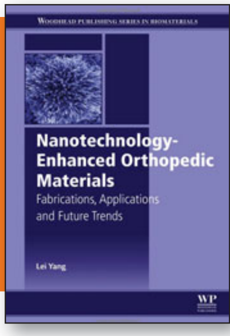


Nanotechnology-Enhanced Orthopedic Materials: Fabrications, Applications and Future Trends

Lei Yang

Woodhead Publishing, 2015
234 pages, $170.00
ISBN 9780857098443

This book is split in two parts. Part one, "Fundamentals of Nanotechnology and Nanomaterials for Orthopedics," has four chapters covering fundamentals, metals and alloys, nanoceramics, and bioinspired nanopolymers and nanocomposites for implants and applications. Part two, "Future Trends in Nanotechnology-Enhanced Orthopedic Materials," has five chapters, covering carbon nanostructures, self-assembled nanostructures for bone- tissue engineering, nanotechnology-controlled drug delivery for treating bone diseases, frontiers, and safety in the field.

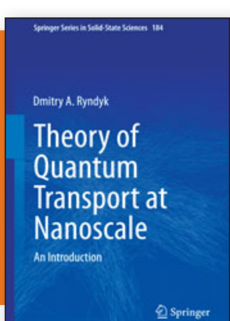
The objectives of the author are ambiguous: the book does not have the wide and deep approach to be a textbook, nor the related necessary educational approach (e.g., there are no homework problems for students or similar teaching material). Moreover, it is hardly an exhaustive account of current trends in the field, as informative material on the well-established results versus open problems and new approaches is insufficient. In fact, the introductory concepts (all of chapter 1 and the introductory notions of every chapter) are quite trivial for researchers active in the field and too generic for young researchers.

Furthermore, the short technical portion of every chapter has only a partial literature review. It basically mentions the summary of results from a curiously select choice of papers in the field, and only concisely. It lacks discussions of significant contributions from important scientists in the field. For example, in chapter 2, the author discusses titanium-based biomaterials, summarizing the results of 15 references—supposedly the crucial ones in the field—in two and a half pages out of the chapter's 17 pages. The problem is that among the references, most of which come from the group to which the author belongs, not one comes from the extensive data produced by the group of M. Textor, which also published a reference book and a large number of papers on titanium-based biomaterials. For such a current and relevant topic, this chapter is lacking. The same attitude can be found for other "hot" topics, notably the carbon-based biomaterials. This suggests that the value of the book will decrease exponentially with the aging of the set of references listed by the author.

Finally, a discussion of future trends is effectively absent. Indeed, the perspectives and future trends given in chapter 8 are quite obvious to any researcher in the field: implant multi-functionality is discussed in detail in many seminal papers (not even referenced from 2010 is the analysis of the fate of stem cells, more of a current topic rather than a future trend, since it has existed for at least the last five years).

Overall, the book has substantial informational value, and the figures are appealing and self-explicative. However, such a wide overview of the results should have prompted a more thorough treatment of the field's problems and perspectives. I cannot recommend this book except as a review of some recent literature.

Reviewer: Giovanni Marletta *of the Department of Chemical Sciences, University of Catania, Italy.*



Theory of Quantum Transport at Nanoscale: An Introduction

Dmitry A. Ryndyk

Springer, 2016
246 pages, $129.00 (e-book $99.00)
ISBN 978-3-319-24086-2

Professor Dmitry A. Ryndyk is an expert on quantum transport theory and has taught classes on this subject at the University of Regensberg and Technische Universität Dresden. This book has been developed from his course notes and is aimed at being a suitable advanced-level textbook for master's- and PhD-level students, with the further intent that it be useful for experts working in the fields of quantum transport theory and nanoscience. Topics that the author says are not discussed include quantum interference of the Aharonov–Bohm type, weak localization, universal conductance fluctuations, random matrix theory, the quantum Hall effect, and quasiclassical and semiclassical transport. There are nine chapters split in two parts.

Chapter 1 is a brief introduction that outlines the excluded subjects listed previously, and provides an overview of the rest of the book. Part I, covering basic concepts, then follows. Chapter 2 explores the Landauer–Büttiker method with sections on quantum junctions, a formulation and derivation of the Landauer formula, multichannel scattering and transport, and a consideration of multi-terminal systems. Chapter 3 discusses Green functions with sections on the scattering problem, matrix Green functions, recursive methods, semi-infinite electrodes, and resonant transport. Chapter 4 explores tunneling with sections on the Hamiltonian method and sequential tunneling. Chapter 5 explores electron–electron interactions and the Coulomb blockade, including sections on

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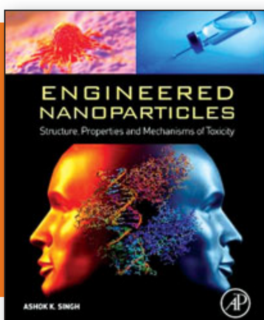
the electron–electron interaction, single-electron box, single-electron transistor, Coulomb blockade in quantum dots, and co-tunneling. Chapter 6 explores vibrons and polarons, including sections on electron–vibron interactions, inelastic electron tunneling spectroscopy, local polarons, inelastic tunneling in the single-particle approximation, and sequential inelastic tunneling.

Part II considers advanced methods. Chapter 7 explores nonequilibrium Green functions (NGFs), including retarded and advanced Green functions, the fluctuation-dissipation theorem, free fermions, free bosons, Green functions for vibrons, the Schwinger–Keldysh time contour, the nonequilibrium equation of motion method, and the Kadanoff–Baym–Keldysh method. Chapter 8 discusses NGF methods for transport through nanosystems. Chapter 9 explores nonequilibrium problems involving vibronic effects as well as Coulomb blockade effects. There is a two-page index, and most of the book's 77 illustrations add value.

The author has done an excellent job of citing the original research literature; however, there are only a few reference citations for 2010, and none beyond that date. The book is heavily mathematical, and (as the author notes) requires some prior understanding of theoretical physics, including quantum mechanics. Although the scientific problems discussed above are worked through in detail, no homework problems are provided. However, the book is useful for a graduate-level seminar class on nanoscale quantum transport and for self-study for experts working in this field. For those interested in nanoscale quantum transport, I recommend this book.

Reviewer: Steven C. Moss *is a senior scientist in the Electronics and Photonics Laboratory at The Aerospace Corporation in El Segundo, Calif., USA.*



Engineered Nanoparticles: Structure, Properties and Mechanisms of Toxicity

Ashok K. Singh

Academic Press, 2016

554 pages, $93.75 (e-book $93.75)

ISBN 9780128014066

A materials scientist working with new materials is often anxious about the product's health effects. This book on engineered nanomaterials promises support in some of these questions with respect to nanoparticles. It gives indications about toxicity and the mechanisms of toxicity of nanomaterials, but it does not provide the average materials scientist with sufficient basic knowledge. As this topic is extremely complex, it is necessary to read at least a few chapters in detail to obtain the answers needed. Finally, this book is written for the professional development of toxicologists or students of this science.

The book starts with a short, simple, and clear introduction to the basics of nanoparticles, namely their properties and characterization. The introduction to "Nanotoxicology" is important to the engineer and materials scientist. The author explains that the conventional concept of a dose–response relationship based on the ratio between mass of the noxa (toxic substance) and body weight is no longer valid. Instead, one needs a new relation, taking into account the huge surface area of nanoparticles. However, such an indicator has been missing until now.

The mechanisms of toxicity of nanoparticles are explained. Nanoparticles may have the potential to distribute in the whole human body; therefore, materials doing no harm as a bulk material to the human body may be highly toxic as a nanoparticle. In some cases, this behavior of nanoparticles is dangerous; however, using nanoparticles in addition to drugs may be the most important property and best approach (e.g., for cancer treatment). To verify these findings, the major part of the book describes the interaction of nanoparticles with proteins, cells, and human organs in detail. Besides the interaction with the human body and its cells, two chapters are devoted to the influence on the ecosystem and environmental risks.

The text of the book is supported by instructive figures. The amount of literature presented is nearly endless. Perhaps an additional selection of a few key papers per chapter would have been helpful for the reader from other fields of science. Analyzing the citations, the materials scientist will realize that toxicologists see other (and sometimes later) scientists as developers of a few key technologies. I would recommend this book for experienced materials scientists who deal with safety problems connected to nanomaterials.

Reviewer: Dieter Vollath *of NanoConsulting, Stutensee, Germany.*

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