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BOOK REVIEWS

Electrochemistry of Nanomaterials. Edited by Gary Hodes (Weizman Institute of Science). Wiley-VCH: Weinheim, New York. 2001. xvi + 310 pp. $149.95. ISBN 3-527-29836-3.

Electrochemistry of Nanomaterials is a collection of nine chapters, with a strong emphasis on semiconductors. The chapters were written relatively independently of one another, and this resulted in some overlap. The editor, however, has used this to advantage in the way the chapters are organized; that is, he has produced a story about the diversity at the interface between nanomaterials and electrochemistry. Moreover, he has pointed out the importance of electrochemistry in the synthesis, processing, characterization, and actuation of a broad range of nanostructured materials and devices. The advantage of Hodes' organization is that the reader is introduced to a topic and reminded, in the subsequent chapters, of the fundamentals to the issues at hand, but with a new spin. In this way, the knowledge needed to follow the chapters is both imparted and reinforced as the reader progresses through the book.

I found the book exceedingly stimulating because the chapters were all written by researchers who are eminent in their fields. The chapters tend not to be rambling collections of all of the papers relevant to a topic, which collections such as this can turn into, but instead they address the fundamentals of the topic and then present historic and relevant examples. Each chapter is also replete with references, which greatly facilitates access to the original literature.

The book starts with some basic chapters on the electrochemical formation of nanostructured materials. The first, by Penner, concerns unique methods developed by his group to grow semiconducting nanoclusters and -wires. It is followed by a chapter by Hodes and Rubinstein on the electrochemical growth of quantum dots of II−VI compounds. Lattice matching issues are discussed in depth. The third chapter, by Switzer, concerns the electrodeposition of oxide materials and includes an excellent discussion of the electrochemical formation of superlattices.

The next two chapters concern semiconducting nanoparticles, starting with a chapter by Kelly and Vanmaekelbergh describing methods for forming a wide range of porous semiconductors. A chapter by Green et al. on the formation, modification, and applications of porous silicon follows.

The next chapter, by Linquist et al., presents a detailed discussion of charge transport in nanostructured semiconductors. This is an important introduction for the subsequent chapter by Cahen et al., which covers the intricacies of the photoelectrochemical "Gratzel cell". Extrapolation of materials and knowledge, relevant to the "Gratzel cell", the formation of electrochromic and photochromic devices is then presented by Kamat.

The final chapter presents a myriad of results concerning structures produced using layer-by-layer growth. In this contribution, the layers consist of nanoparticles of oxides or semiconductors, alternating with layers of polyanions, a group of materials that are significantly less well characterized. However, the vast possibilities for devices based on this sequential dipping growth technique are pointed out.

I highly encourage the reading of this book by researchers interested in any of the topics covered. It should prove an excellent starting point for gaining an understanding of these topics, given the coverage of the fundamentals and the number of references provided.

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Multidimensional Chromatography. Edited by Luigi Mondello (Universita Degli Studi Di Messina), Alastair C. Lewis, and Keith D. Bartle (University of Leeds). J. Wiley & Sons: New York. 2002. xiv + 436 pp. $140.00. ISBN 0-471-98869-3.

Chromatographic separations are traditionally carried out in a monodimensional format wherein a single column is employed to resolve components of a mixture. One serious shortcoming of this approach is the low peak capacity that limits the number of components in a mixture that can be resolved. Monodimensional separation techniques are frequently inadequate to separate and characterize complex samples (e.g., petrochemical, environmental, biomedical, etc.) containing a large number (hundreds and even thousands) of components. The realization of these shortcomings served as a driving force for the development of multidimensional separation techniques that employ more than one column to achieve enhanced peak capacity. Theoretically, the peak capacity of an orthogonally designed multidimensional separation technique is equal to the product of the peak capacities of the separation columns used in each of the individual dimensions. Consequently, such a multidimensional approach should provide a huge gain in the resolving power of the separation system.

In this context, *Multidimensional Chromatography* is a very timely and important publication that contains a wealth of scientific information on various aspects of this rapidly growing area of chromatography. The editors, well-known scientists in the area, have made a commendable effort to bring together leading experts in various areas of this field. The volume is broadly divided into two parts. The first consists of nine comprehensive chapters that cover the general and instrumental aspects of multidimensional chromatography including multidimensional techniques resulting from the hyphenation of various gas-phase, liquid-phase, supercritical fluid-phase, and electromigration separation techniques. The challenges and possibilities of unified chromatography are presented as a separate chapter. The second part of the book consists of six chapters and is dedicated to various applications of multidimensional chromatographic techniques. These include applications involving analyses of foods, flavors and fragrances, biomedical and pharmaceutical samples, industrial and polymer

products, environmental pollutants, samples of interest for petrochemical industries, and samples of forensic and toxicological interests. These chapters provide in-depth accounts of the state-of-the-art in the respective areas of multidimensional chromatography.

From this reviewer's perspective, the book is heavy on the practical aspects of multidimensional chromatography but relatively light on theory. The statistical theory of peak overlap and the thermodynamic interpretation of orthogonality are two areas that should have received increased attention. Coverage of these theoretical aspects could have been instrumental in providing a deeper understanding of the problems associated with the analysis of complex mixtures and thus would have placed the reader on the stronger theoretical footing necessary for effective experimentation. The book also contains some unfortunate typographical glitches (e.g., eq 5.2 on p 111 and eq 7.5 on p 167) that could have been easily avoided.

Overall, this is an outstanding and timely publication that will serve as an invaluable resource for a wide audience of scientists, engineers, and graduate students who deal with the separation and characterization of complex, multicomponent samples that are difficult to analyze by one-dimensional separation techniques. The book contains up-to-date references to major developments in the field and, no doubt, has successfully fulfilled its objectives in providing the scientific community with a comprehensive account of progress in the area of multidimensional chromatography.

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Chromic Phenomena: Technological Applications of Color Chemistry. By Peter Bamfield. Royal Society of Chemistry: Cambridge. 2001. xx + 374 pp. $59.50. ISBN 0-85404-474-4.

In this relatively small book (ca. 350 pp), the author, a former research manager with ICI/Zeneca, aims to provide an overview of the applications of color chemistry in the modern technological world. Once one begins to think about such matters as color, light, optical properties (chromic phenomena), and the use and manipulation of these in different systems and different materials for an immense variety of technological applications, it soon becomes apparent that one has a vast assortment of material to consider. An early task would be to develop a classification system to bring a semblance of order. Admitting that it may be an oversimplification, Dr. Bamfield has settled on a classification that considers five classes of chromic phenomena: reversible color change, absorption and reflection of light, absorption of energy and emission of light, absorption of light and energy transfer (or conversion), and manipulation of light. He assigns one chapter to each of the perceived phenomena with the result that the book has just five chapters plus an introduction. As a consequence, all chapters cover a wide and diverse range of subjects, and a reader will find some unusual bedfellows. Chapter 4, for example, provides discussions on photodynamic therapy and on optical data storage. Altogether, some 30-plus subareas are covered in this monograph. Treatments must be restricted for this number of topics to be addressed in approximately 350 pages, and the result is that some topics are covered much more deeply than others. As is appropriate, the more widely used topics receive the deepest coverage, while those used less frequently are covered, in some cases, in just a few lines.

The author's approach is to focus on technological applications and to introduce theoretical aspects as needed; thus, the theoretical depth is minimal. Nevertheless, this is not unacceptable within the context of the book because sufficient literature citations are included. The book has a distinct "organic" flavor, which presumably stems from the author's own background in the chemistry of dyes and pigments. There is arguably too much about synthetic procedures associated with this topic, and the approach thereto is schematic. Any reader who is interested in actually performing one of the syntheses must refer to the original (quoted) literature for experimental details, of course. In any event, this reviewer was left wondering about the purpose and value of presenting space-greedy synthetic schemes, as found in the first two chapters. A few other schemes that are presented are difficult to fathom (Figures 2.6 and 3.15 are in this category), and one figure (3.1) is misleading. It implies that the S−T intersystem crossing process can occur in an endoergonic manner, and this is certainly not the case.

There are almost no typographical errors in this book, and the writing style is straightforward and easy to read. This is not a book for reading in a cover-to-cover, serial fashion, however; rather, it is for dipping into for individual topics. The references are plentiful and up-to-date with respect to the 2001 publication date, and the book is a mine of information on the materials that interact effectively with light and on the modern ways of applying such materials. As more specialized Ph.D.'s enter today's cross-disciplinary areas of electrooptics, photonics, photomedicine, and the like, they will find this reasonably priced book a very useful entry vehicle for these topics.

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