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Nanomaterials and polymer nanocomposites for multifunctional applications

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The future progress in the field of science, technology, engineering, medicine, etc., depends on the new knowledge-based nanostructured materials. Nanostructured semiconductors and metals are gaining a wide attention in nanotechnology as they exhibit size dependent electronic and optical properties. Metal nanoparticles have been proposed as building blocks in the design of optoelectronic devices. The noble metal nanoparticles such as Ag, Au and Cu have shown wide range of applications. Nano structuring of electrode materials offers enticing new prospects for discovery and development of breakthrough materials and transforming energy conversion and storage concepts. Recently, it is observed that Li-ion battery performance depends upon the nanoscale morphology of the active materials (cathode and anode). Nano-sized conducting or electroactive polymers are also found to be the potential candidates for technological applications in electronic devices and as sensors. Nanocomposites are a new class of materials in which the dimension of one of the dispersed particles occurred at the nanometer scale thus, in polymer-metal nanocomposites, metal nanoparticles are dispersed in the polymer matrix at the nanometer scale. These materials are of current interest because of their multi-functionality, ease of process-ability, potential for large-scale manufacturing, significantly lighter than metals, ease of synthesis when compared to the oxide/noble metal multi-layers. By combining properties from the inorganic and the polymer components, they offer new performance hence, making them interesting functional materials with the possibility of novel mechanical, electronic or chemical behavior. Small changes of the configuration of the composite concerning the metal amount as well as the size and the shape of the nanoparticles can lead to dramatic changes in the electrical and optical properties of the material. Therefore, to obtain nanocomposites for technological applications, the size, the shape and the amount of fillers must be carefully controlled. This presentation is attempted to summarize preparation methods, characterization and multifunctional applications of nanostructured materials and polymer nanocomposites.

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