Book Review

Nanoscience and Nanoengineering: Advances and Application
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‘Nanoscience and Nanoengineering: Advances and Application’ is a comprehensive encyclopedic monograph of the achievements of the research in nanotechnology oriented towards the application in medicine and biomedical engineering. It consists of an introduction and six sections. The introduction is a brief history of nanoscience and nanoengineering. Section I ‘Nanoelectronics’ has two chapters (2 and 3). In chapter 2 the authors present the nanoelectromechanical system (NEMS) processes and devices. NEMS processes include top-down semiconductor processes, microelectromechanical systems (MEMS) processes, lithography and other patterning techniques, and nanowire direct assembly. Among NEMS devices there are the NEMS cantilever-based resonator, and the electromechanical resonator used in electronics as oscillator, receiver, filter and mixer. The biomedical applications of MEMS/NEMS include drug discovery, diagnosis and therapies. Chapter 3 consists of a presentation on the growth of GaAs/GaAsSb axial nanowire (NW) by molecular beam epitaxy (MBE). The most commonly used mechanism is the vapor–liquid–solid (VLS) mechanism. Photoluminescence and Raman spectroscopy are two powerful tools for the investigation of the optical properties of NWs.

Section II ‘Nanobio’ has three chapters (4, 5 and 6). In chapter 4 the authors present the application of micro/nanotechnology to the design and control of neutral interfaces, including regenerative microchannel-based electrode interface (ReME). In chapter 5 the authors describe the general operation of four types of microscopy tools used in nanoscience and nanoeengineering research: atomic force microscopy (AFM), transmission electron microscopy (TEM), scanning electron microscopy (SEM) and helium ion microscopy (HIM). The content of chapter 6 is a presentation on the biological nanostructures of insect cuticles: their composition and formation, nanoscale structure, optical properties, hydrophobicity and superhydrophobicity etc.

Section III ‘Nanomedicine’ has three chapters (7, 8 and 9). Chapter 7 is a review on current systems for imaging and therapeutics: quantum dots (QDs) and different nanoparticles (NPs) such as metallic NPs, in particular gold NPs, iron oxide NPs, upconverting NPs and nonmetal-based NPs (liposomes, polymers, dendrimers and micelles). The content of chapter 8 is a presentation on the nanodevices and systems for clinical diagnostics: biomarkers, microfluidics and Lab-on-Chip (LoC), nanotechnology-based transduction and biosensors, and NEMS/MEMS biosensors.

The efficient uses of fullerenes derivative (FD) in nanomedicine are presented in chapter 9—for therapeutics: the affect of FDs to mast cell (MC)-driven, MCs and peripheral blood basophils (PBBa) in asthma, MCs in arthritis etc; for diagnostics: magnetic resonance imaging contrast agents as diagnostics for atherosclerotic plaque and as theranostics for brain cancer.

Section IV ‘Nanomodeling’ has two chapters (10 and 11). The content of chapter 10 is the modeling at nanoscale: material chemistry level modeling in processing and mechanics of engineered materials with the use of molecular dynamics (MD)—a combination of molecular modeling, computer simulation and statistical mechanics. Chapter 11 is a presentation of the computational modeling of nano-bio interfaces, with the application to polymer micellar nanocarriers for drug delivery.

Section V ‘Nanolithography and Nanofabrication’ has two chapters (12 and 13). Chapter 12 is a presentation on properties of multiscale glass fiber-reinforced composite developed from epoxy resin containing electrospun glass nanofibers: interlaminar shear strength, flexural properties, reinforcement mechanism, impact property, tensile properties. The content of chapter 13 is the design and fabrication of template self-assembly for nanolithography and nanofabrication. The examples are: colloids and nanoparticles, block copolymers and DNA nanosstructures.

Section VI ‘Nanosafety’ has two chapters (14 and 15). Chapter 14 is a comprehensive presentation on the toxicity of engineered nanomaterials (ENs): the dependence of toxicity on EN characteristics, the cyto- and genotoxicity of ENs. In chapter 15 the authors discuss the safety of nanomaterials. The nanotoxicological classification systems and the classification of nanowaste streams are presented.

The monograph was written by a collective of competent specialists and would be very useful for readers with wide-ranging scientific interests as well as for the organizers of clinics and enterprises producing medical equipment and drugs.

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