Book Reviews *

Flavor Technology: Physical Chemistry, Modification, and Process. Edited by Chi-Tang Ho (Rutgers University), Chee-Teck Tan (International Flavors & Fragrances, Inc.), and Chao-Hsiang Tong (Rutgers University). ACS: Washington, DC, 1995. xi + 266 pp. $69.95. ISBN 0-8412-3326-8.

ACS Symposium Series No. 610. This volume provides an overview of the physical chemistry principles involved in the preparation of flavor products. It covers reaction kinetics, modeling, physical phenomena associated with flavor emulsion and encapsulation, and the effects of processing and storage on flavors. The kinetics of flavor binding and release are explored. The physical properties and stability of flavor emulsion, microemulsion, and encapsulation are discussed. The physical characteristics of flavor compounds during food processing are examined.

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Palladium Reagent and Catalysts. Innovations in Chemical Synthesis. By Jiro Tsuji (Okayama University of Science). Wiley: New York. 1995. xiv + 560 pp. $150.00. ISBN 0-471-95438-7.

This book is an excellent resource for anyone interested in the use of palladium in organic synthesis. It appears to be an update of Professor Tsuji's previous book, *Organic Synthesis with Palladium Compounds*, published in 1980. The references included in this new book cover the literature through 1993−94, so its is more up-to-date than other books on this subject. There are over 2000 references to the primary literature, so it is comprehensive but, by the author's own admission, not exhaustive. A careful examination of several sections of each of the major chapters indicated that the subtitle, *Innovations in Organic Synthesis*, is well chosen. The author appears to have selected many examples in which palladium has been used to synthesize natural products or molecules with special properties or structures.

The book begins with a brief 10-page overview of The Basic Chemistry of Organopalladium Compounds in Chapter 1. The author does provide an excellent overview; however, this may be too brief for novices. I would recommend that those who are new to this area of research also look at one or more books on palladium or organometallic chemistry cited in the reference section of Chapter 1. In particular the book by R. F. Heck entitled *Palladium Reagents in Organic Synthesis* would be an excellent companion since each section includes detailed procedures on how to carry out each type of reaction as well as the synthesis of various palladium reagents and catalysts.

To help orient the reader to the large amount of material included in the remaining chapters, Professor Tsuji has devoted a short chapter of 5 pages, Chapter 2, to describing his reaction classification scheme. It is appropriately titled Classification of the Reaction Involving Pd(II) Compounds and Pd(0) Compounds in This Book. These first two chapters represent a quick, easy-to-read introduction to the remaining sections. The classification scheme described in Chapter 2 is based on what Professor Tsuji calls "mechanistic considerations". With this scheme, stoichiometic reactions of palladium are placed in Chapter 3, Oxidative Reactions with Pd(II) Compounds. Included in this chapter are reactions with alkenes, π-allyl complexes, conjugated dienes, and aromatic compounds, reactions by transmetalation, reactions based on chelations of heteroatoms, reactions of alkynes and allenes, oxidation of alcohols and ketones, and oxidative decarboxylations. The next chapter, Chapter 4, contains the Catalytic Reactions with Pd(0) and Pd(II). Included in this chapter are catalytic reactions of organic halides and pseudo-halides, allylic compounds, conjugated dienes, allenes, porpargylic compounds, alkynes, and alkenes. The book concludes with Chapter 5, Various Reactions Catalyzed by Pd(II) and Pd(0). This chapter describes reactions that do not fit into the two previous classifications. Included in this chapter are exchange reactions of alkenyl ethers and esters, palladium-catalyzed decomposition of azo, azides, and peroxides, Cope rearrangements, decarboxylation of aldehydes, reactions of carbon monoxide and carbon dioxide, reduction, and other miscellaneous reactions.

This book has a few minor weaknesses. The index is almost exclusively a compound index with no authors included and only minimal subject terms. Fortunately the table of contents is in outline format and is detailed enough to allow the reader to find which part of the three main chapters is of interest. Finally, with a price tag of $150 it is likely that this book will be purchased by libraries rather than by individuals unless they are active researchers in this area. However, these weaknesses do not detract significantly from the overall quality of the book, which will be a valuable resource for organic and other synthetic chemists.

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Electrochemistry for Chemists, 2nd ed. By Donald Sawyer (Texas A&M University), Andrzej Sobkowiak (Rzeszow University of Technology), and Julian L. Roberts, Jr. (University of Redlands). Wiley: New York. 1995. xv + 505 pp. $64.95. ISBN 0-471-59468-7.

The second edition of Sawyer's *Experimental Electrochemistry for Chemists*, with a shorter new title and two new authors, is a great book. Chemists, including many electrochemists, will find it extremely practical as a reference. The book shows, in a straightforward fashion, through examples from organic and inorganic electrochemistry, the significance and versatility of electrochemistry in the investigation of chemical structure and reactivity. The book is interesting because it shows why electron transfer reactions (or generally redox reactions) are worth understanding as chemical reactions. It helps that these are among the most important reactions in the modern world of catalysis, alternative energy sources, and molecular biochemistry.

The book is comprehensive and practical. It covers theory, methods, and applications. It moves through a vast factual territory without missing facts. The light coverage of modern electrochemical methods is the weak point. This is not a major handicap since cyclic voltammetry, which is described well, is the core technique for the applications chapters. The book stresses thermodynamics over kinetics, and this allows many simplifications. It is easy to read, with a theme of thermodynamics and the chemistry of water, oxygen, and hydrogen.

The initial chapter covers theory succinctly, with an emphasis on chemical thermodynamics and a brief description of electrochemical kinetics. The following three chapters describe methods. There is an especially elegant chapter (Chapter 2) devoted to a classic, potentiometry, where a clear, practical-minded description of this equilibrium method nicely incorporates the fundamentals. Some of the information is detailed later (Chapter 4) but lacks a similar sense of purpose. The dynamic methods chapter (Chapter 3) is disappointing. Too much dc polarography at a dropping mercury electrode, too much chronopotentiometry, and outdated references hide the powerful present capabilities of the techniques for thermodynamic (the authors' favorite) and kinetic measurements.

Chapters 5−7 alone could sell this book for useful experimental details. There are excellent descriptions of reference electrodes, with preparation procedures for a range of applications and likely pitfalls in measurements; of choices and purification of solvents and electrolytes; of electrode and electrochemical cell preparation, including cells for inert atmosphere and dry (including in vacuo) measurements; and of specialized spectroscopic−electrochemical measurements. The information in the chapters will greatly help in understanding more recent references.

The remaining five chapters describe applications: electrochemistry of hydrogen, hydronium, and Bronsted acids (Chapter 8), dioxygen species (Chapter 9), metal and metal complexes (Chapter 10), nonmetals (sulfur, nitrogen, and carbon compounds, Chapter 11), organic compounds (Chapter 12), and organometallic compounds (Chapter 13). Because thermodynamics and the classical theories of reactivity, including Bronsted and Lewis acid−base theories, are a theme, the chapters are not a dry list of facts. The text is well illustrated by numerous examples of "typical" cyclic voltammograms. Kinetics and

*Unsigned book reviews are by the Book Review Editor.

mechanistic information from voltammetry are not really discussed, and the figures may leave some questions unanswered. The references to the authors' work dominate and are relatively up to date, but only a few other current references are cited, possibly because of the already broad scope of the book (the volume has approximately 500 pages). The text can be an introduction to each field while additional existing superb literature is consulted.

The book can be recommended for students as an excellent text because of its breadth and accessibility. As has been said of other books of similar quality, buy two since you may be loaning the book out to answer "electrochemistry questions".

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Luminescent Materials. By G. Blasse (University of Utrecht, The Netherlands) and B. C. Grabmaier (Siemens Research Laboratories). Springer: New York. 1994. x + 232 pp. $49.95. ISBN 0-387-58109-0.

This book provides an introduction to the field of luminescent materials with an emphasis on insulating materials doped with transition-metal, post-transition-metal and rare-earth-metal ions. The target audience of the book is students and beginning researchers. The book satisfies an important need in the field for an accessible, yet meaningful, entry level discussion. Most overview works in the field are either too simplistic or too dense for serious newcomers. This book introduces the essential phenomena and concepts governing the properties of a wide variety of luminescent materials without dwelling on detailed mathematical and theoretical descriptions and provides a number of illustratory examples drawn from recent literature to reinforce the discussion in each chapter. In addition, the book provides a nice balance between science and technological applications. Appropriate recommendations to more advanced treatments are provided for readers seeking more details on any particular aspect of luminescent materials. References for the examples presented are also provided.

The first five chapters provide a general background on the luminescence process, luminescent centers, interactions between centers, and common luminescent materials. Chapter 1 introduces luminescence and describes the various ways it can be excited. It also discusses the general competition between radiative and nonradiative processes and the concept of sensitized luminescence. Chapter 2 focuses on absorption and excitation of luminescent centers. Configuration coordinate diagrams, vibrational coupling, and band shapes are discussed qualitatively. The principle classes of luminescent centers (transition-metal ions, rare-earth ions, s^2 ions, and d^{10} ions) and their optical transitions are presented. Charge transfer and host lattice absorption are also mentioned. Chapter 3 discusses the radiative decay of excited luminescent centers. The Stokes shift is first presented and is followed by a discussion of the most common luminescence transitions: exciton emission in alkali-metal halides, $f \rightarrow f$ emission in rare-earth ions, $d \rightarrow f$ emission in rare-earth ions, $d \rightarrow d$ emission in transition-metal ions, charge transfer emission from d^0 complex ions (e.g., VO_4^{3-}, WO_6^{6-}), $s \rightarrow d$ and $s \rightarrow p$ emission in d^{10} ions, and $p \rightarrow s$ emission in post-transition-metal ions. The principles of stimulated emission are presented, and semiconductor luminescence is briefly discussed. Nonradiative decay processes are discussed in Chapter 4. The mechanism of nonradiative decay in luminescent centers which show weak coupling, intermediate coupling, and strong coupling to the host lattice are discussed in the context of the configuration coordinate model. The effects of charge transfer states on nonradiative decay are also discussed. Interactions between luminescent centers and energy transfer processes, including an introduction to Förster−Dexter theory, are described in Chapter 5. Resonant energy transfer, nonresonant energy transfer, and concentration quenching are discussed.

Chapters 6−10 describe current and potential technological applications of luminescent materials. The current state of the art and future outlook for each application are presented. Phosphors used in luminescent lighting are discussed in Chapter 6. The basic operating principle of luminescent lamps, the role of mercury, and chromaticity diagrams are presented first followed by a discussion of the most commonly used red, blue, and green phosphors and their luminescence properties. The technological requirements for phosphors in low- and high-pressure luminescent lamps are also discussed. Chapter 7 discusses phosphors used in cathode-ray tubes. The chapter begins with an introductory explanation of how cathode-ray tubes and projection television systems work. The properties of phosphors currently used in television, displays, and scanners are discussed. X-ray phosphors and their application to medical imaging and tomography are discussed in Chapter 8. The chapter begins with a discussion of the principles of X-ray imaging, conventional intensifying screens, storage phosphor screens, and tomography. Phosphor property requirements and preparation methods are presented next, and finally specific examples are given. Chapter 9 extends the discussion to counting and scintillation applications involving X-rays and other forms of ionizing radiation (γ-rays, charged particles). Applications, crystal growth, and specific examples of scintillating materials are presented. Important materials requirements and a comparison of properties of different systems are discussed. In Chapter 10, a brief discussion of several other common applications of luminescent materials is given. Upconversion, luminescent probes, luminescence immunoassays, electroluminescence, optical fibers, and semiconductor nanoparticle luminescence are touched upon. The basic ideas and common materials are discussed for each topic.

In summary, the book provides an excellent introduction to the concepts, materials, applications, and literature of luminescent materials.

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Chemical Equilibria Bases for Oxide and Organic Superconductors. By R. J. Thorn (Argonne National Laboratory). Wiley: New York. 1996. viii + 200 pp. $69.96. ISBN 0-471-10363-2.

According to the author, the purpose of this book is to provide a chemical view of the nature of superconductivity in terms of chemical equilibria. Specifically, the unique character of the book is supposed to lie in (1) the fundamental role of chemical equilibria, (2) a detailed analysis of the data, and (3) the development of interrelations among the three signatures of superconductivity: resistivity, diamagnetic susceptibility, and specific heat.

Although the book purports to be a new look at the superconducting phenomena through the eyes of a chemist focusing on equilibria, in actuality large portions of the book amount to a review of the literature. In this regard the references are a little old since the latest is 1994 and most are earlier.

After a review of superconductivity with stress on items supporting the further development of relations for the three signatures of superconductivity, the author develops a set of relations for these signatures. The formulas developed are included on a 1.44 Mbyte floppy in DOS format for both QBASIC and Sigma Plot. The software is very simple, and parameter change requires changes in the BASIC program. The Sigma Plot version might be more amenable to those with limited programming inclination.

Although this is a somewhat dated review of superconductor work, the author does develop some interesting relations which for convenience are included on a floppy disk, although some programming experience would be necessary to change the parameters.

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