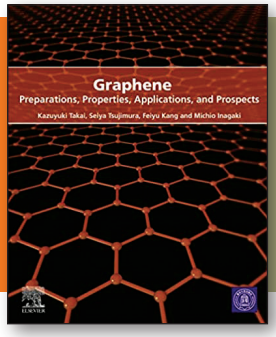


Graphene: Preparations, Properties, Applications, and Prospects

Kazuyuki Takai, Seiya Tsujimura, Feiyu Kang, and Michio Inagaki

Elsevier, 2019
620 pages, $193 (eBook $200)
ISBN 9780128195765

This book is unique in that it discusses in a more detailed manner the graphene literature from the perspective of crystalline or defective layers. The focus is on graphene foams, films, horns, doping with foreign atoms, and electrical, thermal, chemical, mechanical, and biomedical aspects. The collective goal of the authors was to review the literature in an unprecedented way.

Chapter 1 provides an introduction to graphene, followed by a discussion on carbon materials, including highly oriented graphite materials, synthetic graphite materials, fibrous carbon materials, nanoporous carbon, spherical carbon materials, and glass-like carbon. The structure of graphite intercalation compounds is well covered.

Chapter 2 reviews the making of graphene by chemical vapor deposition (CVD), mechanical exfoliation, and chemical exfoliation. The materials produced by CVD using organic precursors have been compared with those arising from graphite exfoliation.

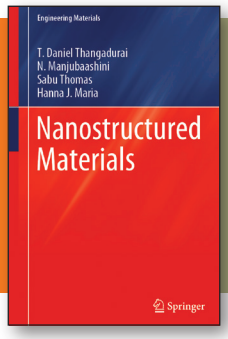
Chapter 3 discusses the electrical properties of graphene, carbon allotropes, carbon nanofibers, and graphite, with illustrations of graphene-based transistors, spintronics, sensor devices, and photon detectors. This chapter also presents the concept of "zero gap" semiconductors, Bernal stacking, pi electron band structures, spin injection efficiency, and the performance of graphene sensors in doped and undoped states.

The chemical properties of graphene-based materials relevant for a variety of applications is the basis of chapter 4. This chapter also includes discussions on energy-storage aspects and environment remediation relevant to batteries and capacitors. Chapter 5 elaborates on the mechanical properties of graphene, with illustrations of nanolubricants and mechanical sensors. The thermal properties of graphene, thermal interface materials, nanofluids, and thermal energy storage are reviewed in chapter 6. Chapter 7 includes discussions on biomedical properties, biocompatibility, cell management, drug delivery aspects, and biosensors. This chapter compares the performance of graphene with carbon nanotubes in their biocompatibility.

Chapter 8 is especially interesting, as it introduces materials derived from graphene (known as graphene derivatives) such as fluorographene, graphene oxide, graphyne, and also single-layer compounds such as boron nitride nanotubes and transition-metal sulfides. The concluding chapter 9 summarizes new knowledge added to materials science from the studies of graphene and future prospects.

This book is a solid contribution to materials science and engineering, as it reviews published research in the literature up until 2018. The book features an index for the easy selection of topics and is well illustrated. Graduate students could use the book for advanced research on graphene, and it serves as a good source on graphene developments viewed as a material derived from a CVD process, contrasting it with mechanical or chemical exfoliation. But it is not a textbook and does not include problems or worked examples.

***Reviewer: K.S.V. Santhanam**, School of Chemistry and Materials Science, Rochester Institute of Technology, USA.*



Nanostructured Materials

T. Daniel Thangadurai, N. Manjubaashini, Sabu Thomas, and Hanna J. Maria

Springer, 2020
221 pages, $106 (eBook $101)
ISBN 9783030261443

Nanotechnology and materials are among the most important fields in R&D of new products and technologies. Consequently, recent developments in design, synthesis, and application of different nanostructured materials have been the focus of much attention. This book covers a wide range of topics in nanostructured materials, which are organized into 18 chapters and written in clear language. Figures and references suitably complement the text, allowing the reader to gain a detailed understanding of each chapter. However, there are no exercises in this book.

Although there are books published with similar themes, this book offers an updated, comprehensive overview of different aspects related to the fundamentals, properties, synthesis, characterization, processing, and applications of nanostructured materials. Its readability, simplified presentations of key concepts and formulas, and solid number of topics and applications distinguish it from other books devoted to this subject. It can be used as a reference for researchers and professionals who are interested in this topic, or as a textbook for undergraduate studies in nanotechnology, nanoscience, and materials science. This book not only describes basic concepts and fundamentals of nanostructured materials, but it also summarizes their diverse applications in different areas such as

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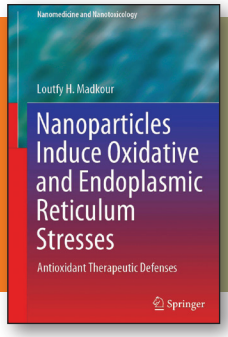
electronics, optics, biomedicine, energy, and photonics. In addition, it explores various examples of nanostructured materials, including quantum dots, nanowires, nanoparticles, carbon nanotubes (CNTs), fullerenes, semiconductor nanostructures, organic nanostructures, and hybrid nanostructures.

The first four chapters focus on basic concepts: the fundamentals of nanotechnology (chapter 1); properties, synthesis, and applications of nanomaterials (chapter 2); and the definition, types, and physical and chemical properties of nanostructures (chapters 3 and 4). The following two chapters describe types of nanostructures, such as CNTs, fullerenes, and dendritic (chapter 5); and semiconductor, organic, and hybrid nanostructures (chapter 6). Chapters 7 through 10 are devoted to the properties, design approach, functionalization, and technical analysis of nanostructured materials. Chapter 11 explains techniques used to fabricate nanostructures. It discusses substrates, lithography, and etching processes including wafer bonding and packaging.

The subsequent four chapters emphasize the applications of nanostructures in: optics and electronics (chapter 12), bioapplications (chapter 13), photonics (chapter 14), environmental remediation (chapter 15), and miscellaneous applications from aerospace to cosmetics (chapter 16). The final two chapters provide a discussion on nanomaterial toxicity and its impact on human health and ecosystems (chapter 17), and an overview of methods for R&D and applied life-cycle assessment models (chapter 18).

The diversity of topics and focus on key issues in nanostructured materials make this book a great reference in three aspects: (1) summarizing the fundamental aspects of synthesis, properties, and characterization of these materials; (2) describing different types of these materials and their characteristics; and (3) demonstrating the practical importance of these materials, detailing their applications in various areas. It is a good resource for anyone interested in studying the fundamentals and applications of nanostructured materials.

***Reviewer: Mariana Amorim Fraga**, Visiting Professor, Universidade Federal de São Paulo, Brazil.*



Nanoparticles Induce Oxidative and Endoplasmic Reticulum Stresses: Antioxidant Therapeutic Defenses

Loutfy H. Madkour

Springer, 2020
752 pages, $142 (hardcover)
ISBN 9783030372965

This book is a reference work focused on the role and interactions of nanoparticles and free radicals that are responsible for oxidative and endoplasmic reticulum (ER) stresses, with deep insights into the intimate mechanisms of their ecotoxicology, cytotoxicity, nanotoxicity, and genotoxicity.

The rapid development of nanoscience and nanotechnologies and their intersections with biological sciences during the 21st century has resulted in an explosion of information produced by numerous inter- and multidisciplinary research projects on nanomedicine. These are directed toward understanding topics such as nano-bio-interactions caused by nanoparticles with beneficial or adverse effects on the environment and human health. The author has organized the scientific sources to be accessible and useful. In this respect, the book is structured into 13 chapters as a collection of scientific review papers, each of which contains a short abstract, keywords, introduction, and explanatory and development sections. A vast list of updated references is included as well.

Each chapter is self-contained, causing repetition in some concepts, definitions, and explanations. The author clearly explains the oxidative stress by the imbalance produced between antioxidants and radical oxygen species (ROS) actions, either by depletion of antioxidants or accumulation of ROS. However, recent research reported in this book has shown that ROS are not simply detrimental because of their high reactivity causing oxidative stress, but they also play an important regulator role in many physiological and pathophysiological redox processes. ROS production can interfere with microbe and virus elimination through various mechanisms, but also could contribute to increasing pathogen burden as occurs in autoimmune inflammation, causing tissue damage. These findings offer perspectives for the use of antioxidants against particular infections.

As a result of recent advances in nanofabrication, there is an extensive application pallet of nanomaterials in industry, consumer products, and medicine, which raises serious concerns regarding the potential toxicity of nanoparticles in humans by generating reactive radicals. Both oxidative and ER stress parameters are analyzed in connection with improvement-testing strategies for aligning nanomaterial safety assessment and oxidative stress responses. The final goal is to highlight the correlation between the roles of antioxidant therapeutic defenses toward redox biology and regulation of immune responses. The book is generously illustrated with figures and diagrams and closes with general conclusions and future perspectives.

This book is recommended for both early-career and experienced researchers and specialists, being extremely useful for graduate students to aid in understanding the fundamentals in molecular biology and mechanisms of oxidative and ER stresses, while also being a resource for the development of new findings in nanomedication and innovative therapies.

***Reviewer: Aurelia Meghea**, Emeritus Professor, University Politehnica of Bucharest, Romania.*

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