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BOOK REVIEWS

Silicon-Containing Dendritic Polymers. Edited by Petar R. Dvornic and Michael J. Owen (Michigan Molecular Institute, Midland, MI). Springer Science + Business Media B. V.: springer.com. 2009. xvi + 428 pp. $209. ISBN 978-1-4020-8173-6.

This book is a comprehensive collection of review papers written by key researchers in the area of dendritic polymers derived from organosilicon components. A number of literature reviews have been published on certain aspects of these materials over the years, but most are now outdated. This new publication is therefore timely because it provides a critical view on the state-of-the-art for the different families of silicon-containing dendritic polymers, e.g., dendrimers, hyperbranched polymers, and dendritic-linear hybrids, up to 2008.

It is suitable as a general introduction to dendritic macromolecules, as it not only covers fundamental concepts on dendritic growth but also provides detailed discussions on the synthesis and properties of dendritic macromolecules that incorporate siloxane, carbosilane, silane, carbosilazane, silyl ether, and silsesquioxane building blocks. Although synthetic aspects are the focus of most of the contributions, specific features of the physical characterization of these materials are also considered to varying extents, e.g., in sections discussing the glass transition temperature, crystallinity, or electronic spectra, but also more specifically in chapters largely devoted to physical properties, such as electrochemical properties and liquid crystals, and to applications, e.g., sensors and catalysis.

Dvornic and Owen have assembled a fine collection of papers providing an excellent overview of silicon-based dendritic macromolecules that should be useful to both beginners and experts.

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Miniaturization and Mass Spectrometry. Edited by Séverine Le Gac and Albert van der Berg (University of Twente, The Netherlands). Royal Society of Chemistry: Cambridge. 2009. xvi+316 pp. $159. ISBN 978-0-85404-129-9.

The aim of this volume is to illustrate "how microfluidics and lab-on-a-chip devices can fulfill the requirement for miniaturized and enhanced analysis." To this end it is wholly successful, as many different schemes for the integration of microfluidic devices and mass spectrometry are presented in full, but not cumbersome, detail.

To prepare readers for later chapters on the integration of devices into experiments involving electrospray ionization (ESI) and matrix-assisted laser desorption ionization (MALDI), the introductory chapter gives an overview of ESI and MALDI processes, as well as the motivations for the coupling of microfluidics with process mass spectrometry. Both research and commercial implementations are discussed. At the outset, the authors note the discrepancy between the size of microfluidic devices and the mass spectrometers themselves. It should be noted that the book does not cover the miniaturization of the mass spectrometers—in this regard the title of the book is rather misleading—although the last chapter begins to address this topic. Instead, the appropriateness of microfluidics for handling and preparing samples for mass spectrometric analyses is highlighted because the use of microfluidics allows efficient handling of small volumes of sample. Moreover, typical flow rates in microfluidics experiments match up well with those needed for nanoscale ESI experiments.

In later chapters, several varieties of micro- and nanoscale ESI emitters are presented, followed by a discussion of the integration of these emitters into online experiments where complex sample handling and chemical reactions occurring on the microchip take place. In the section on MALDI-MS, microfluidics is used for sample mixing, preparation, and deposition onto the MALDI targets, and some techniques for online experiments are presented. In the last chapter, a compact time-of-flight mass spectrometer for use in both homeland defense applications and clinical diagnostics is discussed.

Each chapter is a scholarly article with appropriate and up-to-date references. The text also includes experimental details, results, and performance data, which give a true picture of the scope of the work and quality of the techniques and should benefit readers interested in the field. The book should be a good starting point for scientists who want to know whether microfluidics will fit their needs with respect to handling and preparing samples for mass spectrometry experiments. The least attractive part of the book is its price, which is rather high for the individual wishing to add it to his or her personal library.

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Electrochemistry at the Nanoscale. Edited by Patrik Schmuki and Sannakaisa Virtanen (University of Erlangen-Nürnberg, Germany). From the series, Nanostructure Science and Technology. Edited by David J. Lockwood. Springer Science + Business Media: New York. 2009. x + 472 pp. $159. ISBN 978-0-387-73581-8.

Electrochemistry plays a dominant role in a vast number of research and applied areas. Perhaps the most important development over the past few decades has been the spread of electrochemical concepts into fundamental fields, such as the study of new compounds and biological systems, and into more applied areas, such as shaping materials from the macroscopic to the nanoscopic scale, understanding and preventing the corrosion of materials, and probing the functioning of living cells. In particular, there has been much interest in nanoelectrochemistry where very small electrodes with radii on the order of nanometers are beginning to be used to increase the spatial resolution of electrochemical measurements significantly. On the other hand, electrochemistry can also be used to create

nanostructures on larger surfaces and/or be used to evaluate the behavior of those nanostructured surfaces. This book is largely devoted to the latter application and generally covers five areas: theories and simulations, scanning probe techniques, making nanostructures, corrosion, and nanobioelectrochemistry.

Chapter 1 is a good description of using molecular dynamics and Monte Carlo simulations to describe the generation of nanostructures through the use of STM for tip-induced local deposition and for filling surface defects, such as nanocavities. Electron transfer through functionalized adsorbates and films is also addressed. The authors relate their simulations extensively to similar experiments reported in the literature.

The next chapter provides a very useful overview of techniques in scanning probe microscopy, focusing on electrochemical STM and AFM and emphasizing theory and practical experimental protocols for characterizing nanostructures. Scanning electrochemical microscopy and scanning near-field optical microscopy are also discussed.

Chapters 3−9 and Chapter 12 are mainly concerned with fabrication of nanostructures. In Chapter 3, X-ray lithography techniques are described, with an emphasis on LIGA—a German acronym for lithography, electroplating, and replication—fabrication. In the following chapter, the use of the direct writing techniques electron-beam and focused ion-beam lithography in fabricating nanostructures is discussed. Chapter 5 covers wet chemical approaches for chemical functionalization of semiconductor nanostructures, dealing mainly with the surface modification of nanocrystalline Si and Ge, and Chapter 6 addresses the electrochemistry of porous semiconductors (mainly Si) in aqueous solution at the pore tips, i.e., porous etching, and pore walls, i.e., oxidation and reduction reactions. This is followed by a chapter that focuses on template synthesis methods and includes discussion of electrochemical deposition of metals (as nanowires and nanotubes) and of polymers; electroless deposition of metals; sol−gel deposition of inorganic oxides; chemical vapor deposition; atomic layer deposition; synthesizing carbon nanotubes; fabricating Li-ion battery nanoelectrodes; single-ion channel creation; and Au-coated and DNA-modified ion channels. The electrochemical behavior of Au nanoelectrode ensembles and conductivity measurements across ion channels are also discussed. Chapter 8 is devoted to electroless fabrication of nanostructures that serve as interconnect materials for ultralarge scale integration devices as well as magnetic dot arrays for magnetic recording devices. Metal and metal oxide nanoparticle fabrication and the deposition of thin films on large substrates, complicated shapes, or nonconductive surfaces are also discussed. The electrochemical fabrication of nanostructured, compositionally modulated metal multilayers that consist of stacks of two or three different metals, metal oxides, or ceramics is the topic of Chapter 9, and Chapter 12 focuses on self-organized layers of oxide nanotubes on titanium and other transition metals.

The remaining chapters address corrosion and nanobioelectrochemistry. In Chapter 10, nanoscale corrosion of metals, especially Cu but also Ni, Fe, Cr, and Fe-based and Ni-based alloys, is described. Nanostructural aspects of anodic dissolution, protection by corrosion inhibitors, passivation by ultrathin anodic oxide films, passivity breakdown, initiation of localized corrosion, and AFM or STM tip-induced localized corrosion are also reviewed. Chapter 11, although entitled "Nanobioelectrochemistry", really covers a range of diverse topics such as microelectrode detection of exocytosis events at living cells, quantifying biomolecules through adsorption on carbon electrodes, redox protein studies using protein film voltammetry, electrochemistry of biomolecules attached to self-assembled monolayers, AFM and electrochemical studies of DNA, biosensor devices based on template-synthesized biomolecule nanotubes, and nanoparticle magnetic control of bioelectrocatalytic processes.

As a whole, the book is useful for obtaining brief descriptions of the literature in the areas mentioned. With the exception of Chapters 1 and 2, the chapters are not written in a tutorial style. Although the book has 12 main authors, there is little overlap among the chapters owing to the diverse selection of topics. The literature is well cited and up-to-date in most chapters, many of which include the earliest key references.

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