Book Reviews*

The Chemistry of Organic Silicon Compounds. Parts 1 and 2. Edited by Saul Patai and Zvi Rappoport (Hebrew University). John Wiley and Sons: New York. 1989. Part 1: xvi + 892 pp. $428.00. ISBN 0471-91441-X. Part 2: xvi + 776 pp. $382.00. ISBN 0471-91992-6. (ISBN for Set 0-0471-91993-4).

There has been no attempt at a truly comprehensive review of organosilicon chemistry for many years. With the tremendous explosion of activity in this area of research, it has become an almost unimaginable task. The editors and authors of *The Chemistry of Organic Silicon Compounds* are to be congratulated on the high quality of their efforts. It would be possible to criticize various choices of subjects, particular coverage of a subject, or the choice of one expert author over another, but that would denigrate the overall product which offers us a most up-to-date and comprehensive treatment of this subject. These volumes will and should set the standard as a general reference work in organosilicon chemistry for many years to come. *The Chemistry of Organic Silicon Compounds*, is part of *The Chemistry of Functional Groups*, a series of advanced treatises under the general editorship of Professor Patai. For over 25 years this series has set a very high standard to which these volumes contribute.

Thirty-two authors have contributed 25 chapters with extensive literature coverage up through mid-1987 (a few chapters have references through early 1988). Comprehensive author (110 pages) and subject (29 pages) indices are included in Part 2. The various chapters are not only representative of the many important aspects of modern organosilicon chemistry, but serve to contrast current directions and development. Thus, chapters perhaps best characterized as classical in their subject matter are interspersed with ones describing "hot" research topics, ones of real practical significance are juxtaposed with ones of more theoretical and mechanistic interest, and ones describing topics likely to soon become "hot" research areas are interspersed with ones where the research work has peaked. This organization is really a reflection of the editorial wisdom of Professors Patai and Rappoport. Today's hot topic will ultimately decline and lie fallow; it may, however, become very important at a later stage of development. There are a number of such examples to be found in these volumes. One of the most cogent is the renewed interest in the thermochemistry of organosilicon compounds spurred by the many recent studies of reactive intermediate species containing silicon (see Walsh, Chapter 5).

Part 1 consists of 13 chapters: Chapter 1, J. Y. Corey, Historical overview and comparison of silicon with carbon (56 pages); Chapter 2, Y. Apeloig. Theoretical aspects of organosilicon compounds (168 pages); Chapter 3, W. S. Sheldrick, Structural chemistry of organic silicon compounds (76 pages); Chapter 4, R. J. P. Corriu, C. Guerin, and J. J. E. Moreau, Dynamic stereochemistry at silicon (65 pages); Chapter 5, R. Walsh, Thermochemistry (20 pages); Chapter 6, T. R. Crompton, Analysis of organosilicon compounds, (51 pages); Chapter 7, H. Schwarz, Positive and negative ion chemistry of silicon-containing molecules in the gas phase (65 pages); Chapter 8, E. A. Williams, NMR spectroscopy of organosilicon compounds (43 pages); Chapter 9, H. Bock and B. Solouki, Photoelectron spectra of silicon compounds (98 pages); Chapter 10, L. Birkofer and O. Stuhl, General synthetic pathways to organosilicon compounds (106 pages); Chapter 11, G. L. Larson, Recent synthetic applications of organosilanes (45 pages); Chapter 12, A. R. Bassindale and P. G. Taylor, Acidity, basicity and complex formation of organosilicon compounds (29 pages); Chapter 13, A. R. Bassindale and P. G. Taylor, Reaction mechanisms of nucleophilic attack at silicon (53 pages).

Part 2 consists of 12 chapters as well as the author and subject indices: Chapter 14, A. R. Bassindale and P. G. Taylor, Activating and directive effects of silicon (70 pages); Chapter 15, A. G. Brook, The photochemistry of organosilicon compounds (40 pages); Chapter 16, J. B. Lambert and W. J. Schultz, Jr., Trivalent silyl ions (7 pages); Chapter 17, G. Raabe and J. Michl, Multiple bonds to silicon (127 pages); Chapter 18, R. Tacke and H. Linoh, Bioorganosilicon chemistry (63 pages); Chapter 19, R. West, Polysilanes (33 pages); Chapter 20, R. J. P. Corriu and J. C. Young, Hypervalent silicon compounds (47 pages); Chapter 21, T. C. Kendrick, B. Parbhoo, and J. W. White, Siloxane polymers and copolymers (72 pages); Chapter 22, D. A. Armitage, Organosilicon derivatives of phosphorus, arsenic, antimony, and bismuth (31 pages); Chapter 23, D. A. Armitage, Chemistry of compounds with silicon–sulfur, silicon–selenium, and silicon–tellurium bonds (18 pages); Chapter 24, T. D. Tilley, Transition-metal silyl derivatives (62 pages); Chapter 25, I. Ojima, The hydrosilation reaction (47 pages).

These volumes are ones which every research library should have. They have real value for practicing silicon chemists, organic chemists who need comprehensive source material on silicon chemistry, and students who want to explore an important area of organic chemistry.

R. Damrauer, *University of Colorado at Denver*

The Alpha-2 Adrenergic Receptors. Edited by Lee E. Limbird (Vanderbilt). Humana: Clifton. 1988. 384 pp. $69.50. ISBN 0-89603-135-7.

Timing is of the essence in publication, and this 1988 book just catches the beginning of the structural elucidation of the adrenoreceptors. In a previous 1987 book entitled *Adrenergic Receptors in Man*, the Editor [and incidentally one of the authors (Chapter 6) in *The Alpha-2 Adrenergic Receptors*] expressed a need to justify its publication in an era of "publication metastasis". He did this in terms of the explosion of new information regarding the biochemical mechanisms mediating catecholamine response. Publication metastasis has continued unchecked, and this previous (1987) book is now totally out of date, both conceptually and factually. In the meantime, adrenergic receptors have split into α-2, β-1, β-2, and α-1 receptors, and each has its own book series. Unfortunately, this otherwise excellent book, edited by Dr. Limbird, just misses most of the current excitement; for example, that adrenoreceptors are structurally related, and so, chimeras can be genetically constructed, whereby example, clonidine can elevate cyclic AMP levels instead of reducing it. The reason for these new concepts, of course, is the information generated by the cloning of the β and α receptors by Lefkowitz's group and their analogy to rhodopsin—"the magnificent seven" of the eighties pharmacological folklore. Dr. Regan (Chapter 2) is part of this group and has provided the "hypothetic α_2 structure" as an addendum which is also emblazoned on the cover. The cover is somewhat misleading since the chapters were written, for the most part, in 1984 and 1985.

The book will be of value to practicing physicians, especially psychiatrists because of their widespread use of the α_2 agonist clonidine, and chemists will find chapters 2 and 4 to be extremely useful for discussions of design of specific α_2 agonists and antagonists, and structure–activity relationships. Chapter 4 is especially valuable, and now that the complete amino acid sequence is known, it will be of interest to see if molecular modeling supports the postulated shape of the binding site—which we now know to be located in the transmembrane region.

Chapters 5 and 6 ably summarize the type of functions mediated by α-2 adrenergic receptors, and attempts to explain action and desensitization in terms of coupling to second messenger systems. Much of the basic information is timeless and useful, but we now know much more about kinases and desensitization. Chapter 3 outlines the mechanisms for inhibition of adenylate cyclase, but when one considers the many thousands of publications each year since 1984/85 (when this chapter was written), then, obviously, we do not get the whole story. The reader will get a good general view of the Pertussis toxin sensitive inhibition of adenylate cyclase inhibition, but will also have to read more recent reviews for a fuller picture.

The book is also important for emphasizing the controversy regarding cAMP as the mediator of acute α_2 actions, and Dr. Limbard highlights this area in Chapter 7—focusing on Na^+/H^+ exchange and its physiological importance. Most electrophysiologists now believe that this Gi-coupled family of receptors are directly coupled via G-proteins to a potassium channel. Once again, this information is too recent to appear in the book. Receptor-type classification is covered well in the book by Dr. Bylund but, of course, the best explanation of this response-heterogeneity is molecular heterogeneity at the receptor level. Recent cloning work suggests subclassification into at least α_{2A}, (α_2 chromosome 10), α_{2B} (possibly chromosome 4; although this may be α_{2D}!), and α_{2C} (possibly on chromosome 2); and for a recent update of Chapter 1 by the same author, readers should see *Trends Pharmacol. Sci.* **1988**, *9*, 356–361. Much of this heterogeneity *was* predicted by binding studies, and this work is ably summarized in the book. The mechanistic hypotheses on pages 328 and 348, respectively, which focus much attention on α_2-receptor-coupled acceleration of Na^+/H^+ exchange, will obviously have to be reformulated in the light of new information.

In summary then, the book contains seven well-written chapters and an update (end of chapter 2) which hints at the conceptual revolution which was evolving just as the book went to press. The book is a useful resource and pulls together a lot of disparate information on α_2-receptors,

*Unsigned book reviews are by the Book Review Editor.

but one is left with the feeling that at least four of the chapters could have been totally rewritten if they had been done in 1987 instead of 1984. Perhaps this is a sad commentary that the slowness of book publishing created a need for serials like "*Trends*".

Glyn Dawson, *Wyler Children's Hospital*

Automatic Methods of Analysis. Techniques and Instrumentation in Analytical Chemistry. Volume 9. By M. Valcárcel and M. D. Luque de Castro (University of Córdoba). Elsevier: Amsterdam and New York. 1988. xii + 560 pp. $131.50. ISBN 0-444-43005-9.

The authors are to be congratulated on delivering a rational, integrated, interesting, and easily readable overview of automatic methods of analysis. This is NOT a dull summary discussion or review of what is available in the way of automatic methods—the material has been thoughtfully digested, understood, and abstracted by the authors, and presented to the reader as a balanced perspective on automatic methods. There are not many books on automatic methods of analysis that are fun to read. This one is.

Throughout the text, fundamental concepts are developed clearly. Examples of these concepts are presented concisely with material taken from the literature. The accompanying drawings are especially well done.

The chapter titles summarize the contents of the text: Fundamentals of Laboratory Automation, Computers in the Laboratory, Automation of Sampling, Automation in Sample Treatment, Air-Segmented Flow Analysis, Flow-Injection Analysis, Other Automatic Unsegmented Flow Methods, Automatic Batch Analysers, Robots in the laboratory, Spectrometric Techniques, Electroanalytical Techniques, Chromatographic Techniques, Automatic Titrators, Automation in Clinical Chemistry, Automation in Environmental Pollution Monitoring, and Process Analysers.

The treatment is balanced. While the authors rightly point out the advantages of automation, they also discuss the limitations of each type of automation. They give perspective on when certain techniques will work well, and when they will not. Literature references are abundant.

In the preface, the authors acknowledge the aid of "Drs. Angel Rios and Fernando Lázaro [who] wrote Chapters 2 and 16, respectively; Antonio Losada, MSc, [who] translated and typeset the manuscript to its final form and Francisco Doctor [who] drew the numerous figures in the book". They and the authors have indeed produced an excellent text.

Stanley N. Deming, *University of Houston*

Glasses and Glass Ceramics. Edited by M. H. Lewis (University of Warwick). Chapman and Hall: London and New York. 1989. xii + 378 pp. $86.00. ISBN 0-412-276909.

This volume is dedicated to the memory of Peter W. McMillan and recognizes his work in the field of glasses and glass ceramics. The very title of "glasses and glass ceramics" reflects the widening encroachment of glass technology and materials which are now defined as glasses into the ceramic industry. Modern textbooks have blurred the distinctions between the glassy state and the amorphous state. The eventual identification of a glassy state would seem to be that it is a supercooled liquid; whereas, the disordered state in amorphous materials generally need not result from supercooling from a liquid state. Glasses must therefore be regarded as a special division of the amorphous state. This aspect of the topic is discussed in the very first chapter in the present text by R. Dupree and D. Holland on MAS NMR—a new spectroscopic technique for structure determination in glasses and ceramics—who conclude that an all-encompassing model for glass structure does not exist. The present reviewer is however upset as a teacher at the manner in which symbols are used without a definition. Here MAS NMR is introduced in the title and the text with no attempt at a definition. Students, especially graduate assistants are always told when a new technique is first introduced in an article, to provide in parenthesis the full name after the symbols, and then continue to use the symbols. For the record, of course MAS NMR stands for magic angle spinning nuclear magnetic resonance, and the authors provide a very useful account of this technique to silicon dioxide, alkali silicates, other binary silicates, various mineral glasses, halide glasses, and oxynitride glasses. The authors address the problem of devitrification and materials produced by low-temperature processes. Other chapters deal with X-ray absorption studies of glass structure (by R. F. Pettifer) and volume nucleation in silicate glasses (by Peter F. James) without falling into the pitfall of having to define a glass. Pettifer points out that the main reason why GeO_2 is the most popular choice for study by EXAFS (X-ray absorption fine structure) is that the Ge K-edge lies in a wavelength range easily accessible to a spectrometer which has an air path. Peter F. James contribution on volume nucleation sets out a very good summary of classical nucleation theory before progressing onto experimental systems. A. Leng-Ward and M. H. Lewis introduce the subject of oxynitride glasses and their glass-ceramic derivatives and point out that the reason for the development of these glasses lies in the strength of the Si–N bond, the nitrogen atoms trivalency, and its ability to substitute for oxygen in $Si(O)_4$ tetrahedral units. The other nonsilicate glass system reviewed in this volume are the halide glasses (reviewed by M. Parker and P. W. France). These are important due to their exceptional infrared optical properties and their potential for fiber-optical systems.

Applications form the basis for the remaining chapters. Microporous glasses (written by N. Ford and R. Todhunter) is a chapter dealing with the Vycor process, antireflection coatings and optical waveguides, resistance thermometers and superconducting materials, nuclear waste disposal, refractory foams, enzyme immobilization, and catalyst supports. Glass-ceramics in substrate applications forms a separate chapter by G. Partridge, C. A. Elyard, and M. I. Budd. A chapter also deals with glass-ceramics for piezoelectric and pyroelectric devices (by A. Halliyal, A. S. Bhalla, R. E. Newnham, and L. E. Cross). R. E. Belford and A. E. Owen contribute a chapter on the interfacial electrochemical aspects of glass in solid-state ion-selective electrodes. Finally fiber reinforced glasses and glass-ceramics are dealt with by K. M. Prewo. This book demonstrates the interdisciplinary nature of the subject and provides an up-to-date account of research and application.

D. Dollimore, *The University of Toledo*

Methods in Computational Chemistry, Volume 2: Relativistic Effects in Atoms and Molecules. Edited by Stephen Wilson (Rutherford Appleton Laboratory). Plenum: New York and London. 1988. xiv + 291 pp. $55.00. ISBN 0-306-42946-2.

This volume is a collection of contributions from five authors for the purpose of introduction, review, and survey of current computational methods for relativistic effects in atoms and molecules. The collection begins with Relativistic Atomic Structure Calculations by Ian P. Grant as an introduction and review. Stephen Wilson, editor of the volume, contributes Relativistic Molecular Structure Calculations directing the focus to molecules, considering various models and approximations. Odd Gropen contributes The Relativistic Core Potential Method with applications to AuH, AgH, Pb_2, PbS, and PtH molecules. Semiempirical Relativistic Molecular Structure Calculations by Pekka Pyykö actually includes the documentation and Fortran 77 listing (43 pages) of the program ITEREX 87. This program is also provided on a 5.25-in. IBM 1.2 Mb floppy diskette included inside the back cover of the book. A sample input deck and program output is given for XeF_2. An extensive contribution by Harry M. Quiney entitled Relativistic Many-Body Perturbation Theory completes the volume.

A volume index of authors and a volume index of subjects are included. References for a contribution are logically placed at its end.

This book is a remarkably complete survey of the material. In principle, the introductions to the relevant theoretical and calculational topics should be understandable to a novice with, however, a substantial background in quantum mechanics. A familiarity with advanced matrix algebra and the Lie algebra of SU(2) – nj symbols – is highly desirable. The emphasis throughout is computational with considerable attention paid to particular approximations. The ITEREX program on the diskette requires at least an IBM PC-AT or compatible personal computer.

Even those whose interests in this subject are only superficial may find useful ideas in this volume.

M. L. Ellzey, Jr., *The University of Texas at El Paso*

My Life in the Golden Age of America. By M. Dole. Vantage: New York and Los Angeles. 1989. 207 pp. $14.95. ISBN 0-533-07995-0.

Richard Dole came from England to Massachusetts in 1639. His direct descendant Malcolm Dole was born in that state in 1903, when most travel was over narrow dirt roads. His satisfaction with developments in America since then accounts for the title of his autobiography. He followed his father and two older brothers to Harvard to study physics because "physics ... was closer to manufacturing than other subjects" and "most of the wealthy people I knew when I was a boy made their money in manufacturing". But physics proved dull and he switched to chemistry. He stayed on at Harvard for a Ph.D. with Grinnell Jones, who could offer financial support through a half-time teaching assistantship, and worked in electrochemistry. Somewhere along the way his interest in manufacturing vanished, and he went for two years to the Rockefeller Institute to work with D. A. MacInnes on the glass electrode before joining the faculty of Northwestern University in 1930. He went to Baylor University in 1969, and retired to California in 1982.

At the time of his Ph.D. work the physical chemists at Harvard, under the influence of T. W. Richards (the first American to win a Nobel Prize in chemistry, 1914), excelled in exact measurements but neglected theory. Dole taught himself modern physical chemistry (for that day) and wrote highly successful textbooks on electrochemistry, the glass electrode, and statistical thermodynamics, which he used in his own classes. During World War II he worked in chemical warfare and then at Oak Ridge,

supervising the operation of the gaseous diffusion plant for separating uranium isotopes. After the war be became interested in polymers and studied the cross-linking of polymers by radiation. However, his most curious discovery came in 1935 when he found, by using techniques learned at Harvard, that water produced by burning hydrogen with atmospheric oxygen was denser (by 4.6 ppm) than water produced by burning the same hydrogen with oxygen obtained from the electrolysis of water. This "Dole Effect" was most important when O = 16 was the basis for atomic weights, but now seems to be almost completely forgotten.

Dole's writing is artless and straightforward, packed with details about growing up in Massachusetts early in the century, summer jobs, student days at Harvard, life as a coal-trimmer on a freighter crossing the Atlantic, work with Debye in Leipzig in 1929, bicycling with his wife in Bavaria, salaries at Northwestern University during the Depression, sailboat racing on Lake Michigan, travels to South America, life in retirement in California, and much more. On the last page he brings the story up to 1987, when at the age of 84 he presented a paper to a conference in Ottawa and had a paper published in the *Journal of Physical Chemistry*. The writing is factual and without any philosophical analysis or summing up. If anyone a hundred years from now wants to know what the daily life of an American academic chemist was like in this century, this will be his book. However, I found the absence of any trace of envy or rancour curious. Academic chemists are a competitive lot, and in their writing most show occasional resentment over questions of priority or recognition. By his own account, Dole's researches were occasionally anticipated or overlooked; but there is not a spiteful sentence in the book. On the contrary, almost everyone he meets, from childhood on, is "nice" (the most used adjective of the book). He appears to be a thoroughly nice man himself, and can only be envied for having had such a happy, active, and fulfilling life.

John T. Edward, *McGill University*

Studies of High-Temperature Superconductors. Volumes 1 and 2. Edited by Anant Narlikar. Nova Science: Commack. 1989. Volume 1: v + 381 pp. Volume 2: v + 367 pp. $85.00 each. Volume 1: ISBN 0-941743-54-3. Volume 2: ISBN 0-941743-55-1.

Volumes 1 and 2 contain chapters on the chemistry, physics, theories, and device fabrication and application of high-temperature superconductors. This series is an attempt to bring together current accounts of some of the major advances in the field of high-temperature superconductivity. Although this is an ambitious undertaking, most of the chapters are well-written reviews which cover topics of current interest.

In Volume 1, Chapter 1 by C. N. R. Rao covers the oxygen-hole mechanism of superconductivity. Chapter 2 focuses on common features of the heavy fermion superconductors and the oxide superconductors. In Chapters 3–5, mechanisms for the high-temperature superconductors are examined and compared with experimental data. Chapter 6 discusses results on ion beam modification of $YBa_2Cu_3O_{7-\delta}$ thin films. Thin-film processing of high T_c superconductors is the subject of Chapter 8. Properties, such as flux-creep phenomena, associated with the short coherence length in these cuprate superconductors, are presented and discussed in Chapter 7. Device fabrication and twin formation mechanism in $YBa_2Cu_3O_{7-\delta}$ are presented in Chapters 9 and 10. Nonstoichiometry, synthesis, and substitutional chemistry are the subjects of Chapters 11, 14, and 15. Property measurements such as sound velocity and X-ray photoelectron spectroscopy are the subjects of Chapters 12 and 13.

Volume 2 is similar to Volume 1 in format. The 15 chapters cover a range of topics in high T_c superconductivity. Chapter 1 is a review on the structural chemistry by B. Raveau. Property measurements, high-pressure studies, and magnetic-resonance techniques are the subjects of Chapters 2 and 3. E. Gmelin, in Chapter 4, looks at the thermal properties such as specific heat, thermal expansion, and thermal conductivity, in the high T_c superconductors. The possible involvement of phonons in superconductivity is discussed in Chapter 5. Structure and property studies of the Bi-based cuprates are the subject of Chapter 6. Single-crystal studies are presented and discussed by Y. Iye in Chapter 7. Epitaxial and heterostructure formation of thin-film superconductors is examined in Chapter 8. Evaluation of coprecipitation as a route to the copper oxide based superconductors is the subject of Chapter 9. Chapters 10 and 11 are concerned with property measurements, microwave absorption, and X-ray spectroscopy of the high T_c superconductors. The last four chapters present and discuss theories of high T_c superconductivity.

These volumes provide a great deal of information that is of interest to scientists in all areas that pertain to high-temperature superconductivity. Each volume covers a wide variety of topics, and I would recommend this series for professional scientists and engineers, as well as for graduate students with interests in this area.

Susan M. Kauzlarich, *University of California—Davis*

Problem Solving with Microbeam Analysis (Studies in Analytical Chemistry, 7). By Klara Kiss (AKZO Chemicals, Inc.). Elsevier: Amsterdam and New York. 1988. 410 pp. $119.50. ISBN 0-444-98949-8.

Surface analysis is the principal subject of this book, which treats a range of techniques from optical microscopy to Rutherford back-scattering spectroscopy. The author categorizes these as photon probes (e.g., ESCA), electron probes (e.g., SEM), and ion probes (e.g., SIMS).

In the Preface, the author says that the book is intended to provide an overview of these techniques for the nonexpert industrial analyst or the manager who might be called upon to decide upon a method, or authorize the purchase of one of these expensive instruments. The text is divided into two major sections: Theory and Techniques, which includes 11 chapters, and Case Histories and Applications, which contains 3 chapters.

Part 1 describes the techniques and includes a chapter which compares the various surface techniques in a lucid manner and another chapter which describes special applications for investigation of microelectronic devices. The comparisons are particularly valuable. There are a few missteps: It is certainly true that the neophyte should be told of the existence of "escape" and "sum" peaks in electron microprobe analysis and should be informed that a number of different dispersing crystals will be needed in wavelength dispersive X-ray fluorescence, but does our manager/potential purchaser care about tables of escape-peak energies or wavelength ranges for particular crystals? Elsewhere the author yields to the temptation to give too much detail, in particular too many equations.

Part 2 describes real examples of problems solved with the various microbeam analyses. Included are chapters on synthetic polymers and microelectronics, and a chapter of miscellany. The latter runs the gamut from scanning-Auger detection of chloride as the culprit in corrosion of ball-point pen tips to microscopic examination of whipped cream in search of the cause of too heavy a consistency. This part of the book is of considerable interest, serves its stated purpose well, and shows the author's wide experience. Some readers may find those examples that end with statements like "Recognition of the damage site facilitated prevention of the failure" less satisfying than those in which the cure is actually described.

In consideration of the number of acronyms used throughout, the book would be improved by a comprehensive and easily located glossary. On the whole, the book can be recommended to anyone who wishes to obtain a practical overview of modern methods of surface analysis and imaging.

Wilson M. Gulick, Jr., *Michigan Technological University*

Books on Applied Subjects

Colours for Foods. Second Revised Edition. By the Dyestuff Commission of the Deutsche Forschungsgemeinschaft. VCH: Weinheim. 1989. 454 pp. $165.00. ISBN 0-895-73617-9.

This work from the Dyestuff Commission of the DFG is composed of 70 pages of introductory text in German and English, an index of common names, and a large collection of data sheets, all in loose-leaf form in a ring binder. The data sheets give alternate names, structural formula, preparative methods, properties, spectroscopic characteristics, toxicity data, physiological effects and fate, and chromatographic behavior.