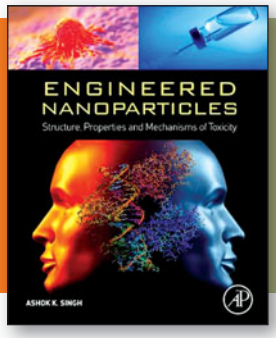
the electron–electron interaction, single-electron box, single-electron transistor, Coulomb blockade in quantum dots, and co-tunneling. Chapter 6 explores vibrons and polarons, including sections on electron–vibron interactions, inelastic electron tunneling spectroscopy, local polarons, inelastic tunneling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