

## Book Reviews\*

**NMR Applications in Biopolymers. Basic Life Sciences. Volume 56.** Edited by J. W. Finley (Nabisco Brands, Inc.), S. J. Schmidt (University of Illinois), and A. S. Serianni (University of Notre Dame). Plenum Press: New York and London. 1990. x + 515 pp. \$115.00. ISBN 0-306-43719-8.

This book presents papers from the following two symposia sponsored by the American Chemical Society: (1) Recent Developments in the NMR Spectroscopy of Carbohydrates, sponsored by the Division of Carbohydrate Chemistry at the Toronto meeting in June 1988, and (2) NMR Applications in Food Chemistry, sponsored by the Agricultural and Food Division at the Los Angeles meeting in September 1988. Since the subjects discussed in the first symposium compliment those presented in the second, the editors felt that the results of both events should be published in one volume. In this book, current NMR techniques and results pertaining to biopolymers are discussed, information on biopolymer behavior in solution and in the solid state is provided, and, finally, the broad range of NMR applications to biopolymer chemistry is presented. The first paper is an overview by the editors on Applications of NMR in Agriculture and Biochemistry. This is followed by 25 papers (in typescript form) and a subject index. Affiliations of the authors of the papers are given in the headings of the individual papers.

**Peptides: Chemistry, Structure and Biology.** Edited by Jean E. Rivier (Salk Institute for Biological Studies) and Garland R. Marshall (Washington University School of Medicine). Escrom: Leiden. 1990. liv + 1113 pp. \$215.00. ISBN 90-72100-06-5.

This book contains the proceedings of the Eleventh American Peptide Symposium held in La Jolla, California, on July 9–14, 1989. The 393 articles published in the book were selected by the Program committee from 65 oral presentations and 390 poster displays at the symposium. A preface by the editors is followed by a list of the chairman of the symposium, the committee members, sponsors, donors, and contributors, and a 6-page list of abbreviations used in the book. The text of the award lecture by Murray Goodman, recipient of the Seventh Alan E. Pierce Award, appears as the first article. The following articles are organized according to the Sessions of the Symposium: (1) Structural biology; (2) Enzymology; (3) Analytical methodologies; (4) Recent bioactive peptides and biology; (5) Peptide/protein folding; (6) Immunology; (7) Protein/DNA interactions; (8) HIV and related areas; and (9) Synthetic methodologies and peptide bond mimetics. There is an author index and a subject index. The affiliations of the authors are given at the headings of each article.

**Amino Acids: Chemistry, Biology and Medicine.** Edited by Gert Lubec (University of Vienna) and Gerald A. Rosenthal (University of Kentucky). Escrom: Leiden. 1990. xx + 1195 pp. \$195.00. ISBN 90-72199-04-9.

This book is comprised of a number of papers presented at an International Congress on Amino Acid Research in Vienna, Austria, on August 7–12, 1989. There are author and subject indexes; affiliations of the authors are given at the headings of each paper.

**Studies in Surface Science and Catalysis. Volume 57. Spectroscopic Characterization of Heterogeneous Catalysts. Part A: Methods of Surface Analysis. Part B: Chemisorption of Probe Molecules.** Edited by J. L. G. Fierro (Instituto de Catálisis y Petroleoquímica, CSIC, Madrid). Elsevier: Amsterdam. 1990. Part A: xii + 384 pp. \$133.25. ISBN 0-444-88242-1. Part B: xiv + 394 pp. \$148.75. ISBN 0-444-88243-X. Set: \$253.75. ISBN 0-444-88812-8.

This work by 14 authors consists of two parts primarily concerning the various available spectroscopic methods for analyzing the interactions of adsorbates with supported transition-metal catalysts. Part A begins with a chapter written by the editor which briefly outlines the numerous spectroscopic techniques that will be covered in depth in later chapters. Although there is far too little information presented in this first chapter to serve as a useful tutorial, it will succeed in convincing the beginning surface scientist that there is a vast arsenal of analytical tools available for surface studies. Many of the figures presented in this chapter are oversimplified and may be confusing in some cases. Chapter 2 presents a useful general discussion of several of the electronic spectroscopic techniques (XPS, Auger, UPS); but there are only a limited amount of data on heterogeneous catalysts actually presented. The third chapter

contains an in-depth discussion of characterization of the surface of oxides, particularly by infrared, Raman, and NMR techniques. In this case quite a bit of experimental data are presented from 210 references. Chapter 4 addresses characterization of catalysts using EXAFS; the 72-p discussion thoroughly treats the topic. The last chapter of Part A concerns the use of Mössbauer spectroscopy in catalyst characterization. A well-written, lengthy treatise on this subject is given with numerous examples presented.

Part B begins with a discussion of the various probe molecules and methods of measurement for adsorption on supported catalysts. The second chapter focuses on the use of infrared spectroscopy in catalyst characterization. This chapter contains 195 references, but infrared probably should have received even more emphasis given its extensive use today. The third chapter of Part B presents a very nice discussion of the theory and use of HREELS in surface science, but all of the examples refer to single-crystal work, with no discussion of the application of the technique to supported catalysts, which was the theme of the volume. Chapters 4 and 5 deal with the use of the NMR and EPR techniques, respectively. Both present thorough discussions of the theoretical aspects of the methods and adequate examples in heterogeneous catalysis. The final chapter in Part B presents an excellent discussion of thermal desorption methods, particularly from a theoretical point of view.

In general, the layout of the volume is satisfactory, although the use of different types of print in some of the chapters can be annoying. In particular, Chapter 4 of Part A could be difficult to read by some due to the light nature of the type. In summary, this two-part volume on spectroscopic characterization of heterogeneous catalysts will be a useful addition to the shelves of libraries, but its rather high cost may preclude its purchase by many individual surface scientists.

S. D. Worley, *Auburn University*

**Studies in Surface Science and Catalysis. Volume 58. Introduction to Zeolite Science and Practice.** Edited by H. van Bekkum (University of Technology, Delft), E. M. Flanigen (UOP, Tarrytown Technical Center), and J. C. Jansen (University of Technology, Delft). Elsevier: Amsterdam, Oxford, New York, and Tokyo. 1991. xvi + 754 pp. \$225.50. ISBN 0-444-88969-8.

This book was conceived during the Summer School on Zeolites, held in 1989 at Zeist, The Netherlands, on the occasion of the 8th International Conference on Zeolites. It consists of 16 chapters in typescript form by 25 authors; a list of these with their affiliations is given in the introductory part of the book. There are two appendixes, a keyword index, and a list of the 58 volumes in the *Studies in Surface Science and Catalysis* series at the end.

**Polyimides.** Edited by D. Wilson (BP Chemicals (Hitco) Inc.), H. D. Stenzenberger (Technochemie GmbH), and P. M. Hergenrother (NASA Langley Research Center). Blackie: Glasgow and London. Chapman and Hall: New York. 1990. x + 297 pp. \$139.95. ISBN 0-412-02181-1.

This book is required reading for anyone wishing to become informed about this commercially important class of polymers. In chapters covering synthesis and reactions, structure–property relations, characterization, and applications, the 12 contributing expert authors have presented a comprehensive review of their subject matter. Each chapter is fully documented with literature and patent references up to 1989, and there is especially good coverage of the Russian literature. An appendix on commercial sources for polyimide materials in all their application forms and grades will be useful for the practitioner who is getting started with his or her work.

It is a virtue of the book that the coverage of the subject is broad and is approached from several different viewpoints. Those wishing to delve into the chemistry of polyimides will certainly want to read the first two chapters by F. W. Harris and T. Takekoshi, respectively, and the fourth chapter by H. D. Stenzenberger. In Chapter 5, P. R. Young and R. Escott present a nice survey of the difficult work that has been done to characterize molecular weight distributions. The third chapter on structure–property relations by T. L. St. Clair has the thinnest coverage. The author shuns some of the deeper theoretical methods that have been, or could be, applied to properties, such as nonlinear optics, but he includes a fair representation of thermal properties. The dielectric behavior of polyimides is now a very hot topic, and one could have hoped for better coverage of it. Readers with practical interests will find a presentation style in the applications chapters (adhesives by P. M. Hergenrother,

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composites by D. Wilson, semiconductors by H. Satou, H. Suzuki, and D. Makino, and films and moldings by C. E. Sroog) that largely avoids the intricacies of the chemistry chapters. In summary, the book will be a valuable addition to the libraries of those working with polyimides.

Bruce E. Eichinger, *BIOSYM Technologies, Inc.*

**Molecular Mechanisms of Herbicide Selectivity.** By D. E. Hathway (Hatfield College, University of Durham). Oxford University Press: Oxford, 1989. v + 214 pp. ISBN 0-19-857642-0.

This book provides a valuable overview of herbicide selectivity from a molecular perspective. Nonexperts (e.g. this reviewer) will find Appendix I almost essential. Appendix I provides names and structures for the many herbicide abbreviations used throughout this book. The author has clearly written this book with plant biochemists, botanists, and agronomists in mind. Nevertheless, the author has correlated a wealth of descriptive data about every common herbicide. This book will become a highly convenient resource book for chemists involved in agriculturally related fields.

The first two chapters provide a basic introduction to weed populations and plant physiology. The descriptive material in Chapter two is collated in terms of various herbicide classes. There are ample references to the primary literature. Chapter three, by far the most comprehensive chapter, describes herbicide metabolism. It contains a thorough coverage of oxidative, reductive, and hydrolytic enzyme reactions. A few of the proposed mechanisms will stimulate discussion among organic chemists. Glycosidation and conjugation with amino acids are also discussed. Bioactivation and detoxification of active herbicides are also described in this chapter. Chapters four and five are short 9-page chapters which present a very readable overview of genetic resistance to herbicides and improving resistance through genetic engineering. Chapter six is a brief 4-page chapter on mycoherbicides. It effectively summarizes the few advances in this intriguing area. Chapter seven deals with allelochemicals as herbicides. It describes some practical consequences of employing chemicals produced by plants for weed control.

Absent from this coverage is the emerging area of light-activated herbicides.

George A. Kraus, *Iowa State University*

**Advances in Molecular Electronic Structure Theory. Volume 1. Calculation and Characterization of Molecular Potential Energy Surfaces.** Edited by Thom H. Dunning, Jr. (Pacific Northwest Laboratory). Jai Press: Greenwich, CT, 1990. xii + 266 pp. \$78.50. ISBN 0-89232-956-4.

This is the opening volume of a new annual series in theoretical chemistry. The editor is a former group leader at Argonne National Laboratories, and most of the authors are present and former collaborators of the Argonne group. While there is danger in such an approach, in the present case it gave a coherence to the collection which is seldom found in multi-author volumes. All authors are first-class scientists, and the well-balanced selection of topics produced a delightful and very useful volume. The subject, potential energy surfaces, should be qualified: most of the discussion centers around the potential energy surfaces of smaller systems, typically four atoms. Individual energy calculations for such systems can be carried out at a very high level these days, but the calculation and representation of whole surfaces and the characterization of the nuclear motion are still difficult problems.

In the first chapter, W. C. Ermler and H. C. Hsieh review the methods for the calculation of vibrational and rotational data from potential surfaces. This is a good introduction but covers only part of the literature on the subject. In Chapter 2, L. B. Harding discusses the calculation of reactive potential surfaces. Instead of a literature survey, most of this chapter consists of the detailed discussion of the reactive valleys of the  $H_2CO$  and the  $H_2O_2$  surfaces. It should be very useful for someone entering the field, as it covers many practical details in a lucid presentation. Chapter 3 (G. C. Schatz) is devoted to the analytical representation of reactive polyatomic potential surfaces. An economic and accurate representation of the surfaces is of major importance for dynamics studies, as it is impossible to map globally surfaces with many variables. I enjoyed this chapter, richly illustrated with examples. E. Kraka and T. H. Dunning summarize the theory of critical points and reaction paths. Due to the difficulties of complete characterization of potential energy surfaces, most studies are limited to determining the location and energy of critical points (minima and saddle points) and, in the next step, reaction paths. While the theory of critical points has been widely available for some time, reaction path calculations are much more problematic and scarce, and its review, together with that of the reaction path Hamiltonian approach, is very useful. C. E. Dykstra reviews long-range and weak interaction surfaces, i.e., van der Waals molecules. The emphasis is on electrostatic effects; Dykstra convincingly explains that the most chemically significant phenomena are largely

electrostatic in nature. This field has much to contribute to practical chemistry, mainly in the form of improved parametrization of empirical force fields. The closing chapter, by R. F. Frey and E. R. Davidson, is a delightful treatise on the Jahn-Teller theorem and its less well known predecessor, the Neumann-Wigner theorem. The chapter covers symmetry breaking, the intersection of potential surfaces, the quantum phase concept, surface topology, and symmetry rules. Much of this, except for the classical Jahn-Teller theorem, is not widely known or understood, and the authors performed a real service to the scientific community with this lucid review. As both experiment and theory moves from ground-state surfaces toward excited states, where surface crossings are common, the importance of these phenomena, formerly considered exotic, will undoubtedly increase.

In sum, this is an excellent volume that is highly recommended to both theoreticians and experimentalists.

Peter Pulay, *The University of Arkansas*

**Studies in Surface Science and Catalysis, 59. Heterogeneous Catalysis and Fine Chemicals II.** Edited by M. Guisnet, J. Barrault, C. Bouchoule, D. Duprez, G. Pérot, R. Maurel, and C. Montassier (Université de Poitiers, France). Elsevier: Amsterdam, Oxford, New York, Tokyo, 1991. xvii + 608 pp. \$220.00. ISBN 0-444-88514-5.

This volume contains the Proceedings from the Second International Symposium on Heterogeneous Catalysis and Fine Chemicals held in Poitiers, France, October 2-5, 1990. The 60 papers in typescript form are organized under the following three headings: Hydrogenation and Related Reactions; Oxidation; and Acid-Base Catalysis. There are author and subject indexes as well as a list of the other volumes in the *Surface Science and Catalysis* series.

**Studies in Surface Science and Catalysis, 62. Characterization of Porous Solids II.** Edited by F. Rodriguez-Reinoso (Universidad de Alicante, Spain), J. Rouquerol (CNRS, Marseille, France), K. S. W. Sing (Brunel University, Uxbridge, UK), and K. K. Unger (Johannes Gutenberg-Universität, Mainz, Germany). Elsevier: Amsterdam, Oxford, New York, Tokyo, 1991. xiv + 782 pp. \$243.00. ISBN 0-444-88569-2.

This collection of Proceedings of the IUPAC Symposium on the Characterization of Porous Solids ("COPS") held in Alicante, Spain, May 6-9, 1990 is the second symposium in a series (COPS I was held in 1987). There were 222 participants from 29 countries in this symposium. The text consists of 82 papers in typescript form, author and keyword indexes, and a list of other volumes in the *Surface Science and Catalysis* series.

**Fine Chemicals for the Electronics Industry II: Chemical Applications for the 1990s.** Edited by D. J. Ando (University of London) and M. G. Pellatt (BDH Limited, Poole). The Royal Society of Chemistry: Cambridge, UK, 1991. viii + 291 pp. £49.00. ISBN 0-85186-887-8.

This book contains the proceedings of a symposium organized by the Applied Solid State Chemistry and the Fine Chemicals and Medicinals Groups of the Royal Society of Chemistry, held at the University of York, UK, April 18-20, 1990. There are 14 papers in typescript form organized under the following headings: Materials for the Semiconductor Industry; Rare Earth Materials; Flat Panel Displays and Electronic Printing; Materials for Insulation and Optical Data Storage; Liquid Crystal Polymers and Nonlinear Optical Materials; and Molecular Electronics—21st Century Fine Chemicals? There is a subject index; affiliations of the authors are given at the headings of the papers.

**Iron Biominerals.** Edited by Richard B. Frankel (California Polytechnic State University) and Richard P. Blakemore (University of New Hampshire). Plenum Press: New York and London, 1991. x + 435 pp. \$95.00. ISBN 0-306-43718-X.

This book contains the Proceedings of a Conference on Iron Biominerals, held at the University of New Hampshire in Durham, NH, July 3-August 1, 1989. It consists of a preface and 31 chapters in typescript form organized under the following headings: Biomineralization; Biological Iron Oxides; Biological Iron Sulfides; Iron Storage in Ferritin; and Iron Acquisition. There is a list of the contributors with their affiliations and a subject index.

**Applied Laser Spectroscopy.** NATO ASI Series, Series B: Physics Volume 241. Edited by Wolfgang Demtröder (Kaiserslautern University, Germany) and Massimo Inguscio (University of Florence and European Laboratory for Nonlinear Spectroscopy, Italy). Plenum Press: New York and London, 1990. xii + 499 pp. \$115.00. ISBN 0-306-43717-1.

This book contains the lectures and seminars presented at the NATO Advanced Study Institute on Applied Laser Spectroscopy, held September 3-15, 1989 in San Miniato (Pisa), Italy. There are 38 chapters in

typescript form organized under the following headings: Fundamentals of Laser Spectroscopy and Quantum Optics; Spectroscopic Techniques and New Coherent Sources; Laser Spectroscopy of Atoms and Molecules; and Interdisciplinary Applications of Laser Spectroscopy (further organized into three parts: A. Solid State and Cluster Physics; B. Sensitive Detection of Isotopes, Combustion Processes and Pollutants; and C. Application to Frequency Metrology and Stabilization). There is a subject index and the affiliations of the authors are given at the headings of each chapter.

**Structure and Bonding. Volume 74. Metal Complexes with Tetrapyrrole Ligands II.** Edited by J. W. Buchler. Springer-Verlag: New York, Berlin, Heidelberg. 1991. vii + 154 pp. \$79.00. ISBN 0-387-52899-7.

This is Volume 74 of *Structure and Bonding* and the second issue dealing with *Metal Complexes with Tetrapyrrole Ligands*. The first issue with this title appeared as Volume 64 of this series in 1987. This volume contains two essays: (1) EXAFS Spectroscopy of Heme-Containing Oxygenases and Peroxidases by Laura A. Anderson (Kansas State University) and John H. Dawson (University of S. Carolina) and (2) Phthalocyaninatometal and Related Complexes with Special Electrical and Optical Properties by Hanna Schultz, Helmut Lehmann, Manfred Rein, and Michael Hanack (Universität Tübingen). These are accompanied by a cumulative index for Volumes 1–74, which is organized alphabetically by first author.

The first article describes the technique of EXAFS spectroscopy and then continues to discuss its applications in the field of heme-containing proteins. EXAFS data of the native species cytochrome P-450, chloroperoxidase, the peroxidases, and the catalase, as well as their protein free model complexes, are presented and discussed in reference to the complete catalytic cycles. A complete and up-to-date review of the field is also provided by the 219 cited references.

The second article (106 pages; 248 references) describes a range of metal tetrapyrrolic complexes which exhibit special electronic or optoelectronic properties. The survey covers the synthetic routes to a variety of porphyrins and phthalocyanines, their metal derivatives, and, finally, the structural alignment as polyassociated, polymeric, or polycondensed stacks. The discussion includes solids, liquid crystals, and Langmuir-Blodgett films. Finally, a number of potential uses for these materials is examined.

The contributions to this volume cover two very different fields relating to tetrapyrrole chemistry. Both are, however, well-written and comprehensive and relate to subjects of considerable current research interest. As such, it is likely that this volume will be of interest to a wide-reading audience.

Jonathan L. Sessler, *University of Texas at Austin*

**Essentials of Molecular Photochemistry.** By Andrew Gilbert and Jim Baggott. Blackwell Scientific Publications: Boston. 1991. 538 pp. Cloth \$114.95; Paper \$44.95. ISBN 0-632-02429-1.

This book addresses the admirable goal of introducing the senior undergraduate and graduate student about to embark on research in organic photochemistry to mechanistic aspects of this discipline. Much of the coverage is similar to that in Turro's classic text *Modern Molecular Photochemistry*, except that this Gilbert/Baggott work includes some additional topics and treats mechanistic aspects of the organic reactions in more detail. This text, for example, organizes reactions by functional group type (with the exception of the chapter on photooxygenations), rather than by mechanistic grouping as has been done in earlier texts. These mechanistic treatments are the highlight of the book, which also includes new sections on pericyclic reactions, lasers, and vision chemistry.

After a brief introductory section in Chapter 1, the authors treat the electronic structure of molecules in Chapter 2. This chapter, which provides a summary of elementary quantum mechanics usually taught in the introductory physical chemistry course, is offered as a descriptive review necessary to begin the more quantitative aspects of organic photochemistry. The next two chapters dealing with radiation, molecular orbitals, and molecular photophysics are also descriptive. They lack the quantitative detail and physical insight that comes with quantitative analysis which is available, for example, in Michl and Bonačić-Koutecký's recent text on *Electronic Aspects of Organic Photochemistry*. Nonetheless, the coverage in the Gilbert-Baggott book is very useful at the

introductory level. Chapter 3 deals with photochemical reactions, and specifically with analysis of electron transfer, energy transfer, pericyclic reactions, and the establishment of photochemical mechanisms. Covering so wide a range of topics, of course, means that each is covered briefly, but the text does provide the basis on which a lecturer can expand for an excellent introduction. The remaining five chapters deal respectively with the functional group photochemistry of C–C multiple bonds, carbonyl compounds, aromatics, nitrogen-containing chromophores, and other organic chromophores, before the book concludes with a chapter on photooxygenation reactions.

This book is a very useful introduction (at the beginning level) to the most important concepts of organic photochemistry. It is quite appropriate for the target audience and provides at least a brief coverage of most of the significant topics of organic photochemistry. This coverage seems to be free of significant errors, although it is rarely quantitatively detailed.

The interdisciplinary nature of photochemistry means that any text held to a reasonable length must omit many significant topics which are necessary for operation within the discipline. Among such topics which are not covered in this text are the following: polymer photochemistry; heterogeneous photocatalysis; the use of organized media in photochemical reactions; photography; inorganic photochemistry; chemiluminescence; quantitative aspects of characterization of reactive intermediates, i.e., rates and energies; solid-state photochemistry; detailed examples of the use of photochemistry in organic synthesis; and a consideration of photosynthesis. Nor are there extensive tables available in the text listing sensitizer energies, chemical filters, or lamp profiles, which are of interest to the practicing photochemist. Nonetheless, all of these topics are treated in review articles elsewhere and can be assigned by a lecturer as additional reading when students have acquired a basic understanding of the topics which are effectively covered in this well-constructed and logically presented text.

Marye Anne Fox, *University of Texas at Austin*

**Multiple Bonds and Low Coordination in Phosphorus Chemistry.** Edited by Manfred Regitz (Kaiserlautern University) and Otto J. Scherer (Kaiserlautern University). Georg Thieme: Stuttgart. 1990. xviii + 478 pp. \$320.00. ISBN 3-13-752201-3.

One of the most exciting developments in main group chemistry in the past 25 years has been the isolation and study of compounds containing heavier main group elements, in particular phosphorus and silicon, that are either multiply bonded or in unusually low coordination states. The pre-1960's "dogma" was that such compounds were not stable enough to be isolated. The volume under review shows how far phosphorus chemistry has moved from that overly narrow view. It is a compilation of clearly written and fully referenced chapters on a wide range of topics related to the volume's title. The authors—there are over 20 of them—are well-known contributors to this area of chemistry.

A brief historical introduction is followed by a chapter on bonding that emphasizes modern calculations. The rest of the volume is organized by the coordination number of phosphorus. Coordination number 1 in 96 pages includes sections on phosphinidenes, phosphalkynes, and phosphorus nitride and polyphosphorus units. Coordination number 2 covers a very large group of diverse compounds and includes, in 238 pages, phosphonium cations, 2-phosphaallylic cations, phosphinylidene-boranes and -borates, phosphalkenes, phosphacarbaoligoenes, phosphallenes, phosphabenzenes and azaphosphabenzenes, heterophospholes, silylene-, germylene-, and stannylene-phosphines, iminophosphines, diphosphenes, phosphinylidene-phosphoranes and -sulfuranes, and oxo-, thioxo-, and selenoxophosphines. The 95 pages of coordination number 3 compounds include bis(methylene)phosphoranes, methylene(imino, oxo, thioxo, and selenoxo)phosphoranes, bis(imino)phosphoranes, and other compounds in which phosphorus is formally linked by double bonds to two other atoms and by a single bond to a third atom, as well as alkylidyne phosphoranes and nitrilophosphoranes. A useful final chapter provides a concise survey of  $^{31}\text{P}$  data for the compounds discussed in the earlier chapters. Individual chapters contain detailed and comprehensive references, with many citations from 1988 and 1989, and even a few from 1990. There is a subject index, but no name index. The editors deserve compliments for assembling such a timely set of chapters in an attractive and interesting volume.

Harold Goldwhite, *California State University, Los Angeles*