Additions and Corrections

Rate-Limiting Formation of Diazonium Ions in the Aqueous Decomposition of Primary Alkanediazoates [*J. Am. Chem. Soc.* **1994**, *116*, 6611−6621]. JIAN HO AND JAMES C. FISHBEIN*

Page 6615: In the last line of the second paragraph, trifluoroethane should be trifluoroethanol.

JA943896E

Book Reviews *

The Fullerenes. Edited by Harold W. Kroto (University of Sussex), John E. Fischer (University of Pennsylvania), and David E. Cox (Brookhaven National Laboratory). Pergamon Press: Oxford, U.K. 1993. vi + 318 pp. $53.95. ISBN 0-08-042152-0.
Buckminsterfullerenes. Edited by W. Edward Billups and Marco A. Ciufolini (Rice University). VCH: New York. 1993. xv + 339 pp. $59.00. ISBN 1-56081-608-2.

The burgeoning fullerene literature clearly warrants book-length overviews. Both of these volumes summarize the key pioneering developments, mainly pre-1993, but with important differences in emphasis; over one-half of *The Fullerenes* is devoted to solid-state chemistry and physics, whereas *Buckminsterfullerenes* offer a complementary in-depth review of early theoretical work.

Part 1 of *The Fullerenes* consists of articles from a special issue of the journal *Carbon*. In the introduction, Kroto presents a thorough and concise summary of the events leading to the discovery and identification of fullerenes. Krätschmer and Huffman then describe their landmark studies which produced the first macroscopic samples of fullerene extract. Curl outlines work carried out from 1985−1990, in the "pre-isolation period", which provided mass-spectrometric and theoretical evidence for the now-accepted structure and physical properties of C_{60}. Campbell and Hertel discuss other molecular-beam work done prior to and soon after the discovery of the Krätschmer−Huffman production and extraction process, focusing on laser desorption, photophysics, and gas-phase and surface collision behavior. Parker and co-workers summarize their early investigations of fullerene synthesis and controlled extraction procedures for giant fullerenes. Howard et al. review the production of fullerenes from benzene/oxygen flames.

The focus then shifts to chemical and physical properties and materials science. Olah et al. describe some general aspects of C_{60} chemical reactivity. Fagan and coauthors elaborate on fullerene studies involving organometallics, free radicals, and halogens. Dunne and co-workers analyze fullerenes in relation to other carbon networks such as amorphous carbons and carbon blacks. Fowler et al. present a highly-detailed theoretical treatment of the Stone−Wales isomerization, which may grow in significance as higher fullerenes become more readily available. Terrones and MacKay's article is an imaginative foray into complex, as-yet-unknown fullerene-related carbon allotropes. The last two articles deal with superconductivity (Whetten and Holczer) and neutron scattering (Prassides et al.).

Part 2, covering fullerene solid-state chemistry and physics, derives from a special issue of the *Journal of Physics and Chemistry of Solids*. Murphy and co-workers describe superconducting alkali metal-doped phases of C_{60}. Heiney reviews the orientational ordering transition- and solid-state equilibrium structures of C_{60}, $C_{60}O$, and C_{70}. Neutron scattering and powder X-ray diffraction of C_{60} and alkali metal-doped derivatives are presented by Copley et al. and by Zhou and Cox. The raman- and infrared-active vibrational modes of pristine and doped C_{60} films are discussed by Ecklund et al. Lucas contributes work on electron energy loss spectra (EELS) of C_{60} films, complemented by Gensterblum and co-workers' HREELS studies of C_{60} epitaxial films grown on GaSe. Weaver discusses optical and electronic spectroscopy of C_{60} and C_{70} and their alkali metal derivatives. Wudl details the doping of C_{60} with an organic donor to form an organic ferromagnet. Oshiyama et al. present results of band structure calculations for C_{60} and related materials, including carbon microtubules. Finally, Schlüter et al. discuss the rationale and theory of superconductivity in alkali-intercalated C_{60}.

The first three chapters of *Buckminsterfullerenes* focus on fullerene discovery and production. Curl describes mass-spectroscopic measurements of carbon clusters; this review extends the author's article in the Kroto volume by discussing fullerenes and the diffuse interstellar bands. Kroto et al. in turn present a general overview of this research, encompassing production, isolation, and chemistry (halogenation and phenylation), physical measurements and cluster experiments, solid-state studies, alkali metal doping, carbon fibers, and as in Curl's chapter, speculation about fullerenes in the interstellar medium. Thilgen, Deiderich, and Whetten then present their early work on the isolation and characterization of higher fullerenes, as well as a comparison of fullerene production methods and theoretical considerations pertaining to fullerene isomers.

The next five chapters summarize theoretical approaches. Schmalz and Klein's review of fullerene structures addresses construction via graphical methods, resonance, strain, stability, and symmetry. The authors then consider higher fullerenes, tubes and tori, and speculate on the mechanism of fullerene formation. Scuseria reviews ab initio calculations on equilibrium structures of C_{60}, hydrogenated and fluorinated derivatives, C_{70}, giant fullerenes, C_{28}, and negative-curvature fullerenes. White et al. describe theoretical work on fullerene geometry, electronics and photoelectron line shapes, molecular dynamics of fullerene impacts with surfaces and rare gas atoms, fullerene formation and compression, and the properties of tubules. Haddon and Raghavachari discuss the pyramidalization of fullerene carbons and analyze the effects of the unique curvature on fullerene electronic structures. Cohen and Crespi continue with theoretical treatment of alkaline metal intercalation and superconductivity. Erwin presents electronic structure theory for alkali-intercalated, endohedral, and metal-surface-adsorbed fullerenes.

The remaining chapters return to experimental work. Schwarz and co-workers discuss the gas-phase production and mass-spectroscopic analysis of exo- and endohedral complexes of fullerene ions with metals and noble gases. Wilson et al. present a concise overview of the solution electrochemistry of C_{60}, C_{70}, organic and organometallic derivatives, higher fullerenes, and films. Olah and co-workers offer a short review similar to their article in *The Fullerenes*. Finally, Wudl discusses the chemical derivatization of C_{60}, emphasizing versatile dipolar cycloadditions and potential applications of the products in materials science.

With new results appearing in the literature at an astounding rate, both of these volumes are already somewhat dated. Nonetheless, they offer the best comprehensive reviews of early research on fullerenes and related materials; as such, the books will prove invaluable to investigators confronted with literally thousands of citations.

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JA934590V

*Unsigned book reviews are by the Book Review Editor.

Molecular Magnetism. By Olivier Kahn (Université Paris-Sud). VCH: New York. 1993. xvi + 380 pp. $95.00. ISBN 1-56081-566-3.

This timely treatise from an established authority brings the intimidating and complex field of magnetism within the grasp of chemists interested in pursuit research in the field. *Molecular Magnetism* fills a void between older reference works and the latest research in the field. Additionally, it provides an excellent description of classical theoretical models as well as more modern formulations of this complex phenomena. Newcomers to the field of magnetism will find this book an ideal reference; however, this does not mean that there is a lack of substance. Clearly even the most established researchers will find this book to be a valuable resource. The book is well-organized, and many important concepts and examples can be gleaned from it without undo effort. It begins by covering general concepts and isolated magnetic centers and then progresses to multiple magnetic centers. The latter reflects recent progress in the understanding and design of larger magnetic systems and materials. The book is written for the nonphysical chemist, but a solid knowledge of quantum mechanics and group theory is necessary to comprehend all of the discussions.

Chapter 1 begins with a general definition of magnetic susceptibility and the unique units. The key equations in molecular magnetism, such as the Van Vleck formula, are established in a very clear and simple way. The basic concepts such as diamagnetism and temperature-independent paramagnetism are briefly discussed. In Chapter 2, the Curie law and its validity are discussed. The origins of magnetic anisotropy are demonstrated in detail for representative systems, and the effects of intermolecular interactions which lead to the Curie–Weiss law are discussed. In Chapter 3, after introducing the first-order orbital momentum and spin–orbital coupling, a detailed analysis of Ti(III) and Co(II) illustrates the role of metal–ligand bonding and symmetry. The magnetism of the rare earth-containing compounds and the free-ion approximation are discussed. Chapter 4 describes low-spin–high-spin transitions and begins with unimolecular thermodynamics and the models (molecular level and those including cooperativity) which govern spin transition phenomena. This chapter concludes with a philosophical discussion of the opportunities of spin transition phenomena in molecular electronics. Chapter 5 is entitled Intermediate-Spin and Spin-Admixed States and details a theoretical treatment of mixing of spin states followed by descriptions of this behavior in square pyramidal iron complexes.

The remainder of the book focuses on magnetic interactions in bimetallic compounds, polymers, and molecular assemblies. Chapters 6 and 7 discuss the magnetic behavior in bimetallic complexes. Chapters 8 and 9 focus principally on magnetic orbitals in bimetallic systems, and the discussions include ab initio methods for calculation of J, orbital orthogonality, and coupling through simple or extended bridging ligands. Chapter 10 focuses on trinuclear systems and features a number of illustrative spin systems. Spin frustration and examples of higher spin state clusters are also discussed in this chapter. Chapter 11 is entitled Magnetic Chain Compounds and discusses the appropriate spin Hamiltonians for chain structures in addition to covering the spin–Peierls transitions and ferrimagnetic chain structures. The design of molecular-based magnets, which has only been realized in recent years, is treated in Chapter 12. A number of approaches for creating long-range magnetic ordering in three dimensions are discussed which include the McConnell–Breslow model, spin polarization, ferrimagnetic chain structures, and spin canting. Representative discussions of key studies and the possible ordering mechanisms are given. Chapter 13 deals with magnetic interactions and delocalization in mixed-valence compounds.

Kahn's distillation of the critical elements of molecular magnetism in a comprehensive and clear way in fewer than 400 pages is nothing shy of masterful. This book fills a critical need as a modern reference for new students of magnetism, such as myself, as well as established researchers. It will be invaluable to researchers in coordination chemistry, mateials chemistry, and bioinorganic chemistry and will be considered a key reference work for years to come.

Timothy M. Swager, *University of Pennsylvania*

JA944891K

Chemical Analysis. Statistical Methods in Analytical Chemistry. Volume 123. By Peter C. Meier (Cilag A. G.) and Richard E. Zund (Lonza A. G.). J. Wiley and Sons: New York. 1993. xvi + 322 pp. $64.95. ISBN 0-471-58454-1.

In recent deades, an increasing emphasis has been placed on the statistical analysis of analytical results, and this has given rise to the field of chemometrics. *Statistical Methods in Analytical Chemistry*, Volume 123, is one of the recent additions to a growing body of reference material in this area. While the material presented is limited in its scope, it is oriented toward the practicing chemist and is quite thorough in its coverage of some subjects. Standards of "good laboratory practice" (GLP) are emphasized throughout the book. Numerous "real world" examples are presented, and a disk containing related programs is included with the book.

The book consists of five chapters. The first treats the subject of univariate data, emphasizing the nature of data and hypothesis testing. Analysis of variance and control charts are considered briefly. Chapter 2 discusses bi- and multivariate data, with an emphasis on linear regression for bivariate data. Chapter 3 treats a number of ancillary techniques, such as optimization, exploratory data analysis, error propagation, and digital filtering, but the coverage is quite cursory. In Chapter 4, real problems are presented as examples, together with solutions proposed by the authors. Chapter 5 consists of appendixes and includes information pertaining to statistical distributions and software. In a unique approach, the authors present numerical approximations to commonly used distributions rather than extensive tables.

This book has a number of features to recommend it. The discussion of univariate statistical tests in Chapter 1 is one of the more thorough I have seen in this type of book and includes, for example, an extensive table of t-tests to be used for various situations. The subject of Monte-Carlo methods is introduced early, and while I am not convinced that the uninitiated will be able to grasp the methodology, this reflects the increasing importance of these techniques for validation. The treatment of linear regression in Chapter 2 is also thorough, and a complete set of equations for uncertainty in the results is presented. While there are no problems and examples are limited, the examples which are presented in Chapter 4, together with the data included on the disk, provide fodder for exploration. Most of the examples seem to be real problems drawn from the pharmaceutical industry and provide good illustrations of complications that can arise. The numerical approximations to common statistical distributions in the appendixes will be beneficial to those writing their own application programs, but those looking for the familiar statistical tables will have to search elsewhere. Finally, the bibliography is extensive and will serve as a valuable resource for those seeking more information on virtually any topic covered in the book.

Despite these features, the book also suffers from a number of serious weaknesses. Statements such as "it is known that real distributions are wider than the Normal one" (page 22) and "accuracy cannot be determined by statistical means" (page 116), while taken out of context, beg for misinterpretation and diminish the authors' credibility. In Chapter 1, no introduction is given to the subject of probability and alternative distributions (e.g., Poisson, binomial) are not discussed. In Chapter 2, the authors virtually ignore the contributions that multivariate methods such as principal components analysis and cluster analysis have made to chemistry and conclude that "only time will tell whether many of these concepts are generally useful" (page 125). The discussion of "ancillary" techniques given in Chapter 3 is minimal and is more likely to confuse readers than enlighten them. The subject of optimization is discussed only in relation to numerical optimization as it applies to nonlinear regression, with no discussion of experimental optimization. This ignores the widely-used Levenberg–Marquardt approach in favor of a brief and inadequate discussion of simplex optimization. Exploratory data analysis is covered in less than 1 page. The discussion of significant figures in the context of error propagation confounds the simple rules that are given to students of general chemistry (e.g., the multiplication of two numbers with six significant

figures yields a result with 12, page 140). The section on smoothing gives no real guidelines for the selection of a digital filter and complicates the subject unnecessarily. The examples provided in Chapter 4 are potentially useful case studies, but I found that some of the data sets used in the examples were not provided in the text or on the disk, making it difficult to verify or contest the authors' results (e.g., Section 4.11).

The programs supplied with the book run in a QBASIC environment and so should be compatible with most DOS environments for some time. The installation of the programs proceeded easily, and they are readily accessed through a master menu. Facility for editing data files is provided. While I did not test the programs exhaustively, the ones I tried seemed to work well, although they seemed to crash easily. The utility of some of the programs, in view of commercial software currently available, might be questioned, but the source code may prove useful for some.

This work serves as a useful addition to reference material in the area, but because of its limited coverage of many topics, I would not recommend it as a sole source of information. It is more likely to be useful to practitioners in the field than students of analytical chemistry, but even then, I can think of several other books I would recommend first.

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JA934672J

Destruction of Hazardous Chemicals in the Laboratory. By George Lunn and Eric B. Sansone (NCI-Frederick Cancer Research and Development Center). J. Wiley and Sons: New York. 1994. xvi + 502 pp. $79.95. ISBN 0-471-57399-X.

How-to-do-it manuals in the chemical industry are usually restricted to internal company procedures or SOP's, but Lunn and Sansone's second edition of their procedures for destroying or detoxifying laboratory wastes provides organizations without formalized manuals useful techniques for researchers and analysts to reduce both hazards and costs and to avoid potential violations of EPA and other regulations.

This well-written volume is meant for specialists with a sophisticated background in chemistry and an awareness of the biological effects of various compounds; however, in the introduction the authors do include a few precautions often presented in freshman chemistry labs, e.g., add H_2SO_4 to water, not water to acid. They are mindful of the tendency of experienced workers to occasionally ignore basic precautions. Lunn and Sansone point out in their introduction both the strengths and the limitations of the procedures and strongly caution against relying on only their volume. They recommend that in-house guidelines, primary references, and regulatory guides should also be consulted, especially in maters of mutagenicity. The authors emphasize that hazardous materials be handled only by trained workers, a point that cannot be made often enough.

Often when designing experiments, we concern ourselves only with a narrow objective, i.e., the actual product, its yield, the rate of reaction, the temperature and pressure conditions, etc. What we will eventually do with the residue is often not considered. Lunn and Sansone strongly suggest that disposal be part of the planning process. The goal is to discard wastes without adverse biological effects.

There are 65 monographs on classes of wastes or individual chemicals. Each monographs starts with a caution to review the general safety precautions presented in the introduction. The introductory paragraph outlines the uses, potential dangers, and in most cases the chemical structure. The type or types of hazard the chemical or the class of chemicals present are also given. The second section deals with the principle of decontamination. The chemical approach, oxidation, reduction, or ion exchange, is detailed. If there are multiple routes, these are explained. Then decontamination procedures are detailed. These are recipes giving concentrations, dilutions needed, mixing times, heating, vacuum, etc. In some cases, procedures for cleaning up spills, decontaminating of laboratory glassware and laboratory clothing, and disposing of bulk quantities are also presented.

Analytical procedures for insuring that decontamination has occurred follow. Analysis methods are given in sufficient detail that a chemist with analytical background can duplicate the procedures without having to do exploratory study first.

The applicability of the methods to related compounds is discussed in many of the monographs. Each section concludes with a reference list. There are not only citations of original articles but also comments on alternate common names for the chemicals discussed in the text. Many of the monographs contain references and procedures for dealing with hazardous metabolites found in body fluids, compounds that can be found not only in hospital laboratories but also in research ones as well. In fact, the volume should be most useful in laboratories for biomedical and biotechnology research.

There are four very useful appendixes. Appendix I lists solvents that can be used to obtain good wipe samples following the cleanup of a spill. Appendix II gives procedures for drying organic solvents needed in the various decontamination and analytical procedures. Appendix III contains discussion of the use of $KMnO_4$ and its safe disposal after use as a decontamination reagent. Appendix IV contains a discussion of the unique problems of disposing of biomedical research waste. In addition, there are indexes for molecular formulas, CAS Registry Numbers, and common names.

A few of the monographs gloss over points that deserve more emphasis. For example, in cautioning the reader to carry out destruction of cyanides only in *a* fume hood, the authors do not mention the need to wear—or least have near—a respirator during the early stages of destruction. Similarly, while there is a general warning (p 331) about the explosive sensitivity of peroxide compounds, there is no warning about specific ones that have been identified in laboratory explosions in the past, e.g., peroxyacetic acid, peroxyformic acid, and peroxytrichloroacetic acid. The warning for picric acid, "Seek professional help for dry picric acid" is vague; the term "an explosives expert" would be better.

Destruction of Hazardous Chemicals in the Laboratory is a valuable and needed reference for every chemical laboratory and should be required reading for every bench chemist and graduate student planning laboratory research. However, a spiral-bound edition for bench use would be useful.

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JA944871I

DNA and Free Radicals. Edited by Barry Halliwell (University of California) and Okezie I. Aruoma (King's College University of London). Ellis Horwood: New York. 1993. xx + 332 pp. $120.00 ISBN 0-13-222035.

This book is designed to review recent developments concerning the role of reactive oxygen species in producing DNA damage and the relation of oxidant-induced DNA damage to human diseases including cancer and aging. There are 16 chapters written by leading experts working in the field. The chapters are organized into four parts—Part I, Chemistry and measurement of damage to DNA by reactive oxygen species, Part II, Mechanism of DNA damage by oxidative stress, Part III, Consequences of oxidative DNA damage, and Part IV, Pro-oxidants and DNA damage.

The first chapter by Ames and Shigenaga reviews evidence for the importance of oxidant-induced DNA damage and mitogenesis in causing cancer and for the relationship between aging and metabolic rate which is related to the levels of endogenous oxidative DNA damage. The next three chapters review the characterization of oxidative DNA damage products generated by free radicals, photosensitization, and other agents and the methodologies for detection of specific oxidative DNA lesions. Chapter 5 presents evidence for the important role iron(II) plays in the generation of DNA damage by hydrogen peroxide. The role of calcium in signal transduction is reviewed, and the possible link of oxidative stress-induced DNA damage and cell death to disruption of calcium homeostasis is discussed in Chapter 6. Chapters 7 and 8 discuss the role that lipid peroxidation and organic peroxyl radicals may play in carcinogenesis, including carcinogen metabolism, DNA damage, and tumor promotion. Prokaryotic and eukaryotic enzymes involved in repair of DNA damaged by reactive oxygen species are reviewed in Chapter 9. Bernstein presents the thesis that oxidative DNA damage may be an important determinant in the selection for sexual (*vs* asexual) reproduction in Chapter 10. The effects of oxygen and reactive oxygen species on cell cycle kinetics and mutations which result in modulation of proliferation in cultured cells are discussed in Chapter 11. Chapter 12 reviews the evidence for the involvement of reactive oxygen species in tumor promotion which relies on induction of ornithine decarboxylase as a marker for promotion. The last four chapters focus on oxidative DNA damage from chemotherapeutic redox cycling drugs, naturally occurring plant substances, mineral fibers, cigarette smoke, and food additives.

This is a well-organized book that gives a thorough and comprehensive treatment of the chemistry, biochemistry, and toxicology of reactive oxygen species and resulting DNA damage. Most of the authors treat their topics in-depth and give an extensive and detailed review; however, a few chapters give a more cursory or perfunctory overview of the material. Although the chapters on calcium homeostasis and sexual reproduction are a bit peripheral to the main topic, they do not detract from the overall quality of the book. The material is fairly up-to-date, with all chapters including 1991 references, most chapters including some 1992 references, and a few having scattered 1993 references. A fairly comprehensive index is included. This book should have broad appeal, and I would recommend it to chemists, biochemists, biologists, food scientists, pharmacologists, and toxicologists in both academia and industry who are interested in free radicals and DNA damage. Graduate students working in this area would find this a useful background source and reference text.

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JA9347090

Tellurium in Organic Synthesis. By Nicola Petragnani (University of Sao Paulo, Brazil). Academic Press: London. 1994. xxviii + 248 pp. $45.00. ISBN 0-12-552810-8.

The latest in the series of *Best Synthetic Methods*, this book provides a comprehensive overview of the preparation and synthetic applications of tellurium compounds. It provides a useful introduction to the preparation and properties of inorganic and organic tellurium reagents, including many detailed synthetic procedures. Of greater interest to the practicing synthetic chemist, the last two-thirds of the book centers on synthetic transformations mediated by organotellurium reagents. Beyond the expected oxidation and reduction chemistry, a variety of other synthetically useful transformations are described. Many novel carbon–carbon bond-forming reactions are reported. Often these transformations complement the more well-known organoselenium- and organosulfur-mediated transformations. Recent radical-mediated reactions of organotellurium compounds are also included.

The book is not without some significant failings, however. In a time when safety in the laboratory is of paramount importance and worries about the environmental impact of synthetic transformations abound, nearly nothing is reported on the safe handling of organotellurium reagents or on the safe disposal of byproducts from the reported transformations. An addendum addressing these concerns should be included with the book. In addition, despite the scholarly handling of text throughout, the equations and tables are often treated in a haphazard manner. In most cases, this consists of only annoying typographical errors; in other cases, however, the illustrations are clearly wrong, significantly detracting from an otherwise well-written work.

One of the goals of the author in writing this book was to "help some chemists to become familiar with tellurium which up till now they may have considered only as a useless and unpleasant element." Despite the above-mentioned shortcomings, the author succeeds in this effort. The book is a very useful general reference on organotellurium chemistry which may prove particularly interesting to chemists versed in the organosulfur and organoselenium literature.

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JA9450364

Basic One- and Two-Dimensional NMR Spectroscopy. Second Edition. By Horst Friebolin (Organisch-Chemisches Institut der Universität). VCH: New York. 1993. xxii + 368 pp. $40.00. ISBN 3-527-29059-1.

This is an excellent book. For a long time, we have had standard texts which explain how to deduce chemical structures from NMR spectral parameters—chemical shifts and coupling constants. More recently, there have been several good texts which explain the elegant and powerful pulse methods for measuring and assigning these spectral parameters. Friebolin's book is one of the few books on NMR that gives approximately equal weight to each of these subjects. It therefore gives an excellent introduction to NMR as it is practiced today.

The book tends to concentrate on NMR as applied to small organic molecules in solution. There are short sections at the end on *in vivo* NMR, polymers, and magnetic resonance imaging, but the bulk of the book is concerned with ^{1}H and ^{13}C spectroscopy. There is no discussion of solids, of biopolymers, or of many other new fields in which NMR is being applied.

For a book of fewer than 400 pages, it is remarkably comprehensive. The author starts with the basic physics of the phenomenon, describes how a spectrometer works, and gives the basic theory behind chemical shifts, coupling constants, and spectral analysis. There are the familar empirical rules for chemical shifts and a good discussion of the Karplus relation for coupling constants. Having established the basic spectral parameters, the second half of the book deals with pulse experiments. It starts with the *J*-modulated spin echo experiment, which I have always felt is the best way to introduce pulse methods. It then discusses COSY, heteronuclear correlations, both carbon and proton detected. There are good separate chapters on the Overhauser effect and on dynamic NMR. Each chapter is well illustrated with clear diagrams and pertinent (but not always state-of-the-art) examples. For further reading, there are short lists of well-chosen references.

The choice of what topics to cover in an introductory book is clearly a difficult one. I would argue that CW spectrometers and off-resonance proton decoupling for ^{13}C NMR are of mainly historical interest. Newer methods, such as TOCSY and various inverse detection experiments, are given too little discussion in the book. These latter experiments require modern instruments, but today's student will certainly be using them eventually.

These criticisms are minor, however. The book is well-written and clear. We have been using the first edition of the book in our graduate course in NMR for three years and have been very pleased with it. My opinion is that someone who began knowing nothing about NMR could become quite proficient at structure determination by simply mastering the contents of this book. I highly recommend it.

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JA9448576

The Metal-Hydrogen System. Springer Series in Materials Science 21. By Yuh Fukai. Springer-Verlag: New York. 1993. x + 356 pp. $98.00. ISBN 0-387-556370-0.

The Metal-Hydrogen System is a comprehensive review of recent literature and techniques that examine the interaction of dihydrogen with bulk metals. The purpose of this book is to "provide a coherent and consistent description of the basic bulk properties of the metal-hydrogen system, ranging from macroscopic properties such as solubilities and phase diagrams to microscopic properties such as atomistic states and diffusion." Surface scientists, physicists, and those interested in the physical properties of the bulk system will find the topics addressed in this book interesting. However, this work is not a primer of surface chemistry and is aimed at scientists active within this field or familiar with solid state concepts and their accompanying experimental techniques. It covers descriptions of the metal–hydrogen system under a range of pressures and temperatures including high pressures attained in diamond anvil cells.

This text is a well-written and well-organized review of recent results characterizing interactions of $H_2/D_2/T_2$ with bulk transition metals and, to a lesser extent, lanthanide and actinide metals. It focuses on a variety of physical methods and instrumental techniques including particle methods like quasi-elastic and inelastic neutron scattering and ion channeling as well as solid state NMR spectroscopy. It often reviews the advantages and theory of less-known methods, but does so at an advanced level. Thus, appropriate but economical writing provides the reader with sufficient background to understand the data and follow the author's reasoning. The strength of this book is its comprehensive coverage of a breadth of data whose conclusions are reexamined and interpreted into the conceptual framework of the current chapter. What the text may lack in fundamental description is supported by well-referenced background information. The reader is regularly referenced to the literature for details not central to the concepts or description at hand. Another strength of this work is a timely update on progress in the high-pressure regime where metal-like properties of hydrogen have been observed.

The book begins by examining physical properties of the bulk metal–hydrogen system in a chapter entitled Phase Diagrams and Statistical Thermodynamics of Binary M-H Systems, followed by Hydrogen in Alloys and Metal-Hydrogen System Under Extended p,T Conditions. A larger emphasis on atomic properties is found in later chapters entitled Atomistic States of Hydrogen in Metal, Diffusion, and Electronic Structure.

While the intended audience for this book is rather specific, those active or interested in solid state sciences will find it a comprehensive and valuable research reference.

Mitchell S. Chinn, *Utah State University*

JA9345478

Applied Laser Spectroscopy. Techniques, Instrumentation, and Applications. Edited by David L. Andrews (University of East Anglia). VCH: New York. 1992. x + 472 pp. $125.00. ISBN 1-56081-023-8.

This edited book aims at the advanced undergraduate or graduate level and assumes no knowledge of lasers. Familiarity with gas-phase spectroscopy is required, however. It strives for maximum breadth of topics and thus does not go into a great deal of depth in any one of them. When background theory is given, it is usually presented rather than developed. The book is not intended to be an updated version of Demtröder's *Laser Spectroscopy.*

Chapter 1, by the editor, is a brief review of the fundamentals of laser radiation and its interactions. Chapter 2 is a review of laser systems spanning the UV to the far-IR and a discussion of techniques to characterize their output (e.g., wavelength and power) by M. R. S. McCoustra. Chapter 3, by W. Demtröder, discusses electronic absorption spectroscopy. Chapter 4, by J. Pfab, presents laser-induced fluorescence. Chapter 5, by B. J. Howard and J. M. Brown, presents high-resolution infrared vibrational spectroscopy. Raman spectroscopy is discussed in Chapter 6 by M. D. Morris. Nonlinear Raman techniques (i.e., SRS and CARS) are presented in Chapter 7 by H. Berger, B. Lavorel, and G. Millot. Chapter 8, by L. Goodman and J. Philis, concerns multiphoton absorption spectroscopy. Chapter 9, by K. W. D. Ledingham and R. P. Singhal, presents laser mass spectrometry. Finally, Chapter 10, by P. A. Anfinrud, C. K. Johnson, R. Sension, and R. M. Hochstrasser, is an overview of ultrafast spectroscopy.

The eight post-introductory chapters keep primarily the same format, as suggested by the title of the book. The basic theory of the fundamental spectroscopic technique is presented. This is followed by a series of discussions of various permutations of the technqiue, along with descriptions of the experimental apparatuses, specific applications, and experiments in the literature. Instrumentation discussions are not limited to the lasers but include auxiliary equipment ranging from photodiodes to vacuum chambers. Advantages and disadvantages of related techniques are given by the authors.

The chapters are well referenced, with 1058 total references. The references are as up-to-date as possible for a book published in 1992, with the vast majority being from the 1980s. The authors have made a point of citing review articles and books. This is quite useful given the relatively shallow depth into which the book delves. However, as the total number of references can attest, there is no shortage of references to original papers. The book contains a four-page list of acronyms used in laser spectroscopy, and this will be especially appreciated by newcomers to the field who are unfamiliar with the menagerie of acronyms in use. A complete subject index is also present.

The fundamental bias of the book is toward high-resolution gas-phase molecular spectroscopy. The chapters on electronic, fluorescence, infrared, nonlinear Raman, and multiphoton spectroscopies are all virtually exclusively related to this field. Brief forays into atomic spectroscopy and mentions of experiments on surfaces and crystals do exist in those chapters, however. The chapters on (linear) Raman and mass spectrometry are well rounded, discussing experiments on samples varying from semiconductors to polymers. The chapter on ultrafast spectroscopy is concerned with liquid-phase experiments on molecules, although experiments on proteins are mentioned as well. One of the consequences of the gas-phase bias and the multiauthor nature of the book is that there are numerous examples of duplicity with respect to several subjects, especially supersonic jets and Doppler broadening.

While no one book could possibly contain all of the spectroscopic techniques involving lasers, the gas-phase leaning of the book leaves out a great deal of exciting work in other areas. Light scattering, hole burning, and sub-diffraction-limited near-field optical microscopy, to name but a few, are all absent. Surprisingly, time-resolved single photon counting is not included in either the fluorescence or ultrafast chapters. As a sign of the rapid advances in instrumentation in the field, Ti:sapphire lasers and optical parametric oscillators are mentioned only in passing as being promising new technologies on the horizon.

The book would work well in a teaching environment only if it is used in conjunction with a text that more rigorously goes into the theoretical details of spectroscopy. In this case, it would serve to show the breadth of experiments being done and the multiplicity of approaches to a given problem. It would also serve well as a general reference book for spectroscopists who want to (re)familiarize themselves with the experiments being performed in this varied field.

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JA944831E

Handbook on Metals in Clinical and Analytical Chemistry. Edited by Hans G. Seiler, Astrid Sigel, and Helmut Sigel (University of Basel). Marcel Dekker, Inc: New York. 1993. xx + 753 pp. $195.00. ISBN 0-8247-9094-4.

As the editors say in the first chapter, "...at the center of this book are humans and the physiology of metals on one hand and analytical procedures for the determination of metals on the other." This statement clearly defines the intent of the handbook, which is to meld current knowledge regarding the biological and clinical aspects of metals with contemporary analytical methods for the determination of metals in biological samples. In order to achieve this goal, the contributions of 80 experts from around the world have been compiled into a book containing two parts.

In the first part, 15 chapters are devoted to a general discussion of metals in clinical chemistry and descriptions of analytical methods. The reduction of errors and inconsistencies and the prevention of contamination are essential when analyzing biological samples for metals. To this end, the book provides valuable information regarding sampling, storage, sample preparation, and quality control of analyses. This section of the book also contains detailed overviews of the theoretical bases and practical experimental aspects of eight analytical methods that are currently used for metal determinations in clinical and research laboratories.

The real strength of the handbook lies in its second section. Here the chemical properties, distribution, technical uses, physiology, and analytical chemistry of 61 metals of clinical and toxicological significance are summarized in individual chapters. These chapters are uniformly well written and are particularly good at addressing the clinical significance of each metal and the working procedures for its determination in biological samples. Although the chapters are intended short summaries, they are well documented with up-to-date references.

As this book is replete with descriptions of contemporary analytical methods and knowledge regarding the physiology of clinically-important metals, it will be a useful resource to investigators in clinical and research laboratories as well as to those whose concerns are in environmental or occupational health. The book will benefit all in the field who need to understand the clinical significance of a specific metal and how best to determine its content in a biological sample.

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JA944868Z

Progress in Heterocyclic Chemistry. Volume 5. Edited by H. Suschitzky (University of Salford) and E. F. V. Scriven (Reilly Industries). Pergamon Press: Oxford, U.K. 1993. viii + 341 pp. $120.00. ISBN 0-08-042074-5.

Progress in Heterocyclic Chemistry, Volume 5, is the most recent volume in the series and describes results published in the 1992 literature. As in previous volumes, the book is organized according to ring size (by chapter) and by heteroatom content (within each chapter). The two initial chapters, however, consist of two review articles, the first of these being a review of sulfur dioxide extrusion from five-membered heterocycles. (It is, in fact, the second of a two-part review of extrusion of sulfur dioxide from heterocycles.) The review is well written and comprehensive and should be of interest to a wide range of chemists. It clearly communicates the utility of sulfur dioxide extrusion as a viable synthetic method for the preparation of a variety of compounds.

The second review, concerning the chemistry of methyl 2-(benzoylamino)-3-(dimethylamino)propenoate, is much more specialized and less likely to be of general interest. The review essentially consists of a listing of numerous monocyclic and fused polycyclic heterocycles that can be prepared using this reagent, though mechanistically the reactions are all quite similar.

With regard to the subsequent chapters, the quality of the writing

varies. Some chapters provide a coherent and cohesive description of recent advances in the synthesis or reactions of the subject ring system. For example, the sections dealing with epoxides and also pyrroles (including indoles) are both quite good. Several other sections in other chapters, however, provide little more than paragraph after paragraph of listings of reactions that have been reported during the time period covered.

Despite a few disappointing sections, the book is quite reasonable overall and would be most useful to anyone whose work involves heterocyclic compounds. A statement on the back cover reads, "Volume 5 of *Progress in Heterocyclic Chemistry* will enable academic and industrial chemists, as well as advanced students of chemistry, to keep abreast of developments in heterocyclic chemistry with a minimum of effort." I believe this monograph lives up to this claim.

Brian Love, *East Carolina University*

JA934722K

Advances in the Use of Synthons in Organic Chemistry. Volume 1. Edited by Alessandro Dondoni (University of Ferrara, Italy). JAI Press: Greenwich, CT. 1993. xii + 228 pp. $90.25. ISBN 1-55938-183-3.

This first volume is divided into four chapters, each reviewing a topic from the recent literature. The subjects covered are (1) New Formyl Anion and Cation Equivalents, by A. Dondoni and L. Colombo; (2) Trimethylsilyldiazomethane: A Versatile Synthon for Organic Synthesis, by T. Shiori and T. Aoyama; (3) From Push–Pull Substituted Allenes to Tetranuclear Chelate Complexes via Spontaneous Self-Assembly: The Synthon Strategy as a Guide, by R. W. Saalfrank and R. Burak; and (4) Chiral Synthons via Enzyme-Mediated Asymmetrization of meso-Compounds, by B. Danieli, G. Lesma, D. Passarella, and S. Riva. The book contains a reasonably complete comprehensive index, and each chapter covers the literature through 1990.

The first chapter begins with a discussion of 1,3-dithiane as a formyl anion equivalent and goes on to discuss the many new formyl anion synthons developed since 1986, when the last comprehensive review was completed. The second part of the chapter discusses masked formyl cation reagents such as 2-chloro-1,3-dithiane and trimethylorthoformate and their reactions with carbon nucleophiles such as enol silyl ethers, aromatic rings, and organometallic reagents. Diastereoselective reactions of chiral cationic and anionic formyl equivalents are discussed.

The second chapter describes the preparation and uses of trimethylsilyldiazomethane, with an emphasis on its use as a replacement for the more hazardous diazomethane. Applications described include the Arndt–Eistert reactions, ketone homologations and ring-expansions, preparation of methyl esters, and *O*-methylation of alcohols and phenols. Other reactions discussed include lithiation of trimethylsilyldiazomethane and reaction with nucleophiles, synthesis of vinylsilanes from higher homologues of trimethylsilyldiazomethane, synthesis of silylcyclopropanes, and conversion of ketones to homologated alkynes. Trimethylsilyldiazomethane can be used to prepare a variety of heterocycles by addition to double or triple bonds, and a number of these reactions are presented. The authors make a strong case for the versatility of this reagent.

Chapter 3 describes the synthesis and reactivity of a variety of 1,1,3,3-tetrasubstituted allenes. Push–pull systems are briefly discussed, but most of the coverage revolves around allenes with four electron-donating substituents such as tetraethoxyallene and 1,3-bis(dimethylamino)-1,3-diethoxyallene. These allenes are malonate dianion equivalents, and their addition chemistries and reactions with electrophiles are presented. The 4-acylfuran-2,3-diones and metal complexes of polycarbonyl anions are also discussed.

The final chapter explores the use of enzymes to resolve *meso*-diols and *meso*-diesters. The first half of the chapter consists of a brief discussion of enzyme-catalyzed desymmetrization, followed by a set of tables listing many of the known examples of desymmetrization. This collection of tables is arguably the single most useful feature of the book. Many of the examples involve the hydrolase enzymes (PLE, PPL, CCL, etc.), but redox examples using HLADH are also presented. The second half of the chapter describes the use of desymmeterized diols and diesters in about a dozen synthetic schemes. These examples nicely illustrate the utility of these optically pure compounds in synthesis.

This volume is a well-prepared set of review articles about synthons in organic chemistry. Given the very broad range of topics covered, most readers will be much more interested in one topic than the other three. I would find it appealing to group more closely related topics in a single volume and cover the broader range of subjects from volume to volume. This book should be carried by major libraries and will be of interest to specialists in the field.

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JA944823Y

Aromaticity and Antiaromaticity. Electronic and Structural Aspects. By Vladimir I. Minkin, Mikhail N. Glukhovtsev, and Boris Ya. Simkin (Rostov State University). J. Wiley and Sons: New York. 1994. xii + 314 pp. ISBN 0-471-59382-6.

This is an important new book that belongs in every chemistry library and in the personal libraries of all chemists whose thoughts and ideas have from time to time sprung from the multifaceted concept of aromaticity. The pages are loaded with information, and the references number close to 1000, including many from the late 1980s and early 1990s. Especially valuable are the numerous citations to papers in the Russian chemical literature that have heretofore received less attention from scientists in the Western world than they deserve.

More than a simple catalog of annulenes and non-benzenoid aromatic compounds, this book stresses the quantitative (mathematical) aspects of aromaticity. It is not an exhaustive compilation of aromatic compounds. Instead, specific examples are chosen and individually treated with great thoroughness, the emphasis being on molecular properties rather than on syntheses and reactions. The flavor of the book clearly reflects the close kinship the authors have had over the years with P. v. R. Schleyer, L. Radom, and R. Hoffmann.

After a brief introduction, more than 100 pages are devoted to the criteria for aromaticity and antiaromaticity and to delocalization modes and electron count rules. These chapters alone make the book worthwhile. There then follows a more traditional survey of annulenes, monocyclic conjugated ions, annulenoannulenes, and heteroaromaticity. The final 80 pages delve into the more specialized and often slighted topics of homoaromaticity, σ-aromaticity, in-plane and radial aromaticity, three-dimensional aromaticity, and spherical aromaticity. The final chapter struggles with the question "Is the physical nature of aromaticity known?"

Aficionados of fine annulenes will be offended by an almost complete neglect of the beautiful, rigidified (bridged) annulenes of Vogel, Boekelheide, *et al.*, and the acetylene–cumulene annulenes of Nakagawa *et al.* The powerful new experimental probe for aromaticity introduced and amplified by R. Mitchell likewise receives scant attention. The book's most serious weak point, however, is the index, which barely fills two pages. The reader is lucky to find even a single reference to pivotal molecules that are used repeatedly to illustrate principles throughout the book, *e.g.* cyclooctatetraene, pyridine, pyrrole, etc. The book would be *enormously* more useful as a reference resource if it had a good index. More forgivable is the absence of an index of authors, though that would have been helpful as well. I found a handful of typographical errors, but the level was tolerable.

Despite these shortcomings, the book is scholarly, authoritative, up-to-date, and well-written; it warrants the attention of practitioners in the aromaticity field.

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JA944859Q

Organic Syntheses Based on Name Reactions and Unnamed Reactions. Tetrahedron Organic Chemistry Series. Volume 11. Edited by A. Hassner (Bar-Ilan University) and C. Stumer (Teva Pharmaceutical Industries). Pergamon Press: Kidlington, U.K. 1994. viii + 452 pp. $39.50. ISBN 0-08-040279-8.

The purpose of this text is to guide the student or researcher through the proliferation of new reactions and reagents used in organic synthesis. It incorporates the details of older name reactions with the newer named or unnamed ones. Over 400 reactions and 2100 references are listed, with brief experimental details provided for each reaction key and cross-references of functional group transformations and experimental procedures.

JA945074N