments. Rather than use "vector picture" approach to describe the various spin manipulations employed in NMR spectroscopy, the authors have chosen the formal method of describing the motion of the spin ensemble in the presence of various interactions. Where possible the authors have combined both approaches when they have felt it would be in the reader's interest. Their treatment, as they claimed, is a coherent one. These two chapters in combination with the appendices should be read with pen in hand. Even with the detailed mathematical presentation, the authors leave many of the little details to the reader. With these two chapters firmly in hand, the rest of the book can be digested with relative ease.

The authors' writing style is clear and concise. From a pedagogical point of view my only concern with the book deals with the lack of references. How can the authors discuss spin echos without a direct reference to Hahn or J-spectroscopy, without a reference to Freeman or concertina effects, without a reference to Waugh? This approach is used throughout the book and it is an annoyance. Another example of this point is the chapter dealing with solids. Here the introductory material in the chapter parallels the treatment presented by Haeberlen. The overall content of the chapter has many of the examples found in Mehring's book. Both of these books are "referenced" at the end of the book in a section entitled "Selected Bibliography". Other than these minor points, I found the book to be excellent. The text could be used as a reference book in graduate level courses in NMR spectroscopy and it should be used by graduate students in the area of NMR spectroscopy.

Paul D. Ellis, *University of South Carolina*

Clay Minerals and the Origin of Life. By A. G. Cairns-Smith (University of Glasgow) and H. Hartman (Massachusetts Institute of Technology). Cambridge University Press: Cambridge. 1986. xiv + 193 pp. $34.50. ISBN 0-521-32408-4

Beauty inspires lofty thought; beauty combined with mystery inspires speculation about hidden meaning and disguised purpose. Clays, so macroscopically dull, exhibit such an endless variety of beautiful forms under the electron microscope that clay mineralogists are understandably inspired to suspect very special roles for clay minerals in nature. One such role might be that growing clay crystals could function as template-instructed information transmitters able to sustain a level of information content and replication fidelity sufficient to behave as genes. On the early Earth, the speculation goes, clay mineral genes could have evolved inorganically through Darwinian selection to a complexity that would satisfy a definition of Life; eventually, catalytic cooperation between clay genes and molecules dissolved in the clay-forming liquor led to the latter taking over the evolutionary process and beginning a long climb to the organic life we know today. Three dozen clay mineralogists and other interested scientists were gathered in Glasgow in 1983 to report on crystal structures of clay minerals and to explain to one another how clay protogenes could have worked. Their discussions led to this book. While formally a conference proceedings with individual authors for each chapter, the editors have devoted so much effort to matching the chapters to one another and to supplying editorial guidance that it really has the character of a coherent popular scientific monograph. Despite the eminence of the authors, the writing style is uniformly clear and the tone is entertaining; it reads easily enough that high school chemistry students can follow the main story. Whether or not you elect to believe in the Clay Hypothesis for the Origin of Life on Earth (my own money has been bet on deep sea hydrothermal vents), you will enjoy and profit from reading this neat little book.

William Gardiner, *University of Texas at Austin*

Chemical Demonstrations: A Handbook for Teachers of Chemistry. Volume 2. By Bassam Z. Shakhashiri (National Science Foundation). The University of Wisconsin Press: Madison, Wisconsin. 1986. xxxvi + 312 pp. $25.00. ISBN 0-299-10130-4

Volume 2 of "Chemical Demonstrations" should enjoy success equal to that of the well-received first volume in this series. Each volume centers on a small number of topics: Volume 1 presented spectacular and colorful demonstrations in Thermochemistry, Chemiluminescence, Polymerization and Complexation; Volume 2, although a bit more sedate, includes many delightful, some startling, and overall, interesting sets of the lecture demonstrations focusing on the Physical and Chemical Behavior of Gases and on Oscillating Reactions.

An essay by Henry A. Bent at the beginning of this edition sets a tone of adventure mixed with practicality, as he discusses the art of teaching chemistry. Following this is Shakhashiri's first-edition introduction, well worth repeating for its presentation of the philosophy of teaching with

demonstrations, and the general methodology, uses, and precautions one should observe in lecture demonstrations. Fourteen collaborators (of which all but four were formally associated with the University of Wisconsin's General Chemistry Program or the University of Wisconsin's Institute for Chemical Education) pooled their efforts with Professor Shakhashiri to develop the 69 demonstrations in this volume.

There are several features that distinguish this work (and its predecessor) from other demonstration handbooks. The most outstanding of these features are the discussions, both those introducing each topic and especially those included with each demonstration. These discussions clearly detail the chemical and physical principles illustrated by the demonstrations. Another interesting feature is the presentation, in many cases, of several alternate procedures, thus allowing the user to choose the size of the effects demonstrated, or the time involved in the particular demonstration; the instructions for each demonstration are complete and easily followed. In addition, methods for disposing of wastes are given as needed, along with an outline of hazards and a listing of references for each demonstration.

Professor Shakhashiri intends his demonstration volumes for high school as well as college and university teachers. Except for the best equipped high schools, I suspect that this volume's contents are largely not usable. Nonetheless, both the uninitiated lecture demonstrator and those experienced will find this volume's material enlightening, useful, and inspiring. I, for one, look forward to the publication of the planned succeeding volumes in this series.

Marian Chu Hallada, *University of Michigan*

Spectroscopy of Biological Systems. Advances in Spectroscopy. Volume 13. Edited by R. J. H. Clark and R. E. Hester. John Wiley & Sons: New York. 1985. xviii + 545 pp. $155.00. ISNB 0-471-90978-5

Volume 13 of the highly acclaimed series "Advances in Infrared and Raman Spectroscopy", which has for many years produced an annual review of important advances in vibrational spectroscopy, is the first of the new series to be devoted to a single theme. To highlight this step, the series title has been changed to "Advances in Spectroscopy". The first volume is on the application of infrared and Raman spectroscopy to problems in molecular biology and reflects the current high level of activity in this area.

The first chapter describes new methods for resolution enhancement of infrared spectra of proteins, enzymes, and phospholipids. These methods are extremely useful in order to be able to analyze instrumentally unresolvable spectra of large molecules such as most biomolecules. The following chapter reviews the current literature on the nonresonant Raman spectroscopy of protein secondary structure determination and side-chain microenvironment. Chapter 3 deals with the exciting new and promising field of ultraviolet resonance Raman spectroscopy of proteins and related compounds.

The next three chapters are essentially devoted to nucleic acid spectroscopy. Chapter 4 review the recent progress in the application of nonresonant and resonant Raman spectroscopy to investigate local conformations and polymorphism of DNA and to established spectra–structure relationships. The next chapter is a logical extension of the previous one and presents the latest results on the structure determination of viruses and nucleoproteins by Raman spectroscopy. In this chapter, the resolution enhancement methods described in Chapter 1 are applied to Raman spectra of nucleic acids and it is shown that Raman spectroscopy can be used as a dynamic probe of virus structure via hydrogen isotope exchange. The last chapter on nucleic acids deals with the study of drug–nucleic acid interactions by Raman, FTIR, and fluorescence spectroscopy and presents some in vitro and in vivo results on anticancer drugs bound to nucleic acids. The micro-FTIR spectrum of a single cell treated with the drug adriamycin demonstrates the enormous potential of vibrational spectroscopy in molecular biology.

The last four chapters of this volume review the current understanding of steady-state and time-resolved vibrational spectroscopy of protein chromophores. Chapter 7 starts this section with a comprehensive discussion of normal coordinate analysis of metalloporphyrins and lumiflavin which are models of the chromophores of haem proteins and flavoproteins, respectively. These calculations are extremely useful to obtain secure assignments of complex spectra. Chapter 8 deals with the detailed analysis of the resonance Raman spectra of flavins and flavoproteins in an attempt to identify intermediates in flavin catalytic cycles. The final two chapters are devoted to time-resolved resonance Raman spectroscopy. Chapter 9 review studies of short-live reaction intermediates of a peroxidase and of a cytochrome *c* oxydase, while Chapter 10 is concerned with the structure and function of bacteriorhodopsin. Both chapters show elegantly that time-resolved spectra are important to determine the mechanistic details of enzymatic and photochemical reactions.

In summary, this volume contains articles by a selection of authors who are leaders in their fields and hence it maintains the overall high standard of the series. The book is well referenced and very readable, and the particular topics covered are all of current relevance. Therefore, this volume should be an exceedingly valuable addition to the literature on subjects of interest to many researchers in several fields.

Michel Pézolet, *Laval University*

Toxicology of Insecticides. By Fumio Matsumura (Pesticide Research Center, Michigan State University). Plenum Press: New York. 1985. xx + 598 pp. $45.00. ISBN 0-306-41979-3

This is the second edition of a book published a decade earlier that seeks to cover the field described by the title. In keeping with the very large area of knowledge covered, treatment of the subject is broad and not generally at a detailed level (which would require a multivolume work). What is given, with some exceptions, is a very good overview of the field.

As in the earlier edition, this book is divided into eleven chapters: Introduction, General Principles of Insecticide Toxicology, Classification of Insecticides, Modes of Action of Insecticides, Metabolism of Insecticides by Animals and Plants, Toxicological Studies on Insects, Dynamics of Insecticide Movement in the Animal Body, Movement of Insecticides in the Environment, Environmental Alteration of Insecticide Residues, Effects of Pesticides on Wildlife, and Hazards to Man and Domestic Animals. The same chapter titles were used in the previous edition, with the exception of Chapter 6, which was titled "Entry of Insecticides into Animal Systems". Those familiar with the earlier edition will therefore find much similarity between the two. In fact, there may be too much similarity with the earlier edition. Much of the earlier edition was used verbatum with additions made sometimes only at the end of the chapter. Chapter 7 is an example; two pages were added to the earlier text. The most extensive revisions appear to occur, as one might expect, in those areas where the author is an active researcher. Other chapters give the impression that the book was published in the 1970's. The chapter dealing with chromatographic analysis of pesticides, for instance, reference works published before the first edition as suggested reading.

The author's stated intent was to produce a usable textbook for teaching at the graduate level or for the use of scientists in other disciplines seeking to understand the basics of insecticide toxicology. The text and numerous figures, tables, and other illustrations are for the most part clear and easily read, although figures representing chemical structures are not consistent in their format. Text is liberally referenced for those wishing to obtain entry into the literature. As noted above, however, most of these references are to publications before 1975. With these reservations, and those expressed in the preceding paragraph in mind, the book can be recommended for pedagogical use. In fact, I use the book as a supplemental reading text in a course on toxicology. The earlier edition had the added advantage that it was a much more current general reference of the field at that time. In most respects the second edition is not as current as its predecessor was when it was published. Purchase of the second edition to replace the earlier one in a personal library might not be called for even though the price is reasonable. However, I would certainly purchase the book if I did not already own a copy.

Kenneth D. McMurtrey, *University of Southern Mississippi*

Chemical, Biological and Industrial Applications of Infrared Spectroscopy. Edited by James R. Durig (University of South Carolina). John Wiley and Sons: New York. 1985. xviii + 399 pp. $49.95. ISBN 0-471-90834-7

This book shows how infrared spectroscopy is used to study a considerable variety of materials and phenomena of chemical biological and industrial importance. It does this very well, comprehensively, and with a wealth of detail, through fourteen authoritative contributions. Most are based on presentations commemorating the founding of the Coblentz Society, but the book is considerably more than a compilation of lectures at a symposium. Each contribution addresses a type of study through description of one or more specific investigations. This makes it possible for the reader to obtain introductions to application areas, particularly infrared studies of pesticides, surfaces, biological systems, natural and synthetic membranes, thin films, mineral/organic blends, fuels, organosilicon compounds, and to the use of infrared methods in studying order–disorder phenomena and structural relaxation. While this is not a complete list of relevant applications of infrared spectroscopy, and the breadths of the descriptions necessarily are limited in order to provide more depth on the specific subjects, the overall approach is successful.

In addition to the chapters on specific applications, there are several unusual ones. These include R. N. Jones' historical review of analytical applications of vibrational spectroscopy, which begins fancifully with Lucretus in 60 B.C. and proceeds through the history of the field up to the present with thoughts about future directions. It is a delightful chapter. In a different vein, the chapter on approaches to solving nonroutine industrial problems illustrates practical ways of dealing with

complex systems.

I expect that many workers seeking to apply infrared spectroscopy to solve chemical, biological, and industrial problems will find the introductions, examples, and references in the book provide a good start. This is very much in the spirit of the many infrared instructional programs inspired and taught by Professor Richard C. Lord, to whom the book is dedicated.

William M. Risen, Jr., *Brown University*

Stopping Powers for Electrons and Positrons. ICRU Report 37. International Commission on Radiation Units and Measurements: Bethesda, MD. 1984, v + 271 pp. $23.00. ISBN 913394-31-9

According to the authors, the purpose of this book was to supply up-to-date information on stopping powers of charged particles to satisfy the needs of biomedical dosimetry. Clearly they have accomplished this. The material is presented in a clear and concise manner. It should be a good reference book for individuals already experienced in radiation physics, chemistry, biology, or medicine, because it provides a summary of recent advances in radiation theory. The first 54 pages discuss the general theories and how to apply them, while the remainder of the book provides stopping powers, ranges, and yields in tabular form for electrons and positrons (0.01–1000 MeV range) in elemental substances and in compounds and mixtures.

The first part of the book is divided into 11 sections. The first section provides a general background that describes how stopping power is customarily separated into collisional and radiative stopping powers with collisional stopping power being the "local" event. The mean excitation energy is the principal quantity needed to evaluate this. After discussing the formulae used for the collisional stopping power, sections 2 through 8 discuss the estimation of mean excitation energies for elements and compounds and the evaluation of collisional stopping powers. Section 9 discusses radiative stopping power for a large energy range while section 10 discusses radiation yields. Finally, section 11 discusses differences between collisional stopping powers of electrons and of positrons.

Overall the theory is presented in an understandable and carefully condensed way. The extensive tables provide numbers of stopping powers for a wide range of energies with an interpolation–extrapolation procedure for energies other than those listed and will undoubtedly also be invaluable to many people working in the field of biomedical dosimetry.

John A. Schreifels, *University of Missouri—St. Louis*

Volumes of Proceedings

Nucleophilicity. Edited by J. Milton Harris and Samuel P. McManus. American Chemical Society: Washington, DC. 1987. xiii + 494 pp. $94.95. ISBN 0-8412-0952-9.

The concept of nucleophilicity is about a half-century old, and although it is quite mature, it remains a source of new ideas and applications and a stimulus to research. A symposium on the subject took place in Chicago in 1985; the papers presented were a mixture of reviews and original research. Thirty-one of them have been carefully rewritten as chapters and arranged as a fairly well integrated presentation to make this book. They are grouped under the headings Marcus Theory, Alkyl Transfer, and Gas-phase Reactions; Brønsted Equation, Hard–Soft Acid–Base Theory, and Factors in Nucleophilicity; Linear Free-Energy Relationships for Solvent Nucleophilicity; Novel Nucleophilic Reactions; and Enhancement of Nucleophilicity. The whole provides a useful review of the nearly present state of the subject. The production is good, with everything set in type, and the subject index is thorough. This should become a widely read reference work of appeal to both synthetic and theoretical chemists.

Books on Applied Subjects

Oats: Chemistry and Technology. Edited by Francis H. Webster. American Association of Cereal Chemists, Inc.: St. Paul, MN. 1986. 433 pp. $79.00. ISBN 0-913250-30-9

Several of the 14 chapters in this book have a strong chemical orientation. Among them may be mentioned Oat Phenolics (by F. W. Collins), Oat Flavor Chemistry (by M. G. Heydanek, Jr., and R. J. McGorrin), Oat Lipids and Lipid-Related Enzymes (by V. L. Youngs), Oat Storage Proteins (by D. M. Peterson and A. C. Brinegar), Oat β-Glucan (by P. J. Wood), Sugars (by L. A. MacArthur-Grant), and Oat Starch (by D. Paton).

Vitamin A Deficiency and Its Control. Edited by J. Christopher Bauernfeind. Academic Press: Orlando. 1986. xviii + 530 pp. $89.00. ISBN 0-12-082852-9

Although the emphasis of this book is on nutrition and public health, there is a substantial amount of biochemistry included, especially in a chapter titled "Vitamin A—Nutrient Interrelationships".

The Microbiology of Poultry Meat Products. Edited by F. E. Cunningham and N. A. Cox. Academic Press, Inc.: Orlando. 1987. viii + 359 pp. $65.00. ISBN 0-12-199880-0

The emphasis of this book is on microbiology, but one chapter treats the use of chemical additives, such as antibiotics, salts, preservatives, and disinfectants, and another treats irradiation as a means of preservation.

Optimal Design of Process Equipment. By K. Urbaniec. Ellis Horwood Limited Publishers: Chichester. John Wiley and Sons: New York. 1986. 243 pp. $79.95. ISBN 0470-20248-3

This is an English translation of a Polish original, the date of which, if indeed it is given, is well hidden. However, a scan of the short list of references (91) disclosed nothing more recent than 1979. The eleven chapters are largely mathematical and treat the fundamental problems of chemical engineering.

Bailey's Industrial Oil and Fat Products: Volume 3. Edited by Thomas H. Applewhite. John Wiley and Sons: New York. 1985. 353 pp. ISBN 0-471-80951-9

This volume is designed to augment Volumes 1 and 2 with a selection of contributed chapters concerned with edible fats and oils. The topics range from instrumental analysis to packaging, with much attention to flavor. This volume is independently indexed.

Alkalinity–pH Changes with Temperature for Waters in Industrial Systems. By A. G. D. Emerson. John Wiley and Sons: New York. 1986. 36 pp + 126 tables. $49.95. ISBN 0470-20727-2

This is largely a book of tables, which follow 32 pages of explanatory text. The principal focus is on the fact that pH changes with temperature, and that measurements of pH made at laboratory temperatures do not accurately reflect the actual pH at the temperatures of industrial use. Use of these tables enables one to extrapolate to the conditions in actual use, and thereby more effectively to combat such problems as corrosion, fouling, etc., which depend on pH.

Drying of Solids: Recent International Developments. Edited by Arun S. Mujumdar. John Wiley and Sons: New York. 1986. xi + 342 pp. $39.95. ISBN 0470-20754-X

The subject of drying, of great importance in the chemical and processing industries, is discussed in a group of contributed papers under several section headings: Modelling and Simulation; Drying of Granular Materials; Drying of Grains; Spray Drying; Drying of Paper and Continuous Sheets; Energy Aspects in Drying of Solids, and Miscellaneous Topics. The papers are reproduced from typescript "as submitted by the authors"; the variation in appearance is extremely large. The two-page index is less than adequate.

Distillation Tray Fundamentals. By M. J. Lockett (Union Carbide Corporation). Cambridge University Press: New York. 1986. xxiii + 226 pp. $54.50. ISBN 0-521-32106-9

The aim of the author is to draw together and interpret the sometimes conflicting previous reports on the subject, primarily for the process engineer. He recognizes that sieve trays are "hardly more than sheets of metal with a few holes punched in them" and proceeds from there to deal with the complex hydrodynamic and mass-transfer problems that are involved.

Mixing: Theory and Practice. Volume III. Edited by Vincent W. Uhl and Joseph B. Gray. Academic Press: Orlando. 1986. ix + 314 pp. $89.50. ISBN 0-12-706603-9

There are five contributed chapters in this volume: Agitation of Particulate Solid-Solid Mixtures (Gray and Oldshue); Turbulent Radial Mixing in Pipes (Gray); Flow and Turbulence in Vessels with Axial Impellers (Fořt); Scale-up of Equipment for Agitating Liquids (Uhl and von Essen); and Mixing of Particulate Solids (Williams). The previous volume appeared in 1967.