

Additions and Corrections

Assembly of High-Valent Oxomanganese Clusters in Aqueous Solution. Redox Equilibrium of Water-Stable $Mn_3O_4^{4+}$ and $Mn_2O_2^{3+}$ Complexes [*J. Am. Chem. Soc.* 1990, 112, 7255]. JOSEPH E. SARNESKI, H. HOLDEN THORP,* GARY W. BRUDVIG, ROBERT H. CRABTREE, and GAYLE K. SCHULTE

Page 7256, Table I: The empirical formula for complex 2 was inadvertently misstated. The formula for complex 2 is $[Mn_3O_4(bpy)_4(OH_2)_2](ClO_4)_4 \cdot 5H_2O$. Two of the solvent molecules were modeled as half-occupancy, giving an empirical formula for the crystal of $C_{40}H_{44}O_{26}N_8Cl_4Mn_3$. This error does not affect the remainder of the crystallographic data or analysis.

Insertion Reactions of CO and CO_2 with Ruthenium Benzyl, Arylamido, and Aryloxide Complexes: A Comparison of the Reactivity of Ruthenium-Carbon, Ruthenium-Nitrogen, and Ruthenium-Oxygen Bonds [*J. Am. Chem. Soc.* 1991, 113, 6499-6508]. JOHN F. HARTWIG, ROBERT G. BERGMAN,* and RICHARD A. ANDERSEN

Page 6501, column 2: Line 11 should read ...with P_B resonating downfield and P_C resonating upfield from P_A

Page 6505, column 1: Line 3 should read ... $MeRu(\eta^2-CH_2PMe_2)(PMe_3)_3$

Page 6506, column 1: Line 10 from bottom should read ... complex 3....

Page 6506, column 2: Line 11 from bottom should read ... formation of 7 in alkane solvents....

Page 6508, column 1: Line 15 should read ...78.2 mg of $(PMe_3)_3Ru(\eta^2-CH_2PMe_2)(Me)$

Page 6503: Many of the patterns in Table III are probably better described as A_2MX , rather than A_2BC systems.

We are grateful to Mrs. Ming-de Wang of the University of Ottawa for calling these errors to our attention.

Is Triquinacene Homoaromatic? An MM3 Study of Triquinacene and Its Hydrogenation Products [*J. Am. Chem. Soc.* 1992, 114, 1165-1168]. J. W. STORER and K. N. HOUK*

Page 1167, Figure 3: The X-ray distances A-D, B-D, and C-D were reported as 2.89 Å. This value is incorrect and should be 2.32 Å. There is no discrepancy between the MM3 optimized geometry of 1 and the X-ray structure.

Page 1167, Figure 4: The structure of 1 labeled C_3 actually has C_{3v} symmetry; the C_{3v} energy of 1 is 58.63 kcal/mol. We thank Professor Jerome M. Schulman for this information.

Book Reviews*

Biosensors. By Elizabeth A. H. Hall. Prentice Hall: Englewood Cliffs, NJ. 1991. viii + 351 pp. \$56.00. ISBN 0-13-084526-4.

As the author points out, this text is intended to provide a basic theoretical and practical introduction to biosensors. This objective is achieved by dividing the work into two major parts—Sensor Techniques: The Concepts and Analytical Principles; and The Biosensor Genus: Its Friends and Relations. The first part translates into a series of six chapters starting with a general introduction to biosensors followed by a chapter on basic biochemistry as well as chapters on principles of potentiometry, amperometry, spectroscopy, and semiconductor electrodes. The general introduction is well-written and provides a valuable perspective concerning the nature of analytical problems to which sensors might be applied, emphasizing not only biomedical applications but also process control and environmental and military uses. Indeed, throughout the text, strong emphasis is placed on how the biosensor will be used and what information it will provide. To cover fundamentals in the remaining first five chapters of 160 pages is a clear impossibility, and rigor has been necessarily sacrificed. For some of the derivations and even some concepts, the reader would have to rely on supplementary texts.

The second part of the book, consisting of five chapters, deals with applications including such topics as cell-based sensors, amperometric, potentiometric, and optical biosensors, and a chapter dealing with miscellaneous techniques. Particularly refreshing is the attempt to put in perspective the developments of the last 10-15 years. The chapters are amply fortified with references to the original literature.

In summary, this is a well-written text which accomplishes the stated objectives. It is strongly recommended for readers who wish to understand the chemical and biochemical rationale for sensor development and utilization. Because of its relatively reasonable price, it would be a good choice for a beginning graduate level course in analytical chemistry or biotechnology.

George S. Wilson, *University of Kansas*

Practical Fluorescence. Second Edition, Revised and Expanded. Modern Monographs in Analytical Chemistry Series 3. Edited by George G. Guilbault (University of New Orleans). Dekker: New York. 1990. ix + 812 pp. \$185.00. ISBN 0-8247-8350-6.

In recent years fluorescence has emerged as an important analytical technique because of its sensitivity, selectivity, and dynamic range.

Fluorescence already rivals radioisotopes in sensitivity, and single molecule detection is on the horizon. New techniques, such as optical sensors, imaging, multidimensional methods, and room temperature phosphorescence, have arisen to keep pace with the many new applications in the environmental and life sciences. The simplicity and accessibility of fluorescence contribute to its widespread use. Books on fluorescence are few and soon outdated, so a new one is welcome.

Like its predecessor, the new edition of *Practical Fluorescence* is a compendium of prevailing luminescence lore. It comprises 13 chapters, six of which are authored or coauthored by the editor, and over 2800 references up to 1989. Each chapter lists review articles on related topics. The book is clearly written with an index that is helpful if not comprehensive. The introductory chapter assumes no prior knowledge of fluorescence and covers basic concepts. This chapter suffers from being somewhat behind the times; it is almost verbatim from the previous edition. The chapter on instrumentation has been mostly rewritten. It has a good description of the components of a spectrofluorometer, but no information about equipment for measuring fluorescence lifetimes. This is disappointing in that lifetime measurements are coming on line as an additional dimension, and the future promises much greater use of them. Two chapters by Wehry on the effects of structure and environment on fluorescence and phosphorescence are excellent. Together they provide a thorough grounding in the salient spectroscopic and photophysical features of organic molecules and metal ions.

The rest of the book is devoted to analytical applications of fluorescence in chemistry and the life sciences. Two chapters on inorganic and organic substances are revised and expanded from the previous edition. These chapters, which catalog fluorescent assays for a large number of compounds, comprise almost a quarter of the book. A new chapter by Wehry on environmental analysis focuses on selectivity. Problems and strategies for selective analysis in complex mixtures are discussed, including chromatographic separation, excitation-emission matrices, low-temperature and time-resolved techniques, and optrodes. The new chapter on phosphorescence by Hurtubise emphasizes room temperature phosphorescence. It covers both experimental and theoretical aspects and describes instrumentation for steady-state, time-resolved, and solid-surface measurements. The revised chapter on pesticides contains new material on TLC detection with fluorogenic reagents, but it is largely unchanged. The new chapter on chemiluminescence by Coulet and Blum covers novel analytical techniques including flow injection analysis using immobilized reagents and photobiosensors. Recent applications of lu-

*Unsigned book reviews are by the Book Review Editor.

ciferase and luminol reactions are described. The chapter on protein fluorescence by Chen has been completely rewritten and expanded in scope. It features a section on basic theory of polarization, time- and frequency-domain lifetime measurements, resonance energy transfer, and Stern-Volmer quenching. This is followed by sections on extrinsic and intrinsic fluorescent probes with ample references to the old and new literature and examples of applications to specific peptides and proteins. The revised chapter on enzymology describes fluorescent assays for an expanded list of enzymes and substrates including substrate determination using immobilized enzymes. The book concludes with a brief chapter on continuous monitoring of fermentations for cell mass and metabolic state.

Overall the book covers a broad range of modern fluorescence topics. It is probably the best choice for a single book on fluorescence and a valuable, albeit expensive, addition to any fluorescence library.

Mary D. Barkley, *Louisiana State University*

Ellis Horwood Series in Analytical Chemistry. Mass Spectrometry. By E. Constantin and A. Schnell (University of Strasbourg). Ellis Horwood Limited: New York. 1990. 184 pp. \$52.00. ISBN 0-13-55525-6.

Translated from the original French edition, this book presents, in condensed form, the basics of mass spectrometry and some fields of application. It is cited by the authors as being primarily intended for scientists in research and industry. The majority of the 18 chapters focus on fundamentals, accompanied by several chapters on applications and new developments.

The strengths of the text are its reasonable size and the fact that it takes the reader from relevant instrumental and chemical concepts through areas of application of mass spectrometry ranging from ^{14}C -dating to cluster chemistry and atmospheric chemistry. However, some basic subjects such as MS-MS are essentially untouched.

Some aspects of the book could be improved. The nomenclature used does not rigorously follow guidelines established by the American Society for Mass Spectrometry, as well as international journals in the field. Figures, frequently taken from published works, are of variable quality and can be confusing to the novice where sufficient experimental or chemical details are not presented. For some topics, discussions are fragmented between chapters. It is difficult to specify the appropriate audience for this book; while many concepts are presented in a most abbreviated and elementary form, some sections require an understanding of more advanced concepts such as Newton diagrams, amino acid designations (Leu, Pro, etc.), microcanonical distributions, and densities of translational states. A particularly important chapter on fragmentation mechanisms is very choppy and incomplete in places and lacks a consistency in labeling ions as being even- or odd-electron species.

Apart from some aspects that may be distracting to practicing mass spectrometrists, this would, in fact, be a good book to have in a chemist's library, particularly for faculty. It has a large number of references, through 1990, which are very useful in identifying the literature on the use of mass spectrometry ranging from the analysis of the Shroud of Turin to the gas-phase chemistry of transition-metal ions. The text does indeed provide an overview of many areas of science that utilize mass spectrometry.

John Allison, *Michigan State University*

The Silicon-Heteroatom Bond. Edited by Saul Patai and Zvi Rappoport (The Hebrew University). John Wiley and Sons: New York. 1991. ix + 529 pp. \$200.00. ISBN 0-471-92904-2.

This volume represents an update of the previously published two-volume set *The Chemistry of Organic Silicon Compounds* edited by Patai and Rappoport and published in 1989. The focus of this collection of chapters is on the chemistry of silicon bonded to heteroatoms from Group 15 and 16 as well as on silicon-transition-metal complexes. The format of this book involves the reproduction of five selected chapters from *The Chemistry of Organic Silicon Compounds*. Each of the selected chapters is followed by an appendix chapter by the same author(s). The last topic, which covers silicon-nitrogen chemistry, was not included in the original two-volume set.

There are twelve chapters: (1) Hypervalent Silicon Compounds (47 pages) by R. J. P. Corriu and J. C. Young; (2) Appendix (17 pages); (3) Siloxane Polymers and Copolymers (72 pages) by T. C. Kendrick, B. Parbhoo, and J. W. White; (4) Appendix (9 pages); (5) Organosilicon Derivatives of Phosphorus, Arsenic, Antimony, and Bismuth (31 pages) by D. A. Armitage; (6) Appendix (28 pages); (7) Chemistry of Compounds with Silicon-Sulphur, Silicon-Selenium and Silicon-Tellurium Bonds (18 pages) by D. A. Armitage; (8) Appendix (10 pages); (9) Transition-Metal Silyl Derivatives (62 pages) by T. D. Tilley; (10) Ap-

pendix (55 pages); (11) Chemistry of Compounds with Silicon-Nitrogen Bonds (80 pages) by D. A. Armitage; and (12) Appendix (37 pages). Each of the chapters is referenced, and there are 44 pages of author and subject indices, which are some of the most valuable features of the book.

Like its predecessor, an overview of the chemistry of silicon-oxygen, compounds as well as silicon-halogen bond chemistry is missing. Thus, this book is not as general as one would hope and misses the mark implied by the title. The format of chapter followed by an appendix does not easily allow for meshing of new data with observations from earlier material. Since compounds, tables, and schemes are numbered consecutively in a two-chapter sequence, it is necessary to flip back from an appendix chapter to determine the structure of an earlier numbered compound.

A simple calculation shows that approximately half of the chapter pages have been previously published. Since the original volume appeared only three years ago, the new material in the updated chapters is not extensive. The primary exception to this is the appendix on silicon-transition-metal chemistry provided by Tilley, which includes 259 new references.

This monograph is most useful for readers seeking an overview of Si-El bonds where El = N, P, As, Sb, Bi, S, Se, Te, and transition metals. Although there is some coverage of silicon-oxygen chemistry, the focus is on polymers; additional examples of SiO chemistry appear in the chapters on hypervalent silicon compounds by Corriu and Young. The authors are recognized experts in silicon chemistry and write well on their individual topics. The book is well-edited and has an excellent appearance. The price tag of \$200.00 seems extraordinary for a monograph in which half of the material has already been published in identical form. Considering the specialized and somewhat limited nature of the subject, it is difficult to recommend its acquisition by libraries.

Joyce Y. Corey, *University of Missouri-St. Louis*

Catalytic Ammonia Synthesis, Fundamentals and Practice. Edited by J. R. Jennings (ICI Chemicals and Polymers, Inc., England). Plenum Press: New York. 1991. xi + 451 pp. \$89.50. ISBN 0-306-43628-0.

"England and all civilized nations stand in deadly peril of not having enough to eat. It is the chemist who must come to the rescue of the threatened communities..." These are the words that Sir William Crookes used in a speech to the British Association for the Advancement of Science in September 1898, warning that the supply of fixed nitrogen for agriculture was inadequate to meet the growing demand of exploding populations. However, by December 1917, merely 19 years later, 230 tons per day of synthetic ammonia were produced. In 1990, world capacity for synthetic ammonia exceeded 125×10^6 tons per year. This book details the science and engineering of this most critical catalytic technology.

The collection of papers touches upon most every aspect of ammonia synthesis, from the molecular level issues at a metal surface, to the large scale unit operations that make up the industrial process. Introduction and historical perspective are provided by a delightfully personalized chapter contributed by Tamaru. From the vantage that he provides, one senses the urgency and excitement at the turn of the century that surrounded the seemingly insurmountable task of fixing nitrogen synthetically. At the same time one gets a glimpse of process research at a time when chemistry and chemical engineering had not yet bifurcated into specialized disciplines.

The technical content of the book begins with the second chapter which is very detailed and describes the synthesis, properties, and behavior of the industrial catalyst. Schlögl gives an in-depth review that covers this complex subject and provides the proper foundation for chapters that follow. The elementary steps involved in ammonia synthesis and surface structural effects are described by Ertl. Energetics and structure are neatly presented and form the basis for kinetic discussions that follow later. The combination of ultra-low-pressure surface science with high-pressure catalytic experimentation is presented by Strongin and Somarjai. This approach brings definition to the otherwise puzzling aspects of electronic and physical promotion of iron by potassium and aluminum oxide in the technical catalyst.

Using transition-state theory, Geus and Waugh develop the preexponential factors for the elementary steps in the mechanism and then couple these with the energetics presented earlier by Ertl to estimate rate constants. Extrapolation of the rates, derived from very low pressure data, to conditions closer to the industrial synthesis leads to good results. The authors place the derived rates in context with other work. Following on this theme, Grammatica and Pernicone drive the kinetic analysis a step further by integrating it into models that capture heat and mass transport in the actual converter. Finally, Hooper takes the reader to the level of the process flow sheet. His discussion is one of unit operations that make up the process. Comparisons of the types of reactors that have

been designed for different process configurations are given.

There is a logical, topical progression for Chapters 2–7. The flow is from the microscopic to the macroscopic. The last three chapters of the book, by Nielsen, Tennison, and Leigh, cover the very important topics of catalyst deactivation, alternatives to the iron catalyst, and new chemistries involving nitrogen coordination, reduction, and oxidation. If any change were to be made, one might have placed Nielsen's chapter on deactivation after the chapter by Geus and Waugh and before that of Grammatica and Pernicone, but this is a minor point. The ten chapters are followed by seven appendices that range from information on the production of ammonia and its uses to equilibrium conversion data and on through to patents and safety. The index that follows is constructed with thorough cross-referencing.

The book is well written and especially well edited. Relatively few errors are in evidence (Figure 5.4 on page 187 is incorrectly captioned as Figure 5.5). The authors are to be commended for their work and individual contributions, but the editor must be especially praised for his conceptualization of the coverage and flow of topics, for his diligence in ensuring optimal overlap between chapters, and for providing the unity of voice and style that pervades the work. This case study of ammonia synthesis should be used by graduate students in inorganic chemistry, physical chemistry, and chemical reaction engineering, specializing in catalysis. Because of its coverage, it should be of broad appeal to chemical professionals who wish to deepen and enrich their understanding of catalytic science and technology. Ammonia synthesis is, perhaps, the only catalysis case study that can be presented so comprehensively from the microscopic, molecular level to the macroscopic, process level.

Limited fixed nitrogen supply was a problem with seemingly dire consequences 100 years ago. Science and technology, in the words of Sir Cooke "came to the rescue". This stands as a testament to the advancement of the science and engineering of nitrogen fixation. When considering the new, dire problems that face us nearly 100 years later, thoughtful reflection on the success of this technology should invigorate and renew our optimism for the value of the scientific endeavor.

Henry C. Foley, *University of Delaware*

Spectroscopy of Polymers. By Jack L. Koenig (Case Western Reserve University). American Chemical Society: Washington, DC, 1992. 246 pp. \$89.95 (cloth), \$49.95 (paper). ISBN 0-8412-1904-4 (cloth), 0-8412-1924-9 (paper).

This book is written by one of the world's leaders in polymer spectroscopy and encompasses a distillation of his years of experience in developing and applying NMR and IR techniques. It reflects his experience in both educational and research environments in that it presents the theory and mathematical components of the various techniques clearly and in sufficient detail for student understanding and application. The lasting value of this book lies in its presentation of basic methods with practical examples that extend to more recent and proven procedures for elucidating details of composition and solid-state behavior.

The book begins with a chapter on "Theory of Polymer Characterization", which is a basic introduction to polymer microstructure and copolymerization. This chapter is essential for understanding several later chapters dealing with polymer-unique structural components. Chapter 2 provides an introductory background to "Vibrational Spectroscopy of Polymers" and demonstrates clearly how IR and Raman spectroscopy work; the remaining chapters do not require complete understanding of this chapter for use of the material presented later. Chapters 3 and 4 deal with "Experimental IR..." and "Applications of IR Spectroscopy to Polymers". The first discusses the background and calculation of FT spectra and ends with quantitative applications. The latter is more concerned with structural analysis and gives more detailed discussions of individual experiments that are used for analyzing materials in general and polymers in particular. Chapter 5 provides an excellent introduction to Raman spectroscopy with specific emphasis on its use in polymer characterization. However, this chapter, and in fact the whole book, suffers from the lack of extensive tables of characteristic peaks. This omission makes it necessary for individuals interested in applying spectroscopic techniques to purchase at least one or more additional reference books containing such functional group information.

Chapters 6 and 7 deal with high resolution solution spectroscopy of polymers strongly emphasizing ^{13}C . While a few specific examples of 2D methods for sorting out the complex information are provided, one is left with the feeling that the potential applications have not been adequately discussed: for example, the extensive use of ^{15}N in biopolymer analysis and ^{29}Si methods for sol-gel polymers are not covered. These are extremely important new advances that have developed over the last 10 years and deserve a place in an introductory book of polymer spectroscopy.

Chapters 8–11 are the real meat of this book and encompass excellent presentations on the use of solid-state NMR methods. These range from

examples of spectral editing methods for elucidating component compositions (amorphous vs. crystalline or rigid material) to evaluation of conformation and cross-linking by solid-state methods and use of various relaxation times for qualitatively determining relative molecular motion between or within samples. The last chapter deals with NMR imaging, an area in which the author has played a leading role with polymeric systems. There is again a glaring omission in this part of the book: while one could argue that any given book cannot be all things to all people, the enormous growing importance of ^2H NMR in the determination of the types and rates of molecular motion in polymers demands that at least one chapter on this area be included. It is my experience that no single technique provides sufficient information to allow a complete understanding of polymers. It is the combination of the various methods, ranging from both ^{13}C and heteroatom MAS and non-spinning methods to ^2H variable temperature analysis of specifically labeled systems, which provides the type of segmental-specific information that allows one to comprehend composition and motion in polymers. The author points out that future development in polymer spectroscopy must encompass an understanding of molecular level information across a range of nuclei and temperatures, thereby, providing specific information to complement other analytical techniques and lead to a correlation between atomic composition and microscopic plus macroscopic behavior. This is (or should be) the ultimate goal of all spectroscopists and is absolutely crucial in the area of polymer characterization.

Overall, this is an excellent book and one well worth the money. The softcover version is especially attractive to students and underpaid academics. The material presented is discussed at length at levels ranging from introductory to advanced. Extensive use of examples and specific applications is crucial to the value of this book and, when combined with the breadth of techniques covered, makes this the single most usable reference or textbook on polymer spectroscopy. While a few drawbacks exist (and what book does not have omissions), I heartily recommend this manual for all individuals dealing in any way with polymeric systems. If you are not using these techniques currently, you should be.

Lon J. Mathias, *University of Southern Mississippi*

The Electronic Structure of Atoms. By Levente Szasz (Fordham University). J. Wiley & Sons/Wiley Interscience: New York, 1992. xii + 571 pp. \$125.00. ISBN 0-471-54280-6.

This book is an excellent workbook for upper class and first year graduate courses. Much of the material is worked out in considerable detail and is easy to follow. Many useful formulas are included, and it contains a good introduction to relativistic Hartree-Fock theory.

It is, however, an elementary text that is somewhat out-of-date. It fails to mention, for example, the multiconfiguration Hartree-Fock theory and leaves out second quantization and Feynman diagrams (see Lindgren and Morrison, *Atomic Many-body Theory*, Springer Verlag (1982)). Group theory is not discussed (see Judd, *Operator Techniques in Atomic Spectroscopy*, McGraw-Hill (1963); Wybourne, Brian G., *Symmetry Principles and Atomic Spectroscopy*, Wiley-Interscience (1974); *Classical Groups for Physicists*, Wiley (1974); and Matsen and Pauncz, *The Unitary Group in Quantum Chemistry*, Elsevier (1986)), nor is there any discussion of configuration interaction.

F. A. Matsen, *The University of Texas, Austin*

Methods and Mechanisms for Producing Ions from Large Molecules. NATO ASI Series, Series B: Physics Volume 269. Edited by K. G. Standing and Werner Ens (University of Manitoba). Plenum Press: New York and London, 1991. x + 334 pp. \$95.00. ISBN 0-306-44017-2.

This book was developed from the Proceedings of a NATO Advanced Research Workshop on the title subject held at Minaki Lodge, Minaki, Canada, June 24–28, 1990. The workshop was hosted by the Department of Physics at the University of Manitoba. After an introduction by H. E. Duckworth entitled "The Founding Fathers of Mass Spectroscopy", the book is organized under the following sections: MeV Particle Bombardment; MeV Bombardment: Theory; keV Particle Bombardment; keV Bombardment: Theory; Spray Ionization Methods; Laser Desorption; Laser Desorption: Theory; and Post-Ionization of Desorbed Neutrals. There is a list of the participants in the symposium, with their affiliations, and a brief subject index.

Biotechnology and Polymers. Edited by Charles G. Gebelein (Youngstown State University). Plenum Press: New York and London, 1991. x + 352 pp. \$85.00. ISBN 0-306-44049-0.

This book grew out of a symposium held in Boston, April 22–23, 1990, and was sponsored by the Polymeric Materials: Science and Engineering Division of the ACS. The typescript material is divided into three sections: (I) Novel Biotechnology-Derived Polymers; (II) Polysaccharide Based Systems; and (III) Protein and Enzyme Based Systems. There is

a list of the contributors, with their affiliations, and a subject index.

Advances in Coal Spectroscopy. Edited by Henk L. C. Meuzelaar (The University of Utah). Plenum Press: New York and London. 1992. xx + 416 pp. \$85.00. ISBN 0-306-43796-1.

This book contains the keynote lectures presented by speakers at a 3-day symposium held at the Snowbird Mountain Resort in Utah, June 14–16, 1989. The book covers the following areas: new characterization methods, in situ microspectroscopic procedures, on-line process analysis methods, and computerized data analysis techniques. There are 15 chapters, with the participants in the symposium and their affiliations listed at the beginning of the book and a subject index at the end.

Metal Promoted Selectivity in Organic Synthesis. Edited by A. F. Noels (Université de Liège), M. Graziani (Università degli Studi di Trieste), and A. J. Hubert (Université de Liège). Kluwer Academic Publishers: Dordrecht, Boston, and London. 1991. xiii + 372 pp. \$132.00. ISBN 0-7923-1184-1.

The focus of this 12th volume in the series "Catalysis by Metal Complexes" is selectivity, and its 16 contributions provide an overview of as many selected topics, mainly in catalysis. There is no overlaid theme in presentation, either by major classes of catalytic processes or general classifications of selectivity, but, rather, this volume is a collection of reviews on topics to which the authors are experienced contributors. The origin of this book was a series of lectures presented at a Comett course held in Trieste (Italy) in 1989 that was sponsored by the European Community.

After a brief overview of Industrial Aspects of Selectivity Applying Homogeneous Catalysis by W. Keim, subsequent contributions report such topics as To What Extent do Phosphanes Induce Selectivity in C–C Bond Formation? (I. Tkatchenko), Catalytic Activation of Hydrogen Peroxide in Selective Oxidation Reactions (A. Lecloux), and Catalytic Carbonylations of Nitrogen Containing Organic Compounds (S. Cenini and C. Crotti). Hydrogenation and carbonylation reactions are each treated in four chapters, and two chapters focus mainly on oxidation, carbene, and dimerization/oligomerization reactions with many of them emphasizing mechanistic interpretations. Four chapters are devoted, at least in part, to enantioselective transformations. References run through 1989 with few citations in 1990. The number of references per chapter ranges from 8 to 77 with an average of 40.

Individual chapters in this volume are often highly personalized. Only one chapter, Carbonylchromium(0) Complexes in Organic Synthesis (S. Maiorana, C. Baldoli, and E. Licandro), is not concerned with catalysis, but another, Applications of Spectroscopic Measurements to Homogeneous Catalysis (D. Brown, B. T. Heaton, and J. A. Iggo), is focused on applications of high pressure spectroscopic analyses to mechanistic investigations. Overall, this volume can be recommended to those whose research interests intersect with those of authors. Many of the contributions are updated versions of prior reviews by the same authors.

Michael P. Doyle, *Trinity University*

Organophosphorus Chemistry. Volume 22. Edited by D. W. Allen (Sheffield City Polytechnic) and B. J. Walker (The Queen's University of Belfast), Senior Reporters. The Royal Society of Chemistry: Cambridge, England. 1991. 365 pp. \$205.00. ISBN 0-85186-206-3.

This is a volume in the continuing series dealing with developments in organophosphorus chemistry. Chapter one, Phosphines and Phosphonium Salts by D. W. Allen, focuses on new synthetic routes to both classes of compounds as well as recent chemistry both at phosphorus and at nearby atoms. The emphasis with phosphines seemed to be with creation of unusual P-containing structures and novel chiral systems as well as some halophosphines. The use of biphosphines as chelating agents is well discussed, especially their generation from a variety of lithio-phosphide reagents. Addition of P–H compounds to unsaturated molecules is cited as a useful entry to unsymmetrical phosphines. Trichlorosilane-induced reduction of chiral phosphine oxides to chiral phosphines is also recognized. A number of new acyclic and alicyclic phosphines are described, including some systems containing only Si and P, C and P, and N and P. Nucleophilic attack of phosphorus in phosphines at carbon, halogen and other atoms is outlined as well. The preparation and chemistry of phosphonium salts are reviewed, although

the coverage is modest. Systems with p_r-bonded compounds are also included, for example, reactive phospho-alkenes such as Cl(H)C=PH and many others. Addition reactions of phospho-alkenes and phospho-alkynes are examined, especially those that lead to cyclic products. A short discussion of the recent chemistry of phosphirenes, phospholes, and phosphinines concludes the chapter.

Chapter 2, Pentaco-ordinate and Hexaco-ordinate Compounds by C. D. Hall, is an excellent overview of structure, bonding, and ligand organization in alicyclic and cyclic members of the title compounds. Reviews are cited on ab initio calculations for certain derivatives and indicate that the Berry pseudorotation process operates in many cases, but deviations via a turnstile process explain other pentaco-ordinate systems. Hexaco-ordinate compounds are still somewhat rare, but several examples are illustrated.

Chapter 3, Phosphine Oxides and Related Compounds by B. J. Walker, in my opinion, is outstanding. The coverage is broad with well-chosen examples both from the standpoint of novel systems and reactions at phosphorus and at carbon, usually α to phosphorus. One interesting case is a citation of large "cage" phosphine oxides, now available, which complex certain phenols. Emphasized is the ability of phosphine oxides to complex a variety of compounds.

Chapter 4, Tervalent Phosphorus Compounds by O. Dahl, primarily addresses certain phosphorus acids and derivatives that can lead to phosphates or related systems of biological interest. Both nucleophilic and electrophilic reactions to produce such compounds are discussed. Some nucleotide chemistry with a variety of phosphorylated units is included. A few two-coordinated phosphorus systems and phosphonium ions are described, the latter having some utility as synthons for certain cyclic phosphorus compounds.

Chapter 5, Quinquevalent Phosphorus Acids by R. S. Edmundson, is concerned with the recent chemistry of phosphoric acid, phosphonic acid, phosphinic acid, and derivatives thereof including certain sulfur and selenium compounds as well the oxygen members. Interest continues in *myo*-inositol phosphates and other derivatives of natural products, some of which include cyclic pyrophosphates from certain bacteria. The author has done well in organizing the material into a useful compilation of data in this fast-changing field.

Chapter 6, Nucleotides and Nucleic Acids by R. Cosstick and A. M. Cosstick, discusses extensively recent developments in the chemistry/biochemistry of these nucleotides and acids. Oligo- and polynucleotides are very active areas of interest, and publications appear at a fast pace. Highlights of DNA and RNA syntheses are also delineated in this chapter. A discussion on phosphorodithioate linkages and modified phosphodiester linkages in oligonucleotides is included as well, since such groups can sometimes inhibit and activate gene expression. The key role of phosphorus in this work is evident in the studies on cleavage and sequencing of duplex DNA, for example. The chapter ends with a brief summary of physical methods (NMR, laser Raman spectroscopy, and X-ray diffraction) utilized in the unraveling of the structures of nucleotides and related systems.

Chapter 7, Ylids and Related Compounds by B. J. Walker, points out the vigorous interest remaining in Wittig reagents of a varying nature for synthesis. It has been possible in some instances to isolate a crystalline Wittig reagent complexed with lithium and the solvent. Reactions with aldehydes and ketones as well as coordination with metals are included. Stereospecific syntheses with phosphonate anions are illustrated as well as other applications, including the synthesis of precursors of macrolides.

The last treatise, Chapter 8, Phosphazenes by C. W. Allen, describes developments in theoretical calculations as well as new synthetic methodology to obtain both acyclic and cyclic members of the title compounds. Metallaphosphazenes and poly(phosphazenes) and physical properties thereof constitute a large portion of the chapter. A table on the molecular structures of certain phosphazenes is included at the end of the chapter.

In summary, this reviewer found the book an excellent source of developments in the respective areas with references in the 1990s. It is recommended as a major resource for those working in these fields. Only the high cost may be a deterrent to widespread use of this book as well as the other volumes in this important series.

K. Darrell Berlin, *Oklahoma State University*