P-211

Fabrication of Chitosan-Oligosiloxane Hybrid Materials by Cross-linking with Sol-Gel Derived Functionalized Oligosiloxane

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Development of the advanced materials from the combination of macromolecules with inorganic species has attracted much attention. Chitosan is one of the most attractive macromolecules because of their unique properties such as hydrophilic and adsorption properties. However, their disadvantages (low mechanical and thermal properties) restrict the practical applications. Thus, many researchers have tried to enhance the characteristics either by cross-linking of chitosan with functionalized polymer such as epoxy, methacryl and isocyanate groups. In this study, the chitosan-oligosiloxane hybrid materials (chitosan hybrimer) were fabricated by cross-linking chitosan chain with the functionalized oligosiloxane which was synthesized by simple sol-gel reaction between functionalized alkoxysilanes. Amine group of the chitosan is chemically bonded with functional groups of the oligosiloxane for cross-linking of the chitosan chains. The fabricated chitosan hybrimer consists of siloxane nano clusters distribution in the chitosan networks. Through the control of the portion of the inorganic networks and organic functional groups could be improved the properties of the chitosan. Chitosan hybrimer showed higher thermal stability, and improved mechanical and swelling characteristics to be applied practically in various fields.

Keywords: sol-gel, chitosan, oligosiloxane, hybrid materials

P-212

Self-Assembly of Ordered Eu:Y2O3 Nanoparticle/Silica Mesophase Thin Film

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Rare earth nanoparticles with a narrow size distribution and high luminescent efficiencies are attractive to used as phosphors in display and lighting technologies because of their intensive, sharp emission and high thermal stability. In particular, the yttrium oxide nanoparticles co-doped with trivalent europium ions exhibit red luminescence and always are used as red phosphors. In this paper, the Eu:Y2O3 nanoparticles were synthesis using oleic acid as surfactant and oleylamine as solvent. Then, the nanoparticles were self-assembled into mesophase silicate thin film to form ordered nanoparticle arrays. The mesophase structure was confirmed by X-ray diffraction and transmission electron microscopy. The physical properties resulting from the coupling of adjacent nanoparticles within the ordered arrays were study using luminescence spectra. The mesophase silicate thin film incorporated with Eu:Y2O3 nanoparticles provide a promising platforms to utilize luminescent nanoparticle arrays.

Keywords: rare earth, self-assembly, Eu:Y2O3, mesostructure