

rotation and reinsertion,¹⁹ after the initial methyl migration²⁰ is complete.

These results suggest alkyl migration to a carbene ligand may be a general and useful method for forming carbon-carbon bonds under very mild conditions.²¹ In some respects it resembles the well-known reductive elimination of *cis*-dialkyl groups. However,

(19) Rapid scrambling by a similar mechanism was proposed by: Yamamoto, A.; Yamamoto, T.; Saruyama, T.; Nakamura, Y. *J. Am. Chem. Soc.* **1973**, *95*, 4073-4074. This was ruled out by: Cotton, F. A.; Frenz, B. A.; Hunter, D. L. *Ibid.* **1974**, *96*, 4820-4825.

(20) We prefer to regard the reaction as a methyl migration rather than as a methylene insertion, owing to the stereochemistry observed for the final ethyl compound **3**. However, mechanistic information is lost if a fluxional 5-coordinate compound is an intermediate in the reaction or is in equilibrium with the product.

(21) Methyl migration to a methylene ligand was predicted to be facile by: Berke, H.; Hoffmann, R. *J. Am. Chem. Soc.* **1978**, *100*, 7224-7236.

closely related *cis*-dialkyl complexes of iridium do not undergo reductive elimination except possibly under extreme conditions.²² Indeed, the stability of iridium (III) dialkyl complexes has permitted the isolation and study of compound **1**. Related compounds which may undergo similar migratory reactions are under active investigation.

Acknowledgment. We thank L. Lardear and W. Gray for skilled technical assistance and Professors B. Trost and M. Brookhart for helpful discussions.

Supplementary Material Available: Tables of positional and thermal parameters and observed and calculated structure amplitudes (16 pages). Ordering information is given on any current masthead page.

(22) Thorn, D. L., to be published.

Book Reviews*

Reminiscences of Los Alamos, 1943-1945. Edited by Lawrence Badash (University of California, Santa Barbara), Joseph O. Hirshfelder (University of Wisconsin), and Herbert P. Broida (University of California, Santa Barbara). D. Reidel Publishing Co., Dordrecht, Holland. 1980. xii + 188 pp. \$26.50, cloth; \$9.95, paper.

This book joins a number of other fascinating accounts of the Los Alamos years. It is the outgrowth of a lecture series held at UCSB in 1975 and focuses not on the technical aspects of the Los Alamos years 1943-1945, but on the personal reminiscences of a diverse group of people associated with Los Alamos during that period. In its own way, the book is a very powerful one, raising all the "Faustian" questions about whether we have sold our souls to the devil. It, like many of the other books on Los Alamos, will haunt many readers.

The whole experience haunts many of its participants. Some of the reminiscences are little more than attempts by the contributors to explain, perhaps rationalize, their actions during this period. It is interesting to speculate about whether this is more a matter of conscience or a reaction to present-day criticism of all things nuclear.

Other participants provide us with many rich details of the life at Los Alamos, including the civilian/military "standoff", the Sante Fe/Los Alamos relationships, and the many interesting interactions with the Native Americans and Spanish Americans of the vicinity. There are many poignant and dramatic passages in this book, particularly some by Elsie McMillan. There is humor, especially in Feynman's chapter chronicling his escapades.

Every chapter is interesting and worthwhile; the contributors are as follows: John D. Dudley, Edward M. McMillan, John H. Manley, Elsie McMillan, George G. Kistiakowsky, Joseph O. Hirshfelder, Laura Fermi, Richard P. Feynman, Bernice Brode, and Norris Bradbury. Everyone who chooses to read this book will find some fascinating aspect of these Los Alamos years.

R. Damrauer, *University of Colorado at Denver*

Petroleum Geochemistry and Geology. By John M. Hunt (Woods Hole Oceanographic Institution). W. H. Freeman and Co., San Francisco. 1979. xii + 617 pp. \$30.00.

This book is intended for students with "basic courses in geology and chemistry and also for oil company operating personnel who are interested in the application of geochemistry to petroleum exploration". Abundant use of organic structural formulas are used throughout, so some grounding in the fundamentals of organic chemistry would also seem desirable for the reader. The author suggests that the book can serve not only as a text but as a reference book; this is a fully justified claim as the book is well-organized and contains a wealth of information. A number of subjects with which the reader is either unfamiliar or out-of-touch are discussed in detail before being utilized; these include discussions of isotopes and isotopic dating, the effect of temperature on reaction rates, fluid expulsion models, geothermal gradients, etc.

The book is divided into four main sections: (1) an introduction with historical information, a description of the primitive earth and the origin

of life, the petroleum potential of various types of rocks, and a description of petroleum and its products, (2) an origin and migration section with a detailed description of how oil and gas form, how they migrate, and how they accumulate, (3) a habitat section discussing source rocks, the quantity of organic materials in various types of rock, types of organic matter, techniques for measuring the state of maturation of kerogen, and the petroleum reservoir and its characteristics, and (4) an applications section discussing seeps and surface prospecting, subsurface prospecting, crude oil correlations, and prospect evaluations.

In all, this would seem to be an excellent book not only for its intended use, but also for the general chemist seeking a readable, yet thoroughly comprehensive treatment of the important area of petroleum geochemistry.

R. Damrauer, *University of Colorado at Denver*

Infrared Interferometric Spectrometers. By A. E. Martin. Elsevier Scientific Publishing Company, Amsterdam and New York. 1980. XI + 292 pp. \$73.25.

Dr. A. E. Martin has been designing infrared instrumentation for many years and was, until recently, associated with a company which has produced infrared interferometers for many years. Thus, this book is written by an expert in the field. It is not primarily concerned with the use of the rapid-scanning infrared interferometers that are in widespread use in analytical and research laboratories today, although the principles and details that it explains are basic to these spectrometers.

The book explains the physical principles and practical details that are required to understand infrared interferometers in detail. It is written from the point of view of a man interested in slow-scanning interferometers, and includes many details that are usually transparent to the user of rapid-scan instruments.

The book contains nine chapters and 13 appendices. The second chapter, on Theoretical Considerations, occupies just under a third of the book, and other major chapters, which together constitute a second third of the book, discuss Optical Considerations, Interferometer Details, and Computation. The remaining chapters describe Commercial Instruments (inevitably not quite up to date), Measurement of Refractive Index, Modifications of the Basic Michelson Optical System, and Other Interferometers and Allied Instruments.

Dr. Martin's style is to present the fundamental principles of a topic and then to immediately explore details that are important but are not essential to the novice. Thus, this book is probably not well suited to the reader who is totally new to the subject, although the level of presentation is such that such a reader would understand most of it. It is very well suited to the reader who knows about these instruments in general and wishes to learn about the details. Thus, the first nine pages of Chapter II contain the basic principles of the Michelson interferometer, then an account of negative frequencies, then quite a detailed account of the troubles that can arise from the constant term in the interferogram. The chapter then goes on to Asymmetric Interferograms, Gaussian Functions and Resolution, and Sampling Considerations, Scanning Functions and Apodization, all of which are presented simply but with an unusual amount of detail that is of interest even to people experienced in the field.

*Unsigned book reviews are by the Book Review Editor.

The book also contains such gems as the development of the Fast Fourier Transform from studies related to the effect of fertilizer on crop yields!

I thoroughly recommend this book to all people who are interested in understanding Michelson interferometry.

John E. Bertie, *University of Alberta*

Review of "Comprehensive Treatise of Electrochemistry. Volume 1. The Double Layer". Edited by J. O'M. Bockris, Brian E. Conway, and Ernest Yeager. Plenum Press, New York. 1980. 453 pp. \$49.50.

This first of a four-volume series presents a detailed treatment of the solid-solution interface, emphasizing thermodynamic aspects. As stated in the preface, the book is intended to make an "overall statement of the modern view" of electrochemistry. This volume covers interfaces ranging from metal-solution to insulator-solution systems.

An excellent job of editing has been done. The book has nine chapters, written by an impressive collection of leaders in electrochemistry. The chapters have thermodynamics as a common denominator. Each chapter presents an up-to-date (1978) theoretical treatment, experimental data to illustrate the theory, and very helpful information on experimental measurement of various interfacial parameters. Each chapter has a bibliography ranging from about 40 to 270 references. Fortunately, the text contains numerous figures and tables, which greatly aid in comprehension of the detailed text. The chapters are largely self-supporting, and can be read independently. This makes for a certain amount of repetition; the topic of electrocapillary curves is dealt with in several chapters. The book also includes a table of symbols, an author index, and a subject index.

Chapter 1 is entitled Thermodynamic Methods for the Study of Interfacial Regions in Electrochemical Systems. Written by Roger Parsons, the chapter develops the fundamental thermodynamic equation describing an interfacial region involving charged particles and presents every form of the equation imaginable. At least a dozen special cases of the interface are dealt with. Chapter 2 addresses the components, origin, and measurement of electrode potentials at metals. The chapter, written by Sergio Trasatti, is quite readable and has excellent diagrams. Chapter 3, by R. Reeves, is concerned with the structure and behavior of the double layer in the absence of specific adsorption. Specific adsorption of ions is treated in Chapter 4, by M. A. Habib and J. O'M. Bockris. In this reviewer's opinion, it is the best written and most informative chapter of the book. Most of the sections in the chapter have a well-written introduction and conclusion. The chapter discusses methods for measurement of surface excess and attempts to evaluate the validity of those methods. Chapter 5 is written by Frumkin, Petrii, and Damaskin, and treats potentials of zero charge. Emphasis is placed on measurement of potentials and on experimental parameters that determine potentials of zero charge. Chapters 6, 7, and 9 are concerned with the double layer at interfaces involving semiconductors (Yu. V. Pleskov), insulators (L. I. Boguslavsky), and colloids (R. J. Hunter). Each chapter discusses the uniqueness of the particular system and contains ample illustration with experimental data. Chapter 8 covers adsorption of organic compounds and is authored by Damaskin and Kazarinov. Reversible and irreversible adsorption is discussed, with specific examples of each.

This volume is indeed a comprehensive treatise on the double layer. It is a book intended for the serious electrochemist, and not for the beginner or casual reader. Each chapter is detailed and rigorous and requires that the reader is comfortable with thermodynamics and fundamentals of electrochemistry. It is a reference that belongs in any institution where fundamental or applied electrochemistry is being researched.

Royce C. Engstrom, *University of South Dakota*

Theory of Chemisorption. Topics in Current Physics. Volume 19. Edited by J. R. Smith (General Motors Research Laboratory). Springer-Verlag, Berlin, Heidelberg, New York. 1980. 240 pp. \$34.30.

A layer of chemisorbed species on a solid substrate is sometimes thought of as a collection of "surface molecules" and sometimes as an extension of the solid. A realistic description requires an approach intermediate between these extremes and it is therefore difficult to calculate the bonding at the surface by standard methods of either molecular quantum chemistry or solid-state theory. The present volume describes the methods that have been developed to treat surface layers, discusses special problems such as electron correlation and self-consistency, and reviews the significant advances made in recent years. For some semiconductor surfaces it is now possible to calculate the electronic structure from first principles and obtain good agreement with photoelectron spectra and other measurements. In the case of d-band metals, the focus of a great many chemisorption studies, progress has been slower and, in general, accurate predictions of the adatom-substrate and adatom-adatom interactions are not yet feasible.

The book is a collection of six articles by different authors: Density

Functional Theory of Chemisorption on Simple Metals by S. C. Ying; Chemisorption on Semiconductors Surfaces by J. A. Appelbaum and D. R. Hamann; Chemisorption on d-Band Metals by F. J. Arlinghaus, J. G. Gay, and J. R. Smith; Cluster Chemisorption by B. Kunz; Concepts of Surface States and Chemisorption on d-Band Perovskites by T. Wolfram and S. Ellialtioglu; and Theoretical Issues in Chemisorption by T. L. Einstein, J. A. Hertz, and J. R. Schrieffer. The articles combine to provide an authoritative and timely survey of the field and the book will be welcomed by surface scientists. Two points should be made for those primarily interested in the chemistry of surfaces. First, all the authors are solid-state physicists and assume that the reader is familiar with the language and methods of solid-state theory. Second, aspects of chemisorption theory other than electronic structure and bonding are not discussed.

Peder J. Estrup, *Brown University*

Molecular Electron Transfer. By Carl J. Ballhausen (Copenhagen University) and Harry B. Gray (California Institute of Technology). The Benjamin/Cummings Publishing Company, Reading, Mass. 1980. x + 133. \$14.50.

This little book is a gem in clarity and design. Although lacking frequently in mathematical rigor, it covers the application of molecular orbital theory to the study of molecules. In the words of the authors, "it is aimed at students who have reasonable familiarity with differential and integral calculus and are beginning the study of the physical description of chemical systems." It restricts itself to the treatment of ground electronic states and, thus, is primarily addressed to the principles of chemical bonding. No form of group theory is invoked, but "symmetry operators" are introduced as any operations that leave the Hamiltonian unchanged. Three introductory chapters deal with the Schrödinger equation, with molecular orbitals and with many electron systems. The final chapter, about half the length of the book, deals with hybridization, with diatomic molecules, and then specifically with water, carbon dioxide, formaldehyde, ethylene, allene, diborane, and finally with some physical properties.

I am afraid that the little book is just a little light to be used as a textbook for any course we are now offering or which we would envisage offering. On the other hand, it should make marvelous subsidiary reading for students during their first exposure to quantum chemistry and to others who would like to get updated about modern simple quantum chemical applications to molecules. In this manner it can be highly recommended. It is unfortunate that the book does not appear to be available in paperback or softcover form.

H. H. Jaffe, *University of Cincinnati*

Anionic Polymeric Drugs. Edited by L. Guy Donaruma (New Mexico Institute of Mining and Technology), Raphael M. Ottenbrite (Virginia Commonwealth University), and Otto Vogl (University of Massachusetts). John Wiley and Sons, Inc., New York. 1980. xii + 356 pp. \$39.50.

This book represents the first volume in the series "Polymers in Biology and Medicine". Future volumes will deal with targeted drugs and polymers in agriculture (both volumes in preparation) and toxicology of monomers and polymers, polymeric artificial organs, and plasma expanders (all tentatively scheduled). The book discusses the use of a number of naturally occurring polymers as drugs, for example heparin and several nucleic acids; however, the emphasis in this volume and in future volumes in the series is on synthetic polymers. The literature coverage appears to end in late 1978, with a few 1979 articles appearing here and there.

A brief introductory chapter is followed by nine chapters devoted to the chemistry, physical characteristics, and physiologic activity of anionic polymeric drugs. Among other effects these drugs exhibit antitumor, antiviral, and antibacterial activity and have been shown to act as inducers of interferon. Although numerous polymers are mentioned throughout the book the most ubiquitous by far is the 1:2 regularly alternating cyclocopolymer of divinyl ether and maleic anhydride, known commonly as pyran copolymer, which is discussed in every Chapter but one. In fact, Chapter three, Synthesis, Characterization, and Biological Activity of Pyran Copolymer, and chapter four, Physicochemical Characteristics and Molecular Pharmacology of Pyran Copolymer, deal almost exclusively with pyran copolymer and together make up slightly more than 40% of the book. The discussion of a single drug by different authors had led to several inconsistencies and repetitions. Pyran copolymer is referred to in the book in no less than five different ways and its structure is drawn in its hydrolyzed form in Chapter two and in its unhydrolyzed form in Chapter three. Reference to identical work on the effect of pyran copolymer on hexobarbital sleeping time is made in both Chapters two and eight. Aside from these criticisms the chapters are uniformly well written and with the slight exception of the structures in Chapter two all structures, graphs, and tables are of high quality.

The editors have done an admirable job of bringing together such a large number of disciplines under one cover. This volume should have wide appeal among those working in the field.

Robert J. Kempton, Northern Kentucky University

Treatise on Analytical Chemistry. Part II. Analytical Chemistry of Inorganic and Organic Compounds. Volume 16. Functional Groups. Edited by I. M. Kolthoff and P. J. Elving. John Wiley and Sons, New York. 1980. xix + 560 pp. \$42.50.

The volume is part of Section B-2: Organic Analysis II. Functional Groups. The section starts in Volume 14 of the treatise and Volume 16 is a continuation of the discussion of nitrogen-containing compounds started in Volume 15. This volume contains chapters on the Azoxy Group, Nitro and Nitroso Groups, Nitrate and Nitrite Ester Groups, and Nitrile, Isocyanide, Cyanamide, and Carbodiimide Groups.

Standing alone, this comprehensive volume has very little value to anyone but a specialist. As part of the whole treatise, it is an invaluable addition to any library.

The layout is clear, detailed, and identical for each of the 4 chapters. Very appropriately, a discussion on Toxicity and Industrial Hygiene is included and emphasis is placed on alleviating confusion on nomenclature.

A paragraph on scope and coverage would have been helpful. Judging from the references, most of the reported work was carried out in the 50's and 60's—some dating far back to, e.g., 1867—but almost none in the 1970's.

The index favors chemical over analytical terms. As an example, no cross-references appear there on "infrared analysis" or "calorimetric methods", while on the other hand, "voltammetry" is indexed.

The inside covers contain periodic system type chart and table, indicating the volume number of Part II in which the particular element is discussed.

The text is very well laid out with effective use of titles, paragraphs, and different sizes of type.

H. G. Langer, Dow Chemical, New England Laboratory

Treatise on Analytical Chemistry. Part II. Analytical Chemistry of Inorganic and Organic Compounds. Volume 17. Index: Volumes 1-16. Edited by I. M. Kolthoff and P. J. Elving. John Wiley and Sons, New York. 1980. xiv + 388 pp. \$50.00.

This is the index volume for Part II of the Treatise. It starts with an alphabetical list of the authors, indicating title, volume, and page of contributed chapters. Multiple authors are cross-referenced.

The next item describes the contents of the 17 volumes in Part II, additionally broken down into Section A: Systematic Analytical Chemistry of the Elements; Section B-1: Organic Analysis I. The Elements; and Section B-2: Organic Analysis II. Functional Groups. For each volume, title, authors, and page numbers are listed, numbered consecutively throughout Part II. It is strange, however, that the chapters are *not* numbered in the volumes themselves. It is slightly distracting that Section B-2, which starts in Volume 13, is interrupted by a part of Section B-1 in Volume 14 and continued in the same volume.

From the contents it appears that coverage is somewhat arbitrary. As an example, Nitrogen-containing Functional Groups are covered by 9 chapters whereas Sulfur-based Groups (other than divalent) are covered by only 1, and to further illustrate the point, for sulfonamides, only *one* reference is found, applying a bioassay.

The third and main item of the volume is the Subject Index—although obvious, unfortunately not titled. It is extremely clear, well-set, and very easy to read—a decided asset for a reference series. The only drawback is the use of roman numerals for volumes within the Subject Index, whereas in the Contents List, the volumes are numbered by arabic numerals. An explanatory footnote on page one of the index does not help much to overcome the confusion. As in Volume 16, the index is heavily oriented toward chemical terms possibly at the expense of techniques and methodology. As an illustration, the reader will not find Infrared Spectra of Nitrogen-Containing Compounds, while those of several inorganic compounds are cross-referenced.

H. G. Langer, Dow Chemical, New England Laboratory

Catalysis. Volume 3. Specialist Periodical Report. Edited by C. Kemball and D. A. Dowden (University of Edinburgh). The Chemical Society, London. 1980. xiii + 285 pp. \$65.00.

Volume 3 is the latest addition to a series of publications whose intent is to review the literature in the general field of heterogeneous catalysis with some attempt made to include related areas of homogeneous catalysis.

Three of the nine chapters of the present volume deal with various aspects of catalytic oxidation of ammonia, methane, alkenes, alcohols, and sulfur dioxide. These chapters are generally well written and an-

notated. They provide an overview of the recent literature (to 1978) in several overlapping areas of oxidation catalysis.

The chapters on zinc oxide catalysis and non-faujasitic zeolite catalysis are also well written and provide useful references to the cogent literature in the respective areas. The chapter on catalysis on well-defined metal surfaces and non-metallic substrates is more a report than a review of the recent literature. Although it is well referenced, the size of the area and the current interest in the area require more effort than was allotted to this chapter.

The chapter on steam reforming is a concise and helpful review of the literature from 1974. The chapter on spillover contains much useful information, but was extremely difficult reading.

The chapter on polymerization by carbanions and carbocations does not belong in this series of reviews. It would be more useful if placed in the proposed fourth volume of "Catalysis" which is expected to cover more homogeneous catalysis.

Richard M. Laine, SRI International

Thermal Analysis, ICTA 1980. Volumes I and II. Volume I edited by H. G. Wiedemann (Mettler Instrumente AG) and Volume II edited by W. Hemminger (Universität Braunschweig). Birkhauser Verlag, Basel, Switzerland. 1981. Volume I, XV + 612 pp. \$85.00. Volume 2, XII + 590. \$85.00.

These two volumes contain four- to six-page extended abstracts of the 201 papers and six award and plenary lectures presented at the Sixth International Conference on Thermal Analysis, held at Bayreuth, Federal Republic of Germany, July 6-12, 1980. All the papers are in English. Each volume contains a subject and author index.

The first volume contains three appendices: Memories of Kyoto by H. Kambe; Report of the Committee on Standardization by P. D. Garn; and Report of the Publications Committee, J. P. Redfern, Chairman. The latter contains a continuation list of books and monographs on thermal analysis since 1971.

Volume I contains three award and plenary lectures: Thermal Analysis in Solid State Chemistry by H. R. Oswald, Some Applications of Thermal Analysis to the Communications and Electronics Industry by P. K. Gallagher, and Thermal Analysis in Earth Sciences by G. Lombardi. In addition, this volume contains 21 papers on Theory, 26 papers on Instrumentation, 43 papers on Applied Sciences, and 22 papers on Industrial Applications.

Volume 2 contains three award and plenary lectures: Calorimetry of Small Animals and Some Consequences of the Thermodynamics of Irreversible Processes by I. Lamprecht, Calorimetry of Aqueous Polymer Solutions at Subzero Temperatures—Supercooled, Bound and Unfreezable Water by F. Franks, and Recent Applications of Scanning Calorimetry in the Biological Sciences by J. M. Sturtevant. The sections and number of papers in each section are as follows: Inorganic Chemistry/Metallurgy, 40; Earth Sciences, 15; Organic Chemistry/Polymers, 21; Biological Sciences/Medicine/Pharmacy, 13.

The papers represent trends occurring in thermal analysis today. While the majority of the papers involve the conventional techniques of thermal analysis, i.e., DTA, DSC, TG, and EGA, calorimetry was included to a degree not found in previous Conference publications. Two of the plenary lectures and a number of the papers, including several in the Biological Sciences section, involved calorimetry. Papers describe microcomputers tied to TG, using an infrared image furnace, dilatometer with an infrared heating system, and simultaneous DSC/TMA/TG. Equipments for simultaneous TG/DTA, TG/MS, and DTA/thermo-microscopy also were presented. Three papers are concerned with treatment of hazardous materials. There are a number of papers on kinetics, phase diagrams, and phase transitions, including stress and temperature induced phase transformations in steel. Other subjects include applications of thermal analysis to polymerization, metal complexes, fire retardancy, polymer annealing, and hydrate stability.

These volumes would be of value to anyone working in the field of thermal analysis. They would provide insight on techniques, data handling, and interpretation that should benefit any investigator.

C. B. Murphy, Xerox Corporation

Molecular Interactions. Volume 1. Edited by H. Ratajczak (University of Wrocław) and W. J. Orville-Thomas (University of Salford). John Wiley & Sons, New York. 1980. xxi + 415 pp. \$78.00.

This text constitutes the first volume of a series that will cover developments in both theoretical and experimental studies in the field of molecular interactions. The present volume concerns itself with theoretical aspects of molecular interactions with special reference to the electronic structure of isolated molecular complexes of the hydrogen-bond and electron-donor-acceptor types, and to vibrational aspects related to the interpretation of the infrared spectra of hydrogen-bonded molecular systems. There are altogether 11 articles. Several reviews appear for the

first time in the literature: cooperative phenomena in molecular systems, crystal orbital approaches to the study of molecular interactions in solids, and the applications of molecular dynamics methods to the study of molecular interactions in liquids.

The reviewer took a special interest in the article on cooperative phenomena in molecular systems. In this paper, the advantages of cluster expansion approaches within the framework of *ab initio* MO-SCF calculations to molecular interactions are discussed. In this way nonadditivities and their associated asymptotic behavior in molecular interactions are isolated and illuminated. Results of various cluster expansion approaches for simple molecular systems studied in detail are surmised. Cooperativity is viewed as an artificial property which is introduced as a refinement of theory into higher order approximations rather than as an intrinsic physical phenomenon. Reference is made to the fact that standard quantum mechanical calculations presuppose independent particle motion. Cooperativity is then brought into the model through higher order terms in the cluster expansion. However, this section must be read with caution. This point of view may be true with regard to the present structure of theory for stationary electronic properties of atoms and molecules. The observation may not strictly apply in respect of theoretical approaches of statistical physics for condensed phases. In this case, the simple operation of filling of space with particles of arbitrary shapes destroys the symmetry of space. This automatically generates configurational factors, and therefore cooperativity, which in their own right have to be taken into account explicitly over and above the properties of the individual particles which may in turn be perturbed through molecular interactions by the very act of bringing them together to share a finite region of space. Both the molecular and configurational aspects are separately amenable to expansion approaches to higher level approximations in statistical physics. What may be artificial is the simplifying supposition that molecular and configurational aspects can be treated as independent phenomena when indeed they are essentially coupled to varying degrees depending on the problem at hand. The review on cooperative phenomena in molecular systems concludes with a recommendation for a reorientation of theoretical effort toward the development of simple physical models leading to analytical expressions which are easy to handle. Results from such approaches will certainly be warmly received in the literature, particularly by those workers whose primary interests lie in the cooperative phenomena in condensed phases.

"Molecular Interactions" is attractive to subscribe to. The series enjoys a high-level editorial effort and, so far, has secured contributions of high standard from its authors. The reviews also provide a rich source of references in the field.

Chodziwadiwa C. Mjojo, *Chancellor College, University of Malawi*

Biological Chemistry. By K. E. Suckling and C. J. Suckling. Cambridge University Press, New York. 1981. xii + 381 pp. \$59.50 (\$19.95 paperback).

The authors hope to enlighten both organic chemists and biochemists by treating biochemical problems from a chemical standpoint and illustrating the ways in which nature has acted as the "ultimate" organic chemist in designing biochemical systems. The first half of the book consists of a treatment of chemical reactions and their applications in biology. Reactions are divided into categories by chapter including polarized double bonds, condensation reactions, reactions of carbon-carbon double bonds, substitution reactions at aliphatic and aromatic carbons, biological oxidations, and metal ions in biochemistry. Each chapter is introduced with a brief review of the reactions and mechanisms involved from a chemical viewpoint. The authors then examine these reactions as they occur in biochemical systems, using, as examples, reactions for which mechanisms are well established. When such examples are not available, possible mechanisms are discussed by analogy.

The second half of the book appears to be aimed at introducing the organic chemist to the unique problems of biochemical investigations. These chapters include discussion of enzymes as catalysts, biochemical techniques, enzyme systems and intracellular control, enzyme mechanisms of phosphate transfer, membranes, drugs, and cellular communication.

Biochemists may find the order of presentation of topics somewhat distracting as reactions are grouped by mechanism rather than by enzyme type. Thus, reactions of phosphate esters and anhydrides are discussed in several sections of the book. Nevertheless, the presentation is consistent with the objectives of the authors in treating biochemistry at the chemical level.

One major shortcoming of the book is the figures which are not at all helpful. Reactions are sketched in the briefest possible form with no figure legends and very little explanatory discussion in the text. It was frequently impossible to determine what it was that was being illustrated let alone the details of the reaction. An excellent feature is the use of problems within the text which encourage the reader to think more deeply

about the points being made and which lead logically into the next sections.

The authors do not attempt a comprehensive study of either organic chemistry or biochemistry and, in fact, assume that the reader is relatively well informed in both fields. Furthermore, neither the reaction mechanisms nor the biochemical systems are presented at a very sophisticated level. References are included which direct the reader both to more advanced treatment of topics and to more elementary reviews for those whose backgrounds have lacked the necessary preparation. Nevertheless, the book must be described as relatively weak in content being neither comprehensive enough for use as a text nor advanced enough for use as a reference. The strength of the book is in promoting interdisciplinary thinking, reminding the biochemist of the chemistry involved in enzyme catalyzed reactions, and pointing out to the organic chemist the elegance of biological chemistry.

Sharon M. Panasencko, *Pomona College*

Polymeric Delivery Systems. Edited by Robert J. Kostelnic. Gordon and Breach, Science Publishers, Inc., New York. 1978. 312 pp. \$39.80.

This is Volume 5 of a series of monographs based on special symposia held at the Midland Macromolecular Institute. The volume contains 18 papers covering such topics as the Formation and Structure of Synthetic Membranes, Films and Microcapsules, Controlled Release of Effectors from Polymers and Microcapsules, Carriers for Bioactive Materials, Sustained Release of Macromolecules from Polymers, Synthetic Polymeric Drugs, Macromolecular Control of Food Additives, and the Status of Delivery Systems for Drugs and Food Additives as Viewed by the FDA. Eleven further contributed papers discuss current research in this growing field. The volume includes the discussions of most of the papers as edited by the participants. The papers are written as conventional journal papers, with experimental descriptions, figures, tables, and references.

Omar Tiba, *The University of Michigan*

Catalyst Deactivation. Edited by B. Delmon (Université Catholique de Louvain) and G. F. Froment (Rijksuniversiteit Gent). Elsevier Scientific Publishing Company, Amsterdam and New York. 1980. x + 602 pp. \$92.55/Dfl. 190.00.

This volume, the sixth of a series entitled "Studies in Surface Science and Catalysis", contains the proceedings of the International Symposium on Catalyst Deactivation, Antwerp, Belgium, 1980. The papers presented cover a wide range of fundamental and industrial aspects of catalyst deactivation by poisoning, coking or solid-state transformation. The contributions consist of 35 research papers and 9 review articles. The review papers include A Quantitative Approach of Catalyst Deactivation by Coke Formation, by G. F. Froment. Froment stresses the necessity to develop a rigorous, quantitative framework for treating the coking phenomena and to take into account that the coking reaction itself can undergo a deactivation as a consequence of coke formation. Deactivation of a catalyst particle by site coverage and pore blockage is discussed and applied to reactor operation. Chemical aspects of coke formation are not considered. J. B. Butts' paper on Catalyst Poisoning and Chemical Process Dynamics treats transient and unsteady state behavior in catalytic processes. Sulfur Poisoning of Nickel in CO Hydrogenation, by C. H. Bartholomew and J. R. Katzer, gives a review of recent literature with the objective of integrating surface and reaction studies in order to understand the mechanism of sulfur poisoning of nickel in methanation reactions. S. T. Sie reviews Catalyst Deactivation by Poisoning and Pore Plugging in Petroleum Processing with special emphasis on hydroprocessing of residual feedstocks. L. L. Hegedus and R. W. McCabe give a thorough review of catalyst poisoning with emphasis on the chemistry of deactivation of metal and metal oxide catalysts. The discussion is extended to the scale of a catalyst pellet and includes a case history taken from automobile exhaust catalysis. The authors give an example of how the analysis of complex catalyst poisoning events and the elucidation of the underlying poisoning mechanisms can be used for the design of poison-resistant catalysts. Automotive exhaust catalysis is also the topic of a paper by J. P. Brunelle, H. Dexpert, J. J. Ehrhardt, E. Freund, N. Pacia, A. Pentenero, G. Praline, and M. Prigent, The Deactivation of Automotive Post-Combustion Catalysts by Lead from Gasoline, which reviews research results obtained in several French laboratories. A qualitative discussion of aging and deactivation of catalysts from the viewpoint of solid-state chemistry is presented by B. Delmon and P. Grange. After a classification of the deactivation phenomena, special emphasis is laid on phase transitions or segregations, on reactions between solid phases, and on changes in composition. For each case, practical methods for preventing aging and deactivation are reviewed. Factors Determining the Life of Industrial Heterogeneous Catalysts are discussed by P. J. Denny and M. V. Twigg. While the other review articles deal mainly with catalyst deactivation, D. B. Dadyburjor's paper considers the

reverse effect, namely the reactivation of sintered catalysts by redispersion of the metal. The single-atom redispersion and the spreading mechanism on one side and the multiautom crystallite splitting model on the other side are described and evaluated.

In the 35 other contributions to the symposium, a wealth of new and important research results is reported. As in the case of the review articles, the different papers look at catalyst deactivation from both fundamental as well as industrial and engineering perspectives. The interdisciplinary character of the symposium and the differences in the background and fields of expertise of the contributing authors provide a good basis for cross-fertilization of ideas and concepts in catalysis.

Johannes Schwank, The University of Michigan

Pentacoordinated Phosphorus. Volume I. Structure and Spectroscopy. By Robert R. Holmes (University of Massachusetts). American Chemical Society, Washington, D.C. 1980. xi + 479 pp. \$92.00.

This volume deals with the chemistry of pentacoordinated phosphorus molecules with emphasis on the structure and spectroscopic properties. The book is divided into four major chapters: (1) The Pentacoordinated State; (2) Geometry and Bond Parameters; (3) Structures and Exchange Phenomena From NMR Spectroscopy; and (4) Potential Functions and Intramolecular Exchange. Two large appendices are also included: Appendix I: Vibrational Spectra of Trigonal Bipyramidal and Square Pyramidal Pentacoordinated Molecules; Appendix II: Expressions for G and F Matrix Elements For Pentacoordinated Molecules. Fundamental frequencies in the infrared and Raman spectra of the title compounds are especially useful in Appendix I.

Volume I contains a wealth of data of paramount value to all who are working in or intend to work in the field of phosphorus chemistry. NMR and X-ray analysis of pentacoordinated, phosphorus-containing systems have been tabulated and critiqued. The Berry pseudorotation process is also discussed in terms of explaining interconversions of rotamers. Although the data are current and certain sections require some background information for ease of comprehension, this book is very well written and the literature coverage is excellent.

K. Darrell Berlin, Oklahoma State University

Pentacoordinated Phosphorus. Volume II. Reaction Mechanism. By Robert A. Holmes (University of Massachusetts). American Chemical Society, Washington, D.C. 1980. xi + 237 pp. \$52.00.

Volume II of this series contains two major chapters: (1) Electronic Structure and Polytopal Rearrangement; and (2) Reaction Mechanisms. Chapter I focuses on the Berry pseudorotation process versus the turnstile mechanism to explain rotamer interconversion. Topological diagrams are provided to graphically display the possible rotamers from a system PABCDE. Energy barriers between intermediate structures with a square-pyramidal and/or a trigonal-bipyramidal transition state are also assessed with values for specific systems tabulated.

In Chapter 2, attention is directed on those systems which seem to have pentacoordinated intermediates. In addition to simple organophosphorus molecules, the role of pentacoordinated phosphorus in phosphates involved in enzyme reactions is included. The reviewer found this section especially informative and it should stimulate the interests of biochemists as well as organic chemists. Again the work is well written and the literature coverage is excellent.

Any serious-minded chemist who works in phosphorus chemistry should have these books in ready access.

K. Darrell Berlin, Oklahoma State University

Thermal Properties of Food and Agricultural Materials. By Nuri N. Mohsenin. Gordon and Breach Science Publishers, New York, London, and Paris. 1980. VIII + 407 pp. \$53.00

This excellent book presents current knowledge of the thermal properties of foods and agricultural materials. Theoretical aspects of specific thermal phenomena are presented and applied to a wide-ranging selection of experimental accounts drawn from the literature. Experimental methodologies are analyzed, the results interpreted, and the significance discussed.

Heat transfer and related physical properties are introduced in the first chapter. The concept of mass-average temperature, heats of adsorption and wetting, and Newton's and Fourier's laws of heating and cooling are discussed. Chart solutions and a criterion for Biot number magnitude as a guide to solution of heat transfer problems are presented.

Specific heat and its measurement are the subjects of the second chapter. The methods of mixtures and differential scanning calorimetry are discussed, illustrations of specific experimental devices are given, and a particularly good account of specific heat determination in frozen, dehydrated, and fluid foods is included.

The theory and measurement of thermal conductivity, diffusivity, and unit surface conductance are presented in the third chapter. Detailed discussions of steady-state longitudinal and radial heat flow, unsteady

state, and TC probe methods are given. Thermal diffusivity measurement by TC probe and transient heat transfer techniques are discussed. Approaches to estimation of unit surface conductivity include an interference method, use of empirical equations employing Nusselt, Reynolds, and Prantl numbers, and geometric analysis and similitude methods.

Applications of theory and techniques described earlier are made in Chapter 4 to diverse materials: grain, fruit, vegetables, wood, soil, soybean meal, red meat, poultry, dairy products, and others.

Excellent presentations of cooling and freezing and heat treatment and drying are given in the fifth and sixth chapters. Applications of Newton's and Fourier's laws and the significance of surface conductance, heat of respiration, thermal expansion, and other thermal phenomena in these processes receive excellent treatment.

The valuable appendix contains 46 tables and 60 figures related to presentations in the text, and all but the table of conversion factors carry references to data sources. Separate lists of tables, figures, and references are included; subject and name indices complete the book.

This book is a masterful blend of theory and practice and is one for authors in other fields to emulate.

James W. Berry, University of Arizona

Laboratory Safety, Theory and Practice. Edited by Anthony A. Fuscaldo, Barry J. Erlick, and Barbara Hindman. Academic Press, Inc., New York. 1980. xiv + 357 pp. \$39.50.

This excellent book has three main sections: General Laboratory Safety, Biological Laboratory Safety, and Medical and Psychological Factors. The sections are subdivided into chapters, each of which is written by a person knowledgeable in the area. The chapters include: Physical, Chemical, and Fire Safety; Classes of Toxic Compounds; Radiation Hazards; Viruses and Cancer; Recombinant DNA Research; Biohazards Associated with Laboratory Animals; Selected Medical Problems of Laboratory Personnel; Medical Aspects of Occupational Health; Genetic Monitoring; and Behavioral Factors in Laboratory Safety. Each chapter has an extensive reference list of up to 11 pp. A glossary would be useful to the book, but there is none.

All chapters are very well written, and the style is remarkably uniform throughout the book, with the exception of the chapter dealing with selected medical problems. It would take a medically trained person to understand that chapter. The abbreviations and medical terms are rarely defined or explained, and the text is written in a stilted obfusatory style which makes reading a labor. Fortunately this is not true of the other chapters, which begin with the basics of the subject, build upon them, elaborate various aspects of the topic, and make a coherent entity.

The chapter dealing with behavioral factors in laboratory safety covers an area never mentioned in similar books: the personalities of the laboratory workers. Some of the subjects covered in the chapter include: accident-prone and accident-free individuals, modeling and shaping behaviors, positive and negative reinforcement for changing a behavior, and dealing with specific types of personalities (e.g., the lone wolf). Laboratory directors, group leaders, and supervisory technicians will benefit enormously from this chapter, and the references provide information specific to many types of situations. In essence, if the principles in this last chapter are ignored, all of the safety information in the rest of the book will stay as theory in the book and will not be applied in the laboratory.

There are several subjects inexplicably missing from the book. Threshold limit values for chemical substances, compressed gas cylinder safety, and chemical waste disposal are not mentioned. There are no reasons given for the omissions.

In spite of the few shortcomings, the book is an excellent reference for any laboratory of any type. It should be in every library and on the desk of any laboratory manager or director interested in laboratory safety.

Barbara Booker, University of Michigan

Thio- and Dithiocarboxylic Acids and Their Derivatives. By S. Scheithauer and R. Mayer. (Volume 4 of Topics in Sulfur Chemistry, edited by A. Sennings.) Georg Thieme Verlag, Stuttgart. 1979. vi + 374 pp. DM148.

This book is an extremely thorough treatise on derivatives of the carboxyl group containing a thiocarbonyl group: acids, esters, anhydrides, acyl halides, but not thioamides. Methods of preparation occupy no less than 181 pages, in which are included many comprehensive tables in a style similar to that found in "Organic Reactions". A smaller but equally thorough section on properties follows, containing useful spectrographic information. A section on reactions, amounting to roughly a third of the volume, follows, and there are concluding sections on technical applications and biological activity. Altogether, 1845 references are cited. A subject index of 13 pp supplements the very detailed table of contents. This book will probably remain the definitive work on the subject for some time, and it is therefore a pity that it is soft-bound.