Book Review

Advances in Electrochemical Science and Engineering, Volume 9: Diffraction and Spectroscopic Methods in Electrochemistry Edited by Richard C. Alkire (University of Illinois, Urbana, USA), Dieter M. Kolb (University of Ulm, Germany), Jacek Lipkowski (University of Guelph, Canada), and Philip N. Ross (Lawrence Berkeley National Laboratory, Berkeley, CA, USA). Wiley-VCH Verlag GmbH & Co. KGaA: Weinheim. 2006. xviii + 428 pp. $190.00. ISBN 3-527-31317-6.

Sanjeev Mukerjee

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BOOK REVIEWS

Advances in Electrochemical Science and Engineering, Volume 9: Diffraction and Spectroscopic Methods in Electrochemistry. Edited by Richard C. Alkire (University of Illinois, Urbana, USA), Dieter M. Kolb (University of Ulm, Germany), Jacek Lipkowski (University of Guelph, Canada), and Philip N. Ross (Lawrence Berkeley National Laboratory, Berkeley, CA, USA). Wiley-VCH Verlag GmbH & Co. KGaA: Weinheim. 2006. xviii + 428 pp. $190.00. ISBN 3-527-31317-6.

This book is an excellent collection of chapters that present a wealth of data on single crystals and planar surfaces of, predominantly, Pt, Pt bimetallic, and Au. Here, the principal attempt is to show new entrants to this field the art of understanding the nature of adsorbed species and its implication on a particular electrode surface.

The first chapter is the only one that deals with direct measurement of the electrode surface using the technique of X-ray scattering. Issues such as adsorbate-induced restructuring of metal surfaces, surface relaxation under various conditions, and extension to bimetallic surfaces are covered. The remaining chapters address techniques for studying surface-adsorbed species. These include UV−vis reflectance spectroscopy; epifluorescence microscopy; sum-frequency generation; IR spectroscopy, including surface-enhanced techniques; and Raman spectroscopy (tip enhanced). These form an up-to-date collection of advanced methods to study surface-adsorbed species and the effect of changes in applied potential to the surface.

The inclusion of neglected techniques, such as UV/vis reflectance spectroscopy in Chapter 2, is refreshing to see because there has been a steady improvement in the technology, and such a method is easily the best among techniques for studying buried interfaces of organic films. This is especially true for studying the dynamics of interfacial changes as a function of time with spatial resolution. The inclusion of a chapter (3) on fluorescence microscopy in conjunction with electrochemical cells was also unique, especially in the context of biological samples. In this review, Bizzotto and Shepherd exemplify the use of fluorophores to probe biological interfaces in order to gain valuable information on the dynamics of the desorbed layer in terms of diffusion and exchange processes. Unfortunately, the book lacks a chapter on *in situ* X-ray absorption spectroscopy. Although the conventional application of this methodology is averaged over the bulk sample and therefore is of limited application—unless considering ultrathin ad-layers or nanoparticles in the range of 2−4 nm—some new developments have allowed researchers to study surface adsorption modes under *in situ* conditions. Because most of these developments are relatively recent, this reviewer would recommend an additional chapter devoted to this area in the subsequent edition of this book.

This book is highly recommended for all graduate and advanced undergraduate students in electrochemistry because it fills the important need for an overview of *in situ* spectroscopy for probing electrochemical interfaces. Because it covers a broad span of topics and research themes, it would be of interest to a wide spectrum of professionals as well. I hope the editors will continue to produce new editions of this book frequently to capture significant advances in this field.

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Metal Ions in Life Sciences, Volume 3: The Ubiquitous Roles of Cytochrome P450 Proteins. Edited by Astrid Sigel, Helmut Sigel (University of Basel, Switzerland), and Roland K. O. Sigel (University of Zürich, Switzerland). John Wiley & Sons, Ltd: Chichester. 2007. xxvi + 652 pp. $360. ISBN 978-0-470-01672-5.

This book is the third volume in the series *Metal Ions in the Life Sciences* and is a compendium of 17 reviews by well-known researchers in the cytochrome P450 field. The name "cytochrome P450" is derived from the observation of strong 450 nm absorption bands in preparations of dithionite-reduced liver microsomes upon binding of CO. The label "cytochrome" was initially applied to describe the electron transfer properties of these enzymes, whose functions were subsequently demonstrated to include both oxygenase and oxidase activity. With the advent of rapid DNA sequencing techniques, the expansion of the known P450 superfamily has been explosive. In humans, there are 57 full-length P450 genes, in many insect species more than 100, and in some plant species several times that number. The P450 superfamily now includes over 5100 known members.

P450s catalyze a diversity of reactions in biosynthesis, metabolism, and detoxification. Those involved in detoxification have evolved active sites to accommodate a multitude of substrates. This extended metabolic capability has been used to advantage in drug development, but there are also unintended negative consequences resulting from actions of this enzyme, including deactivation of drugs and activation of lipophilic procarcinogens. Benzo[*a*]pyrene now serves as a classic example of how carcinogenic polycyclic aromatic hydrocarbons can be activated by P450.

This volume is a review of the current status of developments in P450-related research. The contributing authors have taken advantage of the vastly expanded number of structural determinations available and high-speed spectroscopic and molecular biological techniques, such as site-directed mutagenesis, PCR, and rapid DNA sequencing, to present discussions of P450 chemistry in mechanistic terms. Topics include uncoupling, electron transfer, substrate selectivity, induction pathways, drug development, and bioengineering, to name a few. Newcomers to the P450 field will appreciate a discussion of P450 nomenclature in Chapter 3 and updated descriptions of the roles played by P450 enzymes in a variety of organisms.

Another area that is well covered in this volume is the mechanism of mono-oxygen transfer. Despite the spectroscopic characterization of compounds I and II in related heme proteins, such as the peroxidases, as well as high-valent heme transients of model metalloporphyrin compounds, the active P450 intermediates have not yet been conclusively characterized. Such P450 intermediates may not accumulate over an observable time frame or may be too reactive to persist under conditions used to stabilize them, for example, the absence of substrate. The nature of the postulated transients in the P450 pathway is discussed in some detail in Chapters 6, 7, and 11. A discussion of the recently developed "two-state theory" of hydroxylation and epoxidation is included in Chapter 11.

This volume begs comparison with the book *Cytochrome P450: Structure, Mechanism and Biochemistry, 3rd Edition* edited by Ortiz de Montellano (Kluwer/Plenum 2005). The coverage in both books is similar and includes contributions by many of the same authors. Where this occurs, however, the respective chapters are not repetitive. Cytochrome P450 aficionados will not want to be without either of these two books. However, the high list price of this volume may limit its distribution to the shelves of institutional rather than personal libraries.

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Comprehensive Organic Reactions in Aqueous Media, 2nd ed. By Chao-Jun Li (McGill University, Canada) and Tak-Hang Chan (McGill University and Hong Kong Polytechnic University)John Wiley & Sons, Inc.: Hoboken, NJ. 2007. xvi + 418 pp. $125. ISBN 978-0-471-76129-7.

This second edition follows the 1997 printing of the first, *Organic Reactions in Aqueous Media*, and considerably increases the scope of the reactions covered. The original book comprised seven chapters in 199 pages and began with a brief introduction concerning some of the properties of water, salt effects, and hydrophobic effects followed by six chapters covering pericyclic reactions, nucleophilic additions and substitutions, metal-mediated and transition metal-catalyzed reactions, oxidation and reduction, and, finally, industrial applications. This edition expands the presentation to 415 pages and follows a functional group approach in which the brief introductory chapter on water properties is followed by 11 chapters on the aqueous reactions of alkanes, alkenes, alkynes, alcohols and ethers, organic halides, aromatics, aldehydes and ketones, carboxylic acids and their derivatives, conjugated carbonyls, and amines. Pericyclic reactions are also covered.

Overall this is an interesting book that follows an approach familiar to the organic chemist in which the reactivity of organic compounds is organized according to the reactions and properties of the functional groups. In this case, the coverage is limited to reactions where water or water/organic cosolvents form the media, and there is little room for comparison of the scope and limitations of these reactions relative to the more traditional reactions performed in organic solvents alone. Certain chapters, such as those on reactions involving aldehydes and ketones and alkenyl/aryl couplings, are presented in far more detail than others and have a large number of recent references, but this is probably due to the synthetic activity in the area. The strength of the presentation is its enormous compilation of diverse reactions, although this means that only a few systems are described in detail due to space limitations, and mechanistic considerations are generally omitted.

Overall the presentation is clear, if somewhat catalog-like in nature. In a few instances, there are problems with the grammar and the acronyms, e.g., TPPTS═$P(PhSO_3Na)_3$ and TPPMS═$Ph_2P(PhSO_3Na)$, but these do not detract seriously from the flow. The book does serve as a testament to the enormous expansion in the field of water-based chemistry, and compiling it in a single volume is very useful. Overall this book should appeal to the expert as a serious reference manual and to the interested novice who wishes to explore what sorts of reactions can be performed in water solvents.

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