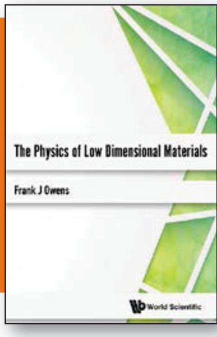



## The Physics of Low Dimensional Materials

Frank J. Owens

World Scientific, 2017
172 pages, $88.00 (e-book $70.00)
ISBN 978-981-3225-85-5

This is an excellent book on the physical properties of low-dimensional carbon and newer noncarbon materials. There are nine chapters covering the physical properties of low-dimensional materials employing elementary theories of solids. This book will be useful for researchers working on low-dimensional materials.

Chapter 1 provides an overview of theoretical approaches used to predict the properties of low-dimensional materials with example calculations. Brief overviews of molecular orbital theory and density functional theory are discussed with appropriate diagrams.

Chapter 2 presents the electronic properties of low-dimensional solids. Free-electron theory and the tight-binding model are employed in discussing the band and electronic structure of solids.

Chapter 3 deals with vibrational properties of low-dimensional materials. The basics of Raman spectroscopy and surface-enhanced Raman spectroscopy are discussed with illustrations and experimental data for graphite.

Chapter 4 discusses fabrication and characterization of single-walled and multiwalled carbon nanotubes. How the energy bandgap changes with size and how the frequencies of radial breathing modes changes with the nanotube diameter are well discussed.

Chapter 5 gives an overview of the physical properties of boron nitride nanotubes, boron, and silicon nanotubes. Raman spectra, infrared spectra, and high-resolution transmission electron microscopy images included are useful.

Graphene structures and their physical properties are presented in chapter 6. The anomalous quantum Hall effect in graphene structures is briefly discussed with the help of energy state diagrams. Identifying the number of layers using Raman spectra is discussed beautifully.

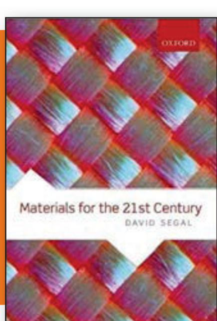
Chapter 7 presents an overview of other low-dimensional materials, such as boron nitride, $MoS_2$, $NbSe_2$, and selenium. The highest occupied molecular orbital and lowest occupied molecular orbital energy-level dependency on the wave vector in all of these structures are depicted well.

Chapter 8 discusses magnetism in low-dimensional materials. The basics of magnetism and experimental techniques to probe the magnetic moments are well discussed with appropriate data and figures.

Superconductivity in low-dimensional materials is discussed in the last chapter. Thickness-dependent transition temperatures in Pb films, selenide, and FeSe superconductors are briefly discussed, along with their structures and experimental resistance data. Superconductivity in graphene and single-walled carbon nanotubes is also briefly discussed.

This is an outstanding book covering the preparation and physical properties of low-dimensional materials. The references in each chapter are up to date. The author did not intend the book as a textbook for undergraduate or graduate students; therefore, there are no problems included in any of the chapters. Nonetheless, I strongly recommend this book to all researchers interested in low-dimensional materials.

***Reviewer: K. Kamala Bharathi**, SRM Institute of Science and Technology, India.*




## Materials for the 21st Century

David Segal

Oxford University Press, 2017
336 pages, $75.00
(paperback $32.95, e-book $25.99)
ISBN 978019880406

This reference book is aimed at high-school students and the general public. It is written from the perspective that materials hold the key to solving 21st century problems, especially in the areas of energy, communications, and human health. The book has 13 short chapters followed by a descriptive glossary that lists 500 materials. The appendices that follow direct the reader to a comprehensive list of books on materials science topics and selected patent documents.

Chapter 1 discusses the important role of materials in the 21st century economy. Chapter 2 focuses on carbohydrates, processing of sugars by the human body, and common features of soft matter. Chapter 3 presents the development of computer chips, starting with vacuum tubes and going through transistors to quantum computing and biological computing. Chapter 4 discusses natural and synthetic polymers, Si-based polymers, protein structure, biofuels, and bioproducts.

Chapter 5 covers the uses of materials in health care, including lasers and imaging technologies, pharmaceuticals, drug delivery, coronary stents, implants, and antimicrobial agents. Chapter 6 deals with materials for solid-state lighting and highlights the large time lag between initial materials discovery and widespread deployment of technology using the example of light-emitting diodes (LEDs).

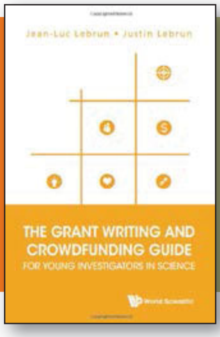
Chapter 7 offers a peek at energy supplies and focuses on technologies that can reduce carbon dioxide emissions or limit global temperature rise. Chapter 8 discusses the synthesis of a variety of materials, such as rare earths, ultrapure materials, size-controlled powders, thin films, and DNA. Chapter 9 puts a spotlight on disruptive materials technologies, including gene editing, ceramic superconductors, three-dimensional (3D) printing, graphene, and metamaterials.

Chapter 10 touches upon the role of microstructure in determining materials properties; chapter 11 covers intellectual property; and chapter 12 mentions the materials associated with commonly used products. Chapter 13 hints that protein-based materials may come to define the 21st century. It concludes with a cautionary note regarding optimistic claims about the potential application of novel materials, such as ceramic superconductors and graphene, or processes, such as 3D printing. A list of references is included at the end of each chapter.

The author has included as much popular materials science as possible in the short chapters. The narrative feels disjointed as it jumps across a dizzying array of topics. A given chapter may cover van der Waals forces, biodegradable polymers, cotton candy, silicon chips, stevia-based sweeteners, and radioactive fission products. Equations and formulas are kept to a bare minimum, and there is a paucity of graphics in the chapters.

The glossary is the strength of this book. Entries in the glossary introduce topics in lay terms and present references that the reader can use for further exploration. Unusual topics, such as artificial nails, electronic ink, faded jeans, hairy adhesives, iridescent organisms, patent trolls, stain-resistant clothing, and wound dressing, are covered. Overall, this book is a useful reference volume for anyone curious about materials science and engineering.

***Reviewer: Ram Devanathan**, Technical Group Manager in the Energy and Environment Directorate at Pacific Northwest National Laboratory, USA.*




**The Grant Writing and Crowdfunding Guide for Young Investigators in Science**

Jean-Luc Lebrun and Justin Lebrun

World Scientific, 2017
240 pages, $58.00
(softcover $28.00, e-book $22.00)
ISBN 978-981-3223-23-3

The primary aim of this book is to shine some light on the grant writing and review processes, but it also provides some insights on how scientists can use crowdfunding to support research efforts. The authors base their commentary on conversations they held with senior investigators and grant administrators, most of whom live and work in Asia.

The authors provide an abridged version of typical advice that new faculty are given by senior colleagues, but it stops short of providing meaningful insights into specific funding agencies that are regularly targeted by researchers in North America or elsewhere. As a result, most of the advice in the book lacks the highly tailored understanding of grants that can be gained by attending an agency-centric grant-writing workshop.

After a short chapter on finding the right grant for which to apply, the authors provide insights on "the first steps" for investigators. Suggestions include: work on a proof of concept, build a track record in publications, become a grant reviewer, and seek mentors who have experience in writing grants. The third chapter provides a list of considerations to be mindful of when offered the opportunity to write a collaborative grant. Chapter 4, perhaps the best chapter in the book, provides a brief but valuable service by explaining some of the vocabulary used in the world of grants.

The book then turns its attention toward different sections of the written document and the purpose of each. Chapters 5–9 are devoted to individual components of the grant, namely, the title, abstract, specific aims, budget, and significance of the work. Each of these chapters provides imaginary examples and exercises to help the reader think through the craft behind each section. Chapter 10 looks at the value and pitfalls of innovation, while chapter 12 discusses the various types of risks associated with grants and grant writing. Chapters 11 and 13 discuss the actual grant review process and how to deal with having your grant rejected. The final chapter briefly explains crowdfunding for scientific research purposes.

This book includes many of the typical soundbites of advice that a new professor should hear within or prior to the first year. However, what this book covers in breadth, it often lacks in depth. Many ideas are limited to a page or less. Furthermore, by focusing on a global audience from across the sciences, there is little discussion on specific funding agencies that new professors in materials science, chemistry, engineering, physics, and related disciplines would be interested in targeting.

The authors use a diverse set of fonts and include some commentary in the page margins, which result in a distracted reading experience. For future investigators who are looking for that first academic position, this book can serve as a simple introduction to the grant writing process, but it should not be the only resource that investigators rely upon when writing a first grant or when turning to a crowdfunding website for the first time.

***Reviewer: Anthony Stender**, assistant professor of analytical chemistry at Ohio University, USA.*