Preface

Nanotechnologies are designed to ensure control and manipulation of matter at the nanoscale, using properties of physical and chemical phenomena that occur at this scale. Many technologies of the past, empirically discovered, have been understood and brought back to structures and mechanisms at the nanometer scale; it is possible to realize materials with tailored properties and high performance through the choice and control of their nanoscale constituents. The combination of methods and instruments with self-assembly processes on the atomic scale provides an impressive range of new opportunities for welding pieces of chemistry and biology to artificial structures made by the man. The ability to create new objects appears therefore unlimited.

Manufacturing procedures of materials and nanostructures depend on the nature of the elementary objects of nanometer size that make them, therefore the nanostructures can be classified on the basis of their elementary components. In order to have an economic impact, the basic science of nanotechnology requires continuous development and improvement, in particular regarding the practical production of useful products. We see an increase of a dedicated knowledge, aiming towards specific application domains, designing nanomaterials with specific properties, which can be tuned and tailored by means of external actions.

Nanotechnology means also to obtain the control of how materials are formed and of their properties at the scale of atoms and molecules. This new skill promises important benefits for all sectors that use materials, offering many opportunities for the development of product and the reduction of waste.

The new knowledge delivered by nanotechnology can be applied everywhere, from lubrication to coatings, from storage of energy to fuel cells and catalysis, from nanoelectronics to biomaterials, from environment to medicine.

This requires an understanding of the way in which small changes affect macroscopic properties, and the ability to reproduce it in controlled and reliable manner. As we evaluate the benefits of new materials, we must at the same time openly and honestly assess the potential risks that their new properties may lead, i.e. an integrated and responsible approach to nanotechnology. Therefore the ability to rationally design and manufacture new features is one of the most interesting challenges of the research about nanoscale materials.

This book is an interesting collection of information related to the science of tailored nanostructures. It presents results about nano-composites containing nano-fillers, nanostructures for sensors applications, carbon nanotubes for pressure and strain measurements, features of polymer nanocomposites, particular nanoparticles for infrared plasmonic applications, comparison of quantum dots with dyes in sensitized solar cells, nanotechnology and nanomaterials for energy applications, study of organic solar cells cross-section by EDS, welded metal nanowire networks for transparent electrode, basics and applications of nanopowders synthesized by solution combustion method, smart materials with future application in drug delivery.

The book is helpful for everyone who wishes to deepen issues relating to the science of tailored nanostructures. I hope that it provides adequate scientific insights, stimulating interesting debates and strengthening knowledge about the world of tailored nanostructures.

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