

Book Review

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Nanoparticles: from theory to applicationWiley-VCH, 2004,
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The opportunities to develop new technologies based on the characteristic changes of material properties on the nanoscale have fueled the development of 'nanoscience' to become one of the most vibrant fields of current research. In this context, the evolution of the field of nanoparticle research from mostly chemistry-focused research on the synthetic and structural aspects of nanoclusters to a diverse field covering new phenomena in quantum mechanics and optical physics, as well as novel approaches in medicine and biotechnology, is particularly impressive. One of the biggest challenges for researchers in this rapidly moving diverse field is that of surveying the vast amount of information and new developments, identifying current scientific and engineering needs, and determining appropriate experimental strategies. To facilitate synergism between the different disciplines, it is important to have available an overall summary and review on the subject that is sufficiently detailed to provide a broad coverage and insight into the area and which, at the same time, is easily readable for the wide audience of those who need to know about the nature of the field and its future prospects.

The book *Nanoparticles: From Theory to Application* contributes to fulfilling this need by providing the reader with an urgently needed compilation of up-to-date reviews of the various fields in nanoparticle research. The book contains seven chapters, two of which (Chapters 1 and 7) provide a readable introduction to the development and current status of the field of nanoscience, as well as its future

prospects. The intervening chapters are a sequence of self-contained monographs, each written by authorities in the respective field, that address the fundamental background, synthetic strategies and recent developments in the field. Chapter 2 represents a well-written introduction to the fundamental properties of matter on the nanoscale (covering both semiconductors and metals), as well as a survey of the most striking physical phenomena that are observed for metal and semiconductor nanoparticles and possible applications that derive from it. This chapter will be very useful to a wide readership, as it provides a comprehensive, easy-to-read treatment of the basic physical concepts of low-dimensional systems and their relation to experimental observation. Chapter 3 is devoted to synthetic strategies for the preparation of nanoparticles and separately discusses the synthesis and characterization of Group 2–4 and 3–5 semiconductors, as well as Group 1b–6 and metal nanoparticles. Each subchapter is self-contained and detailed, providing technical sketches, as well as tips for the laboratory work, thus enabling the reader to perform the experiments described. Because of its technical nature, this chapter addresses readers with a solid chemical background, but it will be useful to everybody interested in synthesizing nanoparticles. Chapter 4 presents various approaches to organizing semiconductor and metal nanoparticles into one-, two-, and three-dimensional arrangements. Both self-organization and 'nano-engineering' strategies are discussed, and 50 figures illustrate the current state of the art at the time of writing (with references dating to 2003). Chapter 5 discusses physical properties of nanoparticles, focusing on optical properties of Group 3–5 and 2–6 nanoparticles, optical and thermal properties of Group 1b–6 and electrical properties of metal nanoparticles. The examples that are discussed in the chapter adequately represent current research,

and in their complexity go beyond the more introductory second chapter. Unfortunately, because of the wealth of systems that are discussed, and probably due to different authors contributing the different subsections, there are multiple redundancies within the chapter. For the physicist, the lack of quantitative physical relationships in the first part of the chapter will render the discussion rather superficial. Chapter 6 highlights biomaterial–nanoparticle hybrid systems, covering synthetic strategies and recent applications. This chapter should be useful to a broad readership, as it explains most of the notions and basic ideas encountered in the recent literature on biomaterial–nanoparticle composites, as well as the challenges encountered when merging the biological and inorganic worlds.

Overall, the book is well formed, with each chapter underpinned by reference to recent literature, and manifold high-quality figures illustrate the material. The book succeeds in conveying important developments in the field, as well as providing useful information for solving actual research problems. Unfortunately, a discussion of the very important field of magnetic nanomaterials is completely missing. Given the rather general title 'Nanoparticles' this is a serious flaw. In my opinion, interchanging Chapters 4 and 5 would improve the logic of the text. Priced at around €170, this book will be not for students; rather, it is addressing practitioners in industry, as well as university libraries. I definitely recommend this text.

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