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BOOK REVIEWS

Properties of Single Organic Molecules on Crystal Surfaces. Edited by Peter Grütter (McGill University, Canada), Werner Hofer (University of Liverpool, UK), and Federico Rosei (Université du Québec, Canada). Imperial College Press: London. 2006. xii + 430 pp. $108.00. ISBN 1-86094-628-3.

The emergence of new laboratory tools with the ability to study and manipulate single atoms and molecules on surfaces has been a major force in the development of nanoscience and nanotechnology. To be able to visualize and manipulate these fundamental building blocks of chemistry is at once amazing and inspiring. In this context, the aim of this book is to provide an overview of the study of the complex interactions of single organic molecules on surfaces. A fundamental understanding of such interactions is critical to further development in the field, such as catalysis and molecular electronics.

The book begins with a number of introductory chapters on surfaces, imaging techniques, and theory that lay the groundwork for understanding the later sections on molecular surface interactions and applications. Its strength is in the sections that deal with the issue at its heart: scanning tunneling microscopy/spectroscopy (STM) of organic molecules on metallic and semiconductor surfaces. The bulk of the book is focused on this issue, and the initial introductory material provides a good basis for understanding the more complex issues of later chapters.

However, these chapters could have been better integrated. For example, the chapter on perturbation methods in STM has many excellent examples of how theoretical calculation can be used to interpret STM images, but none of the examples are the same as those from other chapters. The critical chapter on scanning probe techniques focuses more on atomic force imaging methods than STM, despite the opposite emphasis in other chapters. The book also has a number of chapters that seem out of place. There is a chapter that provides an excellent review of optical methods for single molecule detection. Unfortunately, these methods are never discussed further in any of the other chapters, which deal nearly exclusively with STM detection.

As the editors point out in the Preface, the focus of the book is on single molecules, although there are some chapters that deal with atoms on surfaces as well as on monolayers and superlattices. Again, these chapters provide good reviews of their topics, but they are not well integrated with the core material. The book provides an index as a means to locate information on particular topics quickly, but a quick scan of the keywords and related references shows that the index is far from comprehensive. Some entries that one would expect to point to many pages give only one obscure reference, while it is unclear how to interpret some of the other keyword entries.

On the whole, the book offers some outstanding reviews of single molecule research in the past decade with a particular emphasis on scanning tunneling microscopy. Because the book is a compilation of reviews from different labs, however, it is not as well integrated as a text might be from a single author; the individual chapters can be valuable, but they are not tied together in a unified fashion. The strength of the text is in the chapters on single molecule imaging with STM along with the closely related areas of molecular electronics and catalysis. The other topics stand alone well enough but seem out of place here and would unlikely be sought out by someone picking up this book based on its title.

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JA069788X

10.1021/ja069788x

N_4-Macrocyclic Metal Complexes. Edited by José H. Zagal (Universidad de Santiago de Chile), Fethi Bedioui (Ecole Nationale Supérieure de Chimie de Paris, France), and Jean-Pol Dodelet (INRS-Énergie, Matériaux et Télécommunications, Varennes, Québec, Canada). Springer Science + Business Media, LLC: New York. 2006. xvii + 814 pp. $179.00. ISBN 0-387-28429-X.

This is an excellent and detailed book of 14 chapters that is timely in its reviews of the electrochemical and electrocatalytic properties of the porphyrinoids and is written by a range of experts in the different fields covered. My only quibble is that the title, *N_4-Macrocyclic Complexes*, is misleading because the book is dominated by chapters that are very much focused on the electrochemical properties of these complexes, especially as applied to catalysis. Indeed, the editors state their objective in writing this book is "to provide a general updated view of the vast applications of these materials in electrochemistry by focusing on a few significant topics and examples". Thus, I would have thought it best to have included some of those descriptors in the title.

No matter. The chapters are assembled into three main groups, the first five of which cover the reduction of oxygen, NOx, and CO_2. The book begins with a discussion by Boulatov on the biological reactions that take place via the heme enzymes, specifically the heme-copper terminal oxidases. This is a really interesting chapter that is very well written and an excellent start. In Chapter 2, Zagal et al. introduce the catalytic activity of synthetic macrocycles in aqueous solution, which here are metalated porphyrins and phthalocyanines. This leads fairly naturally to a discussion by Dodelet in Chapter 3 of the use of porphyrinoids in fuel cells in place of platinum. In Chapters 4 and 5, Blair et al. and Costamagna et al. close this section with reviews of the porphyrin-mediated reductions of NOx and CO_2, respectively. These first 254 pages are extremely readable and informative and could easily be the basis of a free-standing monologue.

Unsigned book reviews are by the Book Review Editor.

The topics change in the second overall part of the book to the direct use of porphyrins and phthalocyanines as assemblies, in which Arakia and Toma in Chapter 6 provide considerable details about the spectroelectrochemical properties of porphyrinoid assemblies with both covalent attachments and as films. Nyokong in Chapter 7 describes the use of modified electrodes in the electroreduction of a wide range of pollutants, including organohalides and pesticides. The theme of coated electrodes is continued by Pailleret and Bedioui (Chapter 8) in their extensive review of the applications of porphyrinoids in electrocatalysis. This section is extremely detailed, with extensive examples of both physical properties, such as spectroscopic data, and the molecular structures used. As with the first five chapters, these three are informative and useful.

The final third of the book begins with three chapters that focus more on individual systems, with D'Souza and Kadish describing the effects of peripheral-pyrrole bromination on the electrochemical and spectroscopic properties of porphyrins in Chapter 9, Schlettwein discussing the properties of phthalocyanines-photoelectrodes in Chapter 10, and Fermin and Eugster covering the photoelectrochemistry of, primarily, water-soluble porphyrins in Chapter 11. In the final three chapters, Ciofini et al. explore the more basic electrochemical properties of the porphyrinoids through theoretical analysis in Chapter 12, Weiss and Wytko focus on the properties of multiporphyrin assemblies in Chapter 13, and Vallete describes the use of surface-enhanced vibrational spectroscopies to probe the molecular structure of the ring on the substrate in Chapter 14. Of particular interest to me were the diagrams of energy levels in Weiss's chapter, which made the often difficult task of interpreting the spectroscopic data following association much easier.

Overall, this is an exciting book to read. It would be a really useful book to have in the laboratory library. The chapters are detailed and informative with excellent tables and figures, and the references are reasonably current, up to 2004 in places.

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JA069795L

10.1021/ja069795l

Organic Synthesis: State of the Art 2003−2005. By Douglass F. Taber (University of Delaware, Newark). John Wiley & Sons, Inc.: Hoboken, NJ. 2006. x + 216 pp. $99.95. ISBN 0-470-05331-3.

This book is a collection of 103 articles on "leading synthetic procedures" that have appeared in Taber's weekly column "Organic Chemistry Highlights" (http://www.organic-chemistry.org/) from 2003 to 2005. Why publish a book if the content is already available online? As Taber states in the Preface, it is convenient to have all the columns in one place, with reaction and author indices available for ease in looking them up. Also, the collection provides an overview of some of the more significant developments in organic synthesis in a 2-year period. It is a handy reference that should be useful to both students and current practitioners in this field.

JA069830O

10.1021/ja069830o

Metal-Catalysis in Industrial Organic Processes. Edited by Gian Paolo Chiusoli (University of Parma, Italy) and Peter M. Maitlis (The University of Sheffield, UK). Royal Society of Chemistry: Cambridge, 2006. xx + 290 pp. $189.00. ISBN 0-85404-862-6.

This reference covers important industrial organic processes involving the use of metal catalysts, including information on oxidation, hydrogenation, carbonylation, C−C bond formation, as well as metathesis and polymerization reactions, and the mechanisms underlying these processes. The value of catalytic reactions over traditional processes is emphasized, and the nature of metal catalysis is explored. Each of the chapters, with the exception of the first, includes a set of "Discussion Points" intended to engage the reader in further dialogue on the topic at hand. The book concludes with two appendices, (1) "Basic Organometallic Chemistry Related to Catalytic Cycles" and (2) "Some Basic Aspects of Surface Science Related to Heterogeneously Catalyzed Reactions", and a subject index.

JA0698376

10.1021/ja0698376