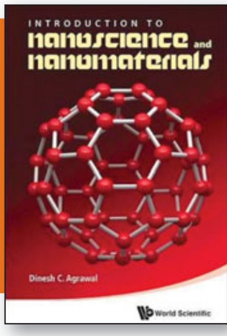


Introduction to Nanoscience and Nanomaterials

Dinesh C. Agrawal

World Scientific, 2013
556 pages, $89.00
ISBN 978-981-4397-97-1

The preface of this book states that it can be used as a textbook on nanoscience and nanotechnology for senior undergraduate or first-year graduate students from various disciplines, as well as a reference for researchers looking for basic information outside of their discipline. This is a tall order. This requires combining a proper pedagogical approach together with encyclopedic coverage of the multiple subdisciplines encompassed in the fields of nanoscience and nanomaterials. To a large extent, this book meets this challenge successfully. The 14 chapters cover an impressive variety of topics with sufficient information on each to allow the reader to understand the important physical and chemical concepts involved.

The pedagogical challenge is met by incorporating three important features: (1) adequate fundamental background material is provided to make this book self-sufficient for a reader with a basic scientific background; (2) numerous examples are included to clearly demonstrate a concept just presented (e.g., after discussing the quantum size effect, showing how to calculate the size of a Si particle that would exhibit quantum effects at room temperature); and (3) problems given at the end of each chapter.

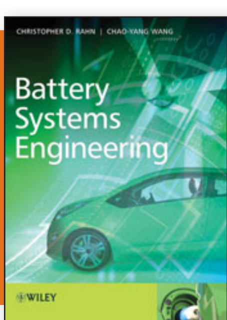
In order to satisfy the need to cater to individuals from varied backgrounds, the first two chapters of the book are devoted to some general concepts used in nanoscience such as surfaces, quantum effects, and electronic properties. These principles are then drawn on later in the book, and further background information is provided in later chapters as needed. The material is presented in both lucid and basic fashion so that only a general scientific background is required to use the book.

Much of the rest of the book is ordered according to dimensionality. Chapters 3–7 deal with electrical and quantum effects, growth of quantum structures, magnetism, and colloid physics. Chapters 8–9 are devoted to 1D structures, including carbon nanotubes and nanowires: preparation, properties, and applications. Chapter 10 covers 2D structures (thin films), chapter 11 covers bulk nanostructures, and the final three chapters cover polymers, their composites, and self-assembly.

Any attempt to cover a versatile and dynamic field such as this will have its shortcomings. The book has sacrificed some important and timely topics in favor of thoroughness of more fundamental background material. Thus, whereas basics of quantum mechanics such as solution of the Schrödinger equation for a particle in a box are included, there is no mention of density functional theory, which is becoming an increasingly important technique for the understanding of nanosystems. This is symptomatic of topics in the book being somewhat dated—the coverage of self-assembly describes Langmuir–Blodgett films extensively but barely touches upon self-assembled monolayers, which are much more relevant to modern nanoscience.

Despite these few shortcomings, this book still provides an excellent basis for learning about the wonders of nanoscience and nanomaterials.

Reviewer: Sidney Cohen *works at the Weizmann Institute of Science, Israel.*



Battery Systems Engineering

Christopher D. Rahn and Chao-Yang Wang

Wiley, 2013
250 pages, $125.00
ISBN 978-1-119-97950-0

Batteries are becoming such an organic part of modern life that my six-year-old daughter recommends changing the batteries when something breaks, and she alerts me immediately when the box pops up on the screen saying the battery is running out of energy. While materials researchers endeavor to find battery materials that can store more energy per unit weight and volume, the periodic table presents relatively few options for cost-effective solutions, so the control of batteries and the careful metering of their power and energy represent some of the more important research being done toward making them long-lived.

Christopher D. Rahn and Chao-Yang Wang explain methods and approaches to modeling batteries in *Battery Systems Engineering*. The philosophy of this book is that “fundamental model-based controllers have a built-in understanding of the underlying processes, allowing them to be more efficient, accurate and safe.” Most of the book is dedicated to battery model development at the cell and system levels, focusing on rechargeable batteries for hybrid electric vehicles.

Both Rahn and Wang are supremely qualified experts on the fundamental processes in batteries and relevant controls mathematics. Rahn is a professor of mechanical engineering at The Pennsylvania State University (Penn