

When Physics Became King

Iwan Rhys Morus

University of Chicago Press (2005), 288 pp.
ISBN: 0-226-54202-5
\$25

The term 'physicist' didn't appear in the English language until the 1830s. Morus traces the cultural history of physics – a discipline that struggled to rise out of natural philosophy in the early 19th century but, within 100 years, came to be regarded as the key to unlocking nature's secrets. The links between physics and advancing industrialism, the success of statistical mechanics, and the establishment of astronomical laboratories and precision measurement tools are described.

Principles of Nanotechnology

G. Ali Mansoori

World Scientific (2005), 360 pp.
ISBN: 981-256-205-2
\$48 / £29

This textbook on bottom-up nanotechnology is aimed at graduate students and emphasizes the molecular-based study of condensed matter in small systems. It includes discussion of forces and potentials within nanosystems as well as their thermodynamics and phase transitions. Various simulation techniques and approaches to nanostructure assembly are outlined.

Interfacial Nanochemistry

Hitoshi Watarai (ed.)

Springer (2005), 322 pp.
ISBN: 0-306-48527-3
\$129 / £84.50 / €109.95

Organic synthesis, electrochemistry, laser spectroscopy, and separation engineering can involve reactions that take place at liquid/liquid interfaces. Watarai has brought together a series of contributions that provide an insight into this new area of study at the boundaries of analytical, synthetic, surface, and colloid chemistry.

Expert 👤 👤 👤
Graduate 👤 👤
Undergraduate 👤

Class textbook for nano

Introduction to Nanoscale Science and Technology is a great starting point for the study of all things nano and is an excellent resource for teachers and students alike, say **Benjamin Wiley** and **Younan Xia**.

A class in nanoscale science and technology is daunting for the educator, who must organize a large collection of materials to cover the field, and for the student, who must absorb all the new concepts. This textbook is an excellent resource that allows students from any engineering background to quickly understand the foundations and exciting advances of the field. The example problems with answers, a CD with color pictures, and the long list of references in each chapter are a big plus for course tutors.

The book is organized into seven sections. The first, nanoscale fabrication and characterization, covers nanolithography, self-assembly, and scanning probe microscopy. Of these, we enjoyed the section on nanolithography most, as it includes many interesting details from industrial manufacturing processes. The chapter on self-assembly also provides an excellent overview by introducing six types of intermolecular interactions and the ways these can be employed to fabricate nanostructures.

The second section covers nanomaterials and nanostructures. Out of its 110 pages, 45 are devoted to carbon nanotubes. Fullerenes and quantum dots each have their own chapter that focuses on the properties and applications of these nanostructures. Nanolayer, nanowire, and nanoparticle composites of metals and semiconductors are briefly covered (just 12 pages), with slightly more discussion of specific applications.

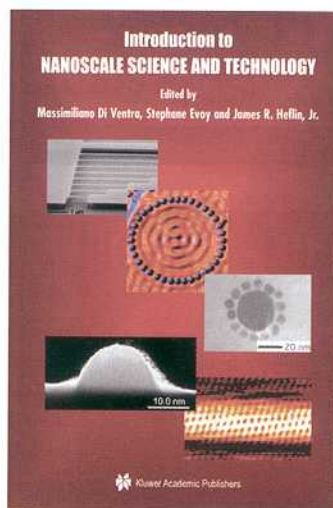
The section on nanoscale electronics begins with a history of microelectronics before discussing the difficulties in shrinking transistor size further. The discussion of problems (leakage current, hot electrons, doping fluctuations, etc.) and possible solutions (high-*k* dielectrics, double-gate devices) could easily motivate deeper discussions of nanoscale electrical transport. A chapter on molecular electronics considers transport through alkanes, molecular transistors, and DNA in a simple, qualitative manner we found highly instructive.

Nanoscale magnetic systems are examined in the fourth section. The concept of quantum computation

is nicely presented, although the discussion of how this can be achieved with controlled spin states is (perhaps necessarily) not clear. We found the chapter on magnetic storage to be one of the most lucid in the book. The giant magnetoresistive effect, operation of spin valves, and issues in magnetic scaling are easier to understand when placed in the context of the modern magnetic hard disk drive.

Micro- and nanoelectromechanical systems are covered with an emphasis on the integration of sensing, computation, and communication. Here, the student can see advanced applications of lithography. The sixth section, nanoscale optoelectronics, describes quantum dots, organic optoelectronics, and photonic crystals. The chapter on organic optoelectronics is especially clear in its discussion of the fundamentals of this complicated field. The book concludes with an overview of nanobiotechnology that covers biomimetics, biomolecular motors, and nanofluidics.

Because so many authors have contributed to this textbook, it suffers a bit from repetition. However, this also allows sections to be omitted without any adverse effect on student comprehension. We would have liked to see more



Massimiliano Di Ventra, *et al.*, (eds.)
Introduction to Nanoscale Science and Technology
Springer (2004), 632 pp., ISBN: 1-4020-7720-3
\$89.95 / £61.50 / €79.95

technology to balance the science; apart from the chapters on lithography and magnetic storage, little more than an acknowledgment is given to commercial applications.

Overall, this book serves as an excellent starting point for the study of nanoscale science and technology, and we recommend it to anyone with a modest scientific background. It is also a great vehicle to motivate the study of science at a time when interest is waning. Nanotechnology educators should look no further.

Benjamin Wiley is a graduate student of chemical engineering and Younan Xia is a professor of chemistry at the University of Washington.