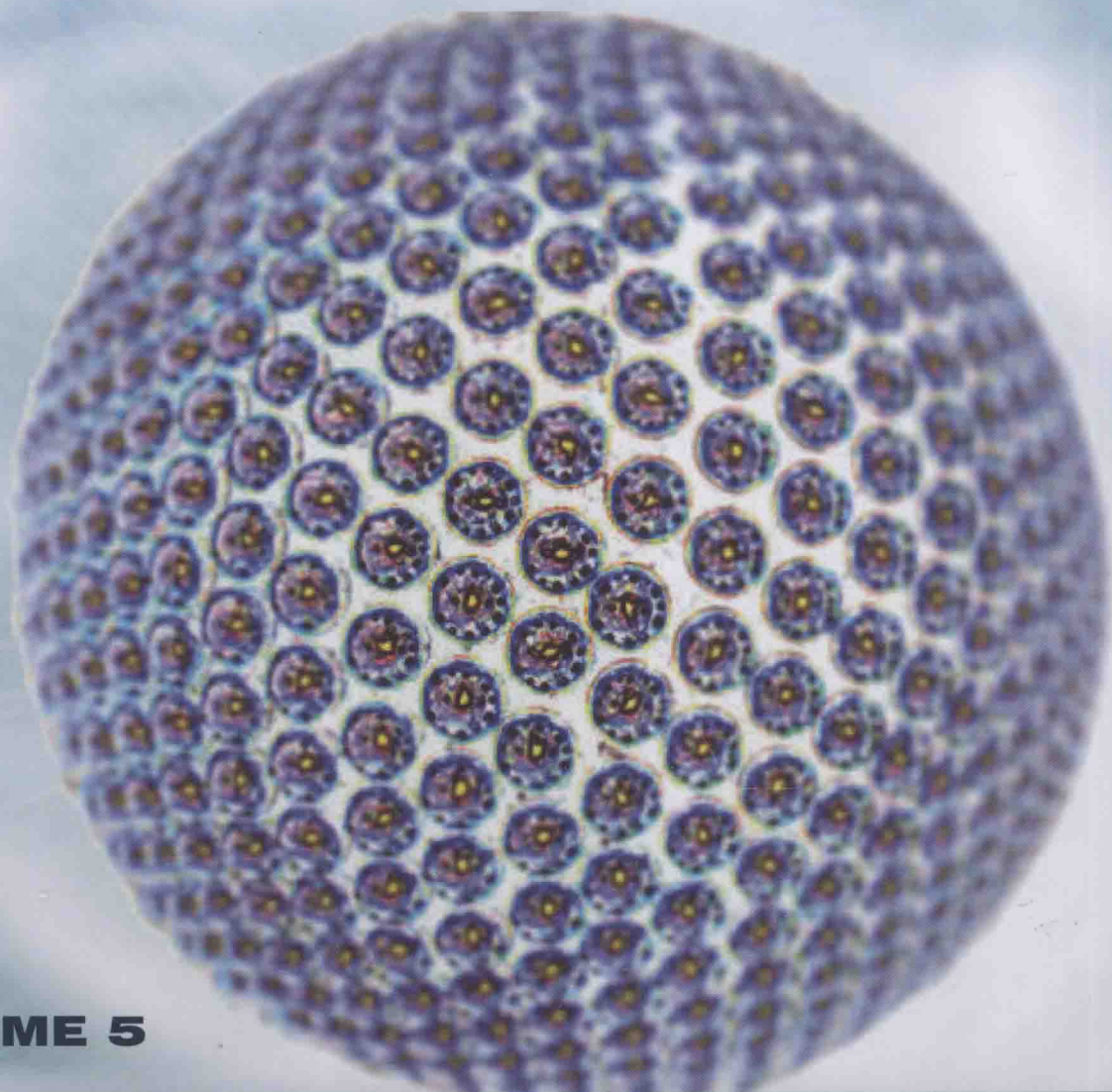


**DAVID L. ANDREWS
GREGORY D. SCHOLLES
GARY P. WIEDERRECHT**



VOLUME 5

**COMPREHENSIVE
NANOSCIENCE
AND TECHNOLOGY**

**SELF-ASSEMBLY AND
NANOCHEMISTRY**



COMPREHENSIVE NANOSCIENCE AND TECHNOLOGY

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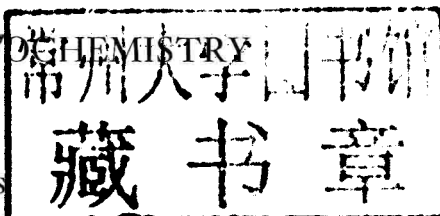
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Volume 5

SELF-ASSEMBLY AND NANOCHEMISTRY



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COMPREHENSIVE NANOSCIENCE AND TECHNOLOGY

Editors-in-Chief Biographies



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Preface

Volume 5: Self-Assembly and Nanochemistry

Self-assembly and nanochemistry go hand-in-hand. Nanochemistry uses the principles and methods of chemistry to assemble complex nanoscale systems. New materials formed in this manner are envisioned to play an important role in future directions of research, innovation, and manufacturing because these material systems can be produced with desirable properties integrated. Part of the attraction is the sophistication of functionality that can be engineered into nanoscale materials. For example, optimized, photostable fluorophores have been demonstrated that are easily solution processed and functionalized to bind specific analytes. While the amateur scientist will have heard of many (so far) fictional wonder nanomaterials in this vein, many exquisite state-of-the-art examples are described in this volume. The power of self-assembly is that such sophisticated systems can be constructed automatically, over a hierarchy of length scales, through the control of intermolecular forces. Assembly could not otherwise be achieved in any practical fashion because of the tiny dimensions involved. Polymer chemistry has played a central role in establishing important underlying concepts. These ideas have evolved and diversified, and the incredible control of the chemist is evident in templating methods underpinning soft lithography and mesostructured inverse opal materials.

The breadth of molecules, chemistry, and materials that are being discovered in this field is stunning. This volume of *Comprehensive Nanoscience and Technology* will give the reader a sense of the cutting-edge directions presently being explored in the area classified as 'self-assembly and nanochemistry'. At the same time, accessible introductions to these topics are provided. The specialist will be inspired by the detailed accounts presented in these chapters, with topics ranging from the molecular-scale organization of mesogens, amphiphiles and polymers, to the preparation and functionalization of fullerenes, nanocrystals, and zeolites, to the assembly of sophisticated capsules, mesostructures, nanocomposites, and emulsions. The general reader will appreciate why contributions to this field have multiplied many times over the past decade, transforming materials chemistry into the vivid and exciting field it is today.

Gregory D. Scholes

Foreword

Nanotechnology and its underpinning sciences are progressing with unprecedented rapidity. With technical advances in a variety of nanoscale fabrication and manipulation technologies, the whole topical area is maturing into a vibrant field that is generating new scientific research and a burgeoning range of commercial applications, with an annual market already at the trillion dollar threshold. The means of fabricating and controlling matter on the nanoscale afford striking and unprecedented opportunities to exploit a variety of exotic phenomena such as quantum, nanophotonic, and nanoelectromechanical effects. Moreover, researchers are elucidating new perspectives on the electronic and optical properties of matter because of the way that nanoscale materials bridge the disparate theories describing molecules and bulk matter. Surface phenomena also gain a greatly increased significance; even the well-known link between chemical reactivity and surface-to-volume ratio becomes a major determinant of physical properties, when it operates over nanoscale dimensions.

Against this background, this comprehensive work is designed to address the need for a dynamic, authoritative, and readily accessible source of information, capturing the full breadth of the subject. Its five volumes, covering a broad spectrum of disciplines including material sciences, chemistry, physics, and life sciences, have been written and edited by an outstanding team of international experts. Addressing an extensive, cross-disciplinary audience, each chapter aims to cover key developments in a scholarly, readable, and critical style, providing an indispensable first point of entry to the literature for scientists and technologists from interdisciplinary fields. The work focuses on the major classes of nanomaterials in terms of their synthesis, structure, and applications, reviewing nanomaterials and their respective technologies in well-structured and comprehensive articles with extensive cross-references.

It has been a constant surprise and delight to have found, among the rapidly escalating number who work in nanoscience and technology, so many highly esteemed authors willing to contribute. Sharing our anticipation of a major addition to the literature, they have also captured the excitement of the field itself in each carefully crafted chapter. Along with our painstaking and meticulous volume editors, full credit for the success of this enterprise must go to these individuals, together with our thanks for (largely) adhering to the given deadlines. Lastly, we record our sincere thanks and appreciation for the skills and professionalism of the numerous Elsevier staff who have been involved in this project, notably Fiona Geraghty, Megan Palmer, Laura Jackson, and Greg Harris, and especially Donna De Weerd-Wilson who has steered it through from its inception. We have greatly enjoyed working with them all, as we have with each other.

David L. Andrews
Gregory D. Scholes
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