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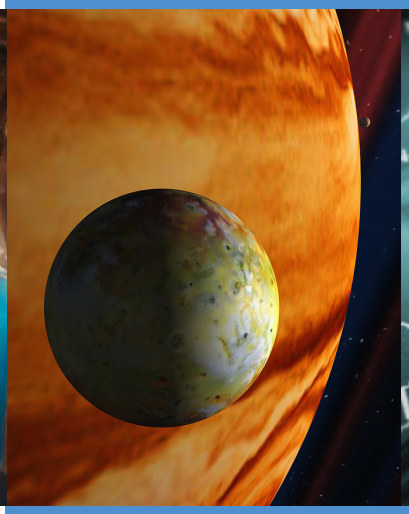
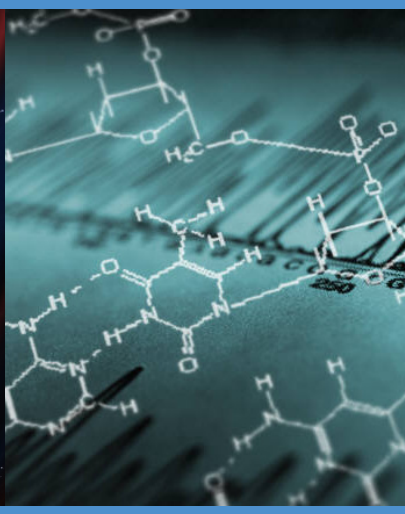

Reviews

A guide to publications in the Physical Sciences

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Introduction to Nanoscience

Subject area
Nanoscience

Description
Overview and general text for this specialised branch of multidisciplinary science

Authors
Gabor L Hornyak, Joydeep Dutta, Harry F Tibbals, Anil K Rao

Publishers/Suppliers
CRC Press - Taylor & Francis <www.crcpress.com>

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Research

Price
£39.99

Summary Review

range: * poor to ***** good	
Academic content	*****
Usefulness to student	*****
Usefulness to teacher	*****
Meets objectives	*****
Accuracy	*****

The style of the book is weighty and extensive; the presentation is fluid but deals with in-depth coverage across the topics that comprise the field in a manner that is done nicely within fourteen chapters and 856 pages. The book is extremely easy reading for students with an affable line and the genial insertion of dilemmas and contemporary issues. It places the central position of physics, chemistry and biology neatly in the 'folder' that is nanoscience and nanotechnology. In terms of the ease of usage for the teacher, it is refreshing to see a textbook that is written from a biomedical perspective in an area customarily frequented by material scientists and physicists[1,2] and their customary dry writing style. The authors do a very good job at contextualising the field and the reading is made ever more pleasant by the use of magnificent figures of superlative clarity.

The societal impact and value of nanoscience is discussed rather tidily and succinctly and the reviewer was pleased to see it included; when it is customarily omitted. The section dealing with society and its perceptions of nanoscience deals with an invaluable background on ethics versus technical advances, intellectual property and patenting. There is an interesting aside when the book makes reference to the Osaka Bull Sculpture (p 80) that featured in the journal, *Nature* in 2001. However, in addition to nice images the book quite seriously and correctly deals with concerns of toxicology, environmental impact, sustainability and the unease among the public at large with this 'Frankenstein-ian' new science. The book doubles as supporting physics and physical chemistry courses and in this case it is a good investment for the price. The cost of the book at £40 is quite reasonable as a core text, particularly for courses where nanotechnology features strongly.

There are a number of similar books on the market[3], however, the book is particularly good at addressing materials covered piecemeal in many of these books and with unification of them under one cover. The book is a particularly good read in view of its appealing figures, explanatory text, diagrams and that the mathematics is kept at a 'need-to-know' level. The sections, all five of them, are clear and the thematisation used is particularly comfortable to encounter for students. Themes cover areas of, perspectives, nano-tools, physics, chemistry and finally, natural and biosciences. Prerequisite reading and knowledge needed by the reader is a sound pre-university level base in chemistry and physics. The text is written agreeably because the customary high level of mathematical description is kept to a bare minimum and concepts are allowed to be amplified in this way so the text is less daunting to many newcomers.

The book scales the subject matter from nano-crystals (quantum dots) to cell biology and talks about notions of the 'nano-world' both artificial or synthetic and natural. As with many books thoughtfully crafted by subject experts, significant attention is paid to problem sections throughout the text and this has always proved very popular with undergraduates. Sample questions to help students range from, "What is grey goo? Green goo?" to "What is a pi-acid ligand" and on to "Describe the structure of a cell membrane." The problems posed by the authors are masterfully both

Dipak Kumar Sarker
School of Pharmacy and Bimolecular Sciences
University of Brighton
Lewes Rd
Brighton BN2 4GJ
October 2008

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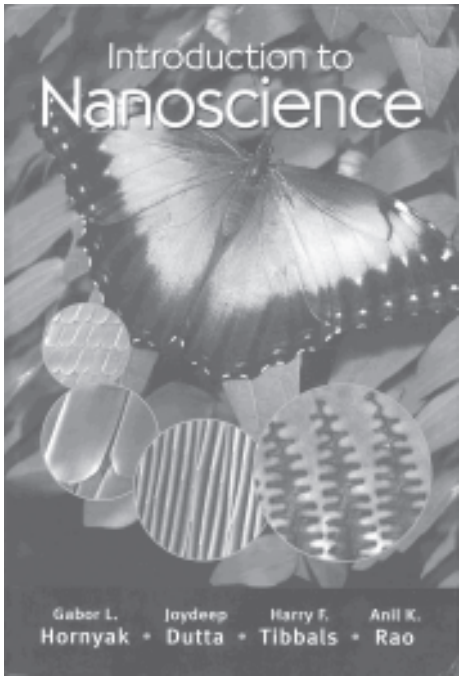
fundamental and applied and involve both calculation and essay-type practice questions. Despite the specialised title there is enough subject matter and concept common ground to mean the textbook is always likely to be handy for core course teaching.

The title is specific to an application area of natural sciences consequently, there is little possibility of routine application of the book, for example as a chemistry textbook for a standard chemistry course. However, the range of topics endorsed by Gabor Hornyak et al mean its use for particular courses (covering diverse topics) is the expected path and then ultimately perhaps to application for routine teaching at graduate level. The book covers areas of analytical sciences, methodology, fabrication, gross and atomic-scale structure, thermodynamics, self-assemblies and natural materials. The analytical sections appear at first sight to be limited in terms of interfacial analysis (that are ubiquitously) applicable to the modern form of nanoscience and nanotechnology. These topics without detailed perusal appear to be manifested in terms of energy at the nanoscale (chapter 6), spectroscopy, the Brewster-Angle microscope (p113) and adsorption (chapter 12). On further reading it becomes clear that Gabor Hornyak's treatment of the subject matter means the material is present in entirety but inter-woven within various sections and thus located at the point of context rather than the subject matter that might be found in a particular order, in say a chemistry textbook. A very impressive chapter is the one dealing with the scanning tunnelling (probe) microscopy and the related atomic force methods. There is also excellent treatment of scanning electron microscopy and micrographs and at the same time it was interesting on a personal level to see the inclusion of the quartz crystal microbalance (quartz crystal resonant sensor) as a form of 'standard method' for interfacial study alongside the Langmuir-Blodgett methodologies.



The fabrication methodology section is well written and presents clear details of a range of methods on difficult topics in light of continual new discoveries and a rapidly evolving branch of scientific disclosure. Themes such as top-down and bottom-up (piece assembly), and supra-molecular assemblies are mentioned with appropriate weighting.

Supramolecular chemistry dealing with micelles, vesicles, natural colloids and single walled nano-tubes (SWNTs) and related Bucky balls and geometric systems is superbly written. The section on structure and crystallinity is dosed with liberal amounts of energetics, the theory of interfaces, liquids and theory on solids even at the atomic and molecular level (nanothermodynamics, p384); just as would be expected from a tutor. The book deals swiftly but cogently with concepts of the material continuum and the nano- (quantum) perspective and as might be expected discusses and explains the Schrödinger equation at comfortable depth for the newcomer. The text additionally deals with the notion of one-dimensional materials (quantum wires, p369) and nano-whiskers. Inclusion of Table 8.2 greatly impressed the reader since this represents an excellent attempt at minimalisation and 'de-clouding' of sometimes unnecessary and over zealous use of equations to suit the multi-disciplinary reader. This is also exemplified in the discussion and comparison of the nano- and macro-world.

A textbook covering nanoscience would be incomplete without a section on carbon-based nanostructures and the obvious contemporaneous inclusion of treatment on fullerenes, SWNTs and diamondoids is fully expected in a textbook of such superlative quality. The book then navigates through a difficult conceptual area of pi-interactions (p515), dative bonds (useful for biological and pharmaceutical scientists) and the hydrophobic effect (p533); that is critical to drug encapsulation[4] and vesicle or cell membrane function and binding or product stability. The book makes a great attempt to compare soft-matter with hard-matter (Table 11.3) and discusses supramolecular systems that find current applications, such as macrocycles (p565) and dendrimers (p572). These areas themselves are branches of nanoscience that are growing rapidly year-on-year.

Basic treatment of micelles and surfactants as a technological device is good but compounded further since the book also discusses strategies used as part of fabrication, such as those of Jean-Marie Lehn for supramolecular materials. The section on polymer types and synthesis (chapter 12.4) is needed and essential to nanotechnology but (unfortunately), in the eyes of the reviewer, too brief in such an extensive

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survey of other themes. However, the reviewer was a little surprised to see little reference to nanomedicines or the drug applications of nanotechnology as this is a current area of huge economic and international regulatory interest. There is an occasional reference such as in Figure 12.39 to this subject matter and one must not be too critical as the authors do an excellent job in trying to squeeze a vast amount of information into such a student-friendly short textbook.

Chapter 13 deals with nanomaterials such as minerals and clays and then goes on to discuss natural biomaterials such as, exoskeletons and chitin. This was really appreciated by the reader by way of presenting a balanced portrait of nanoscience using biological and geological examples to prove that nanoscience is not just something invented in the late 20th century. This treatment also serves to send an important but subtle message to the reader. The notions of photonic crystals and photonic band gaps as applied to butterfly wing scales and the scansors-setae-spatulae of gecko's feet are two areas that have spawned interest in synthetic nanotechnology and the highlighting to the newcomer that some of the best ideas come from nature itself. Biomolecular nanoscience is reserved for the end of the book (chapter 14.2) and includes areas of cutting-edge pharmacological and biochemical research such as cell signalling, ion pumps and ion channels but then this area also refers indirectly to the earlier sections on self-assembled structures mentioned within the book.

There are no glaring errors in the book, in terms of accuracy and the content is excellent, as already mentioned. The sections on surfactants and micelles (11.1.4) and Langmuir-Blodgett films (12.1.1) were scrutinised very much by the reviewer, since these topics relate to the personal subject area of expertise and specialist knowledge. The final findings and overall conclusions were that the section was found to be flawless, succinct and of an ideal content for this general text.

Gabor Hornyak (GLH), Joydeep Dutta (JD), Harry Tibbals (HFT) and Anil Rao (AKR)'s book reflects the author group interests[5,6]. Those interests range from manufacturing through engineering to genetics (GLH), clinical and industrialised process testing and systems control (HFT), biophysics and electronics (JD) and endocrinology and systems biology (AKR) and are clearly alluded to in the book. This adds to the value of the text in light of the typical and rather customary positioning of these types of teaching texts. The intended area of potential use for this text is for those graduates embarking on colloid or material science study and research projects[3,4,6,7] and this of course ties up nicely with the backgrounds of the authors. This book would certainly be used by me personally, as a tutor and students for courses of biophysical, medical and biological sciences. Typical applied areas with these themes include pharmaceutical[8] and biochemical aspects[5] of nanotechnology and nanosciences. The text is primarily recommended for entry into the interdisciplinary field with direction towards undergraduate and postgraduate (eg MSc) specialisms[4,7].

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