

The Nano–Micro Interface: Bridging Micro and Nano Worlds

Edited by Hans-Jörg Fecht and Matthias Werner.

Wiley-VCH, Weinheim 2004. 351 pp., hardcover € 99.00.—ISBN 3527309780

By its very title, *Nano-Micro Interface: Bridging Micro and Nano Worlds* is a timely book for the field of nanotechnology. Since researchers can make microscale objects nanoscale (the top-down approach) as well as atomic and molecular species nanoscale (the bottom-up approach) are there applications in nanoscience and technology that can benefit, or be revolutionized, by combining both approaches? This book addresses this question primarily from the perspective of miniaturization, or how microtechnologies (e.g., micromachining, microfabrication, chemical polishing) can impact nanotechnology. This “bridge” is not as strong from the bottom-up, however, although significant research progress has been made in this direction. How nanometer-scale building blocks (e.g., nanowires, nanotubes, DNA) can be assembled, or be integrated with microtechnology, receives little attention. Presentation-wise, the design and layout of the book are excellent. The table of contents is well organized; each chapter is divided into small, readable sections; and the chapter titles are descriptive. The best audience for this book would be scientists and engineers interested in nanotechnology and its economic history, and faculty and graduate students interested in applications at the nano/micro length scales.

Perhaps the most unusual, and arguably the strongest, portion of this book is the first 80 pages, which provides a historical background for when and how different countries initiated research funding for nanotechnology. Another useful inclusion is a primer on start-up and small businesses and the



necessary steps for how nanotechnology can make an impact in the marketplace. Based on these perspectives alone, a strong case could be made that this book is a significant contribution, well worth reading. The first section provides social and economic context for the science and applications of nanotechnology that are covered in the subsequent chapters.

The remaining two sections of the book are organized into *Fundamentals and Technology* and *Applications*. These sections are composed of well-written chapters that cover a broad range of topics from the impact of nanoscience on heterogeneous catalysis to microfluidics and lab-on-a-chip technology to bio-inspired antireflective surfaces. Although each individual chapter provides a short introduction to the subject area, these paragraphs are not always inclusive of the current advances to date (end of 2004). The chapters could be more useful to readers either if the articles functioned more as minireviews (including figures) instead of summaries of the authors' own work or if larger portions of the chapters were dedicated specifically to the nano–micro interface. To complement the existing chapters, the topics of nanoscale fabrication and assembly methods might have been included.

What really would have made this book a “must have” is a forward-looking chapter (or two) devoted to the evaluation of creative strategies that can *practically* connect nanomaterials to the macroscale world. Is the best approach at the interface of top-down and bottom-up or would an entirely new paradigm be more effective? One example is device applications (e.g., transistors, light-emitting diodes, sensors) based on nanostructures, in which the academic standard is to wire-up these nanostructures one (or several) at a time using micrometer-sized leads (microfabrication meets nanomaterials). But is this method suited for creating massively parallel arrays of devices that can be addressed individually? The exploration and development of new ideas for this and other areas would be a shot

in the arm for progress in nanotechnology.

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Carbon Nanotubes

By Stefanie Reich, Christian Thomsen and Janina Maultzsch.

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Not many materials have generated such hype in science in recent years as carbon nanotubes. This is to some extent due to the fact that nanotubes might be applicable in many kinds of (nano)technological devices. For example, it is discussed in *Carbon Nanotubes* that they could be useful for the reinforcement of materials, as emitters in display technology, or even as nanoscopic transistors in electronic devices—but this is not the subject of this book. In contrast, this book is devoted to the basic physical principles of carbon nanotubes that lead to their remarkable material properties. As such, it is an excellent physical textbook, which explains several fundamental aspects of one-dimensional nanoscopic systems on the basis of carbon nanotubes, and then leads the reader to the frontiers of fundamental science in this field.

The main focus of the book is to develop a detailed understanding of the relationship between the structure of the carbon nanotubes and the evolving electrical, optical, and vibrational properties. Therefore, the topic of the first chapter “Structure and Symmetry” is a central issue throughout the whole

