species in materials. In the sixth chapter, electronic transport and magnetic influences (e.g., the Hall effect) in micron- and nanoscale materials are examined with the help of classical and quantum mechanical treatments. The seventh chapter covers the fundamentals and applications of magnetism, characterization of magnetic properties down to small scales, and magnetoelectronic devices. The eighth chapter deals with the interaction of electromagnetic radiation with matter, photonics technology, and nonlinear effects.

The ninth chapter discusses applications and characteristics of micro- and nanomaterials in dynamic mechanical devices. Probing the local interactions of matter employing scanning probe microscopy, micromechanical systems, and application of microelectromechanical systems are discussed with the experimental setup and their functionality. Chapter 10 briefly discusses fluid dynamics at the micro- and nanoscale and applications. Different types of flow in various structures such as laminar flow, surface interactions, and electrolytes are explained with beautiful diagrams and real images. Applications of nanofluids and microfluidic devices such as flow sensors are discussed in the second half of the chapter.

Chapter 11 covers the relevance of nanotechnology to biology, including detection, and monitoring of biological information. The last chapter discusses the realistic near-future applications of nanotechnology in materials science and in the energy, electronics, information technology, and biology industries, as well as hazards and dangers. References are very relevant and up to date. At the end of each chapter are several exercise problems.

Fundamentals of nanotechnology and its applications are well discussed in this book. I strongly recommend this book to all undergraduate and postgraduate students interested in nanotechnology.

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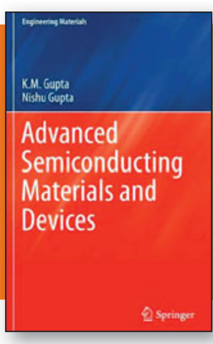

Advanced Semiconducting Materials and Devices
K.M. Gupta and Nishu Gupta
Springer, 2016
573 pages, $129.00 (e-book $99.00)
ISBN 978-3-319-19757-9

In considering the plethora of textbooks on semiconductor devices, one cannot fail to use such well-known ones as Sze (*Semiconductor Devices: Physics and Technology*) and Streetman/Banerjee (*Solid State Electronic Devices*) as benchmarks. Indeed, *Advanced Semiconducting Materials and Devices* by Gupta and Gupta claims to cover a wider remit than such standard texts, and in doing so could fill a real niche.

After a short introduction, the basics of semiconductor theory are covered in much the same way as in other texts, moving on to simple devices such as the *p–n* junction and transistors. Following a short section on fabrication technologies, the later chapters are devoted to recent advances, special devices, and nanostructures. Unfortunately, these later chapters are rather weak and disordered, with short paragraphs and a few bullet points on each subject. These seem superfluous in the era of Internet search engines, where one could find a recent review in seconds. They are far too superficial and inadequately referenced to be of any real use. To take a rather extreme example, less than half a page is dedicated to semiconductor nanocrystals, the same amount of space that is given to light-emitting diodes on cricket stumps in the introduction.

This text also suffers from the sloppy use of language. In the introductory chapter, it is stated that atoms are indivisible in one sentence, and that they contain protons, neutrons, and electrons in the next. We are told silicon and germanium are "not useful" in their intrinsic form and semiconductors do not follow Ohm's Law. There is an element of truth to each statement, of course: atoms do not usually divide in semiconductors (except in some novel radiation detectors); one generally dopes silicon and germanium in semiconductor devices to enhance their utility, and semiconductors do not follow Ohm's Law under high fields. However, there is also radioactive decay that produces soft errors in modern devices, there are intrinsic detectors, and there is low field linearity in ohmic semiconductors.

The use of colloquial language throughout is also inappropriate. For example, metals have "too many" electrons, and silicon forms a "nice" gate material and has a "reasonable" bandgap. In the case of the latter, this is qualified as "not too high so that room temperature cannot ionize it, and not so low that it has a high leakage current." This is plain wrong: the dopants in silicon are ionized at room temperature, not intrinsic carriers across the bandgap, as this would lead to high leakage currents.

The text includes some basic example questions, and there are many lists and tables of material properties and their applications.

The quality of some of the figures is very poor. They are clearly scanned from elsewhere without any acknowledgments. Several are hand drawn or scanned off blemished paper. Incredibly, in a text of almost 600 pages there is no index.

It is hard to see the purpose of such a text alongside the aforementioned texts. Both of them cover semiconductor materials and devices in far more depth and with very few errors.

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