

Advanced Nanomaterials. Edited by Kurt E. Geckeler (World-Class University and Gwangju Institute of Science and Technology, Gwangju, South Korea) and Hiroyuki Nishide (Waseda University, Tokyo, Japan and World-Class University, Gwangju, South Korea). WILEY-VCH Verlag GmbH & Co. KGaA Weinheim. 2010. xxiv + 458 pp. \$460.00. ISBN 978-3-527-31794-3.

The burgeoning disciplines of nanoscience and nanotechnology have grown at a breathtaking pace over the past decade, fueled largely by massive worldwide governmental and industrial investments and the tantalizing promise of unparalleled technological breakthroughs. The dizzying pace at which knowledge is being created, reinvented, or recast regarding the effects of finite size on material properties and the seemingly endless possibilities for elaborate nanoscale architectures make it difficult even for practitioners to keep pace with the state of the art. The editors of this two-volume set have the ambitious goal of orienting both established practitioners and new entrants to recent discoveries pertaining to the nanomaterial building blocks that undergird nanoscience. They have assembled a somewhat eclectic mix of contributions, ranging from commentaries and tutorials to authoritative reviews and focused summaries of research findings. The two volumes of the monograph contain 28 chapters authored by some of the leading experts in the field, covering both “soft” and “hard” nanostructures and some of their properties and technological applications. The incredible range of topics touches on most areas of nanotechnology, although block-copolymer-based nanostructures, polymer nanocomposites, and stimuli-responsive “smart” nanomaterials appear to be the recurring themes that have been especially emphasized across the two volumes.

As is perhaps inevitable for a monograph that draws upon more than 60 contributors, there is some variation in the quality and scope of the different chapters, but in general the editors are to be commended for keeping redundancies to a minimum and ensuring that most of the chapters provide a reasonably updated account of the relevant areas. The most useful chapters are those that go beyond simply summarizing the research contributions of the specific authors to include sufficient introductory detail for the nonspecialist reader as well as a wider perspective of the field. Happily, there are several chapters in the two volumes that nicely fit the bill.

Schwartz and Ober in the first chapter in Volume 1 provide a masterful and lucidly written perspective of spatially resolved chemistry made possible by the use of block copolymers and give particular attention to applications in lithography (for patterning sub-100-nm features), the fabrication of nanoporous surfaces, and light-sensitive and holographic constructs. In another stellar contribution of the same volume, Lazzari and De Rosa offer detailed insight into methods for aligning the domains of block copolymers on surfaces and take a practical approach to summarizing the pitfalls and possibilities in a manner that will be particularly instructive for new entrants to the field. The chapter by Oyaizu and Nishide on organic battery architectures constituted from redox-active mesostructured radical-bearing polymers is a fascinating peek into a rather new

area that has the potential to alter electrochemical energy storage dramatically. Indeed, it provides the rare example wherein the authors are able to go beyond advances in synthesis to obtaining a fairly decent understanding of function. Another notable contribution in the first volume comes from Richards and co-workers and is focused on the catalytic properties of noble metals that are uniquely observed at nanoscale dimensions. This contribution is particularly well researched, and the authors do an excellent job of providing a historical perspective and clearly outlining the many outstanding questions on the topic.

The separation of the chapters into the two volumes does seem somewhat arbitrary, and one wonders why the two chapters on layered clay/polymer matrices are split between the two volumes even though they are remarkably complementary in scope. Furthermore, several chapters pertaining to nanostructured block copolymers are interspersed over the two volumes. Collecting the chapters in some sort of sequence would likely have improved the readability of the monograph. Nevertheless, the second volume does indeed have its gems. Seki and Onaka provide a tightly focused but greatly instructive review of mesoporous alumina and have compiled a useful list of possible catalytic applications of this material. Chapter 18 by Roberts and Otter is a sobering and thought-provoking account of the environmental implications of carbonaceous nanomaterials, such as fullerenes and carbon nanotubes. This volume also features a lucidly written and nicely illustrated authoritative contribution from Flavin and Resmini reviewing strategies for imprinting with nanomaterials for applications in chromatographic separation and biosensing.

The wealth of information and the diversity of topics covered in the two-volume set make this a useful acquisition for science and engineering libraries and as a primer for practitioners in the field seeking to learn about a new topic quickly. Furthermore, several of the chapters will serve as excellent supplemental material for advanced undergraduate or graduate courses in materials chemistry or nanoscience.

It is important of course to realize that the relentless pace of research in nanoscience and nanotechnology makes it difficult to truly capture the state of the art, but the editors and the authors have certainly mounted a strong effort. In this context, a jarring note is struck by the inclusion of a couple of chapters from a previous monograph published in 2006, which unfortunately can no longer claim to be updated accounts. Another quibble is the relative neglect of contributions from theorists. As demonstrated by the recent prediction and subsequent discovery of 2D topological insulators, the field of nanoscience has benefited greatly from advances in computational materials science and condensed matter physics. Nevertheless, the editors have come close to achieving their rather ambitious goals. The monograph serves as an excellent snapshot of a nascent discipline that is in the process of learning to define itself.

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