

# Preface

In the heart of so-called nanotechnology, one can engineer the finest building blocks of atoms and molecules to achieve outstanding properties and qualities of materials and create nanostructured materials or nanomaterials. Nanomaterials include atomic clusters, layered films, filamentary structures, and bulk nanomaterials. More precisely nanomaterials are materials with at least one dimension in the range of 1–100 nm. They consist of atoms or clusters of single or mixed elements, all packed together to form a nanoparticle or at a larger scale, a bulk nanomaterial and in a special case a nanocomposite.

The development of nanomaterials opens the possibility for new materials with outstanding properties compared to classical engineering materials. These materials can find applications in different fields such as medical treatment or structural mechanics. This monograph focuses on two major groups of nanomaterials, i.e., nanoparticles and nanocomposites. Nanoparticles, for example in the form of hollow particles, allow for new possibilities in drug delivery. Different aspects of nanoparticles ranging from manufacturing to modeling and simulation are covered. Nanocomposite materials are formed by mixing two or more dissimilar materials at the nanoscale in order to control and develop new and improved structures and properties. The properties of nanocomposites depend not only on the individual components used but also on the morphology and the interfacial characteristics. Nanocomposite coatings and materials are one of the most exciting and fastest growing areas of research and novel properties being continuously developed which were previously unknown in the constituent materials. Thus, the second part of this monograph gives an overview on the latest developments in the area of composites based on nanomaterials.

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Materials

Novel Principles and Techniques

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