

Editorial

Nanostructured Materials for Biomedical Applications

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Current developments in nanostructured materials and nanotechnology will have profound impact in many areas such as energy technologies and biomedical applications. These include solar cells, energy storage, environmental control, tissue engineering, bioprobe, biomarking, cancer diagnosis, cancer therapy, and drug delivery. Many critical issues in nanostructured materials, particularly their applications in biomedicine must be addressed before clinical applications. Some of the key issues in biomedicine, deal with bioactivity, compatibility, toxicity, and nano-bio interfacial properties. In the biomedical applications, traditional materials science and engineering face new challenges in the synthesis and microstructure development since the requirements for general materials must be based on special medical needs. The most fascinating development in nano-biomedicine is to be found in biomedical diagnosis and treatment, and involves the direct use of nanomaterials within a biological system. Today, in vivo imaging by fluorescent nanoparticles such as quantum dots is progressing rapidly; and cell targeting via surface functionalized nanoparticles is undergoing animal tests and should be available within a few years. Localized drug delivery for tumor treatment by specially designed nanoscale systems is also being tested. Up to now, investigators have attempted to develop particular nanoscaled systems with surface functionalized groups that are able to conjugate with a variety of biological molecules including DNA, RNA, and viruses. These new technologies will also have significant potential in environmental monitoring, bio-probe, and quantitative virus detection. The challenge for future nano-biomedicine concerns how nanoparticles interface with biological systems with high biodegradability and minimum toxicity. We need to know how to design and synthesize nanoscale structures for a variety of medical and biological applications.

This special issue summarizes the most recent research and developments in nanostructured materials and their applications in a variety of applications. The articles in this issue address the critical problems in nanomaterials synthesis, structure, and properties. The special issue devotes several articles to various aspects of nanomaterials and biomedical applications. Detailed experimental procedures are presented in conjunction with biomedical considerations. Importantly, these articles give overviews of nanoscience and technology and the basic information relevant to the synthesis of nanomaterials. As nanoscience advances rapidly, extensive research activities have been emphasized on the design and development of new nanomaterials. Due to special requirements in both engineering and biomedicine, the materials developments have been directed to solving key problems that are different from those of traditional materials. For instance, medical diagnosis requires multifunctionality such that imaging and drug delivery are preferred to take place at the same time. Therefore, novel nanomaterials and technologies are needed for dealing with specific medical issues. Another critical issue deals with the nano- and biointerfaces involving nanoparticle surface functionalization. This is particularly important in nano-biocomposites. Functional groups must be deposited on the nanoparticles surfaces in order to conjugate biological molecules for purpose of targeting, virus detection, and drug delivery.

We intend this special issue of Journal of Nanomaterials to provide up-to-date information in the field of nanostructured materials and applications in nano-biomedicine. The focus of the special issue is on the basic concepts and recent developments in nanomaterials and related fields. This special issue covers a wide range of nanomaterials research for a variety of applications including biomedicine.

Fundamental understanding of basic mechanisms on nanostructures and biomedical processes related to the unique nanoscale properties of the materials will be the highlight of this special issue. All authors are prominent researchers and have extensive research experience in diverse fields of materials and biomedical sciences. We are grateful to them for these important contributions from which, we trust, many readers will benefit significantly.

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