

Current Researches on TiO₂-based Nanocomposites and Applications

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Abstract

Current researches on TiO₂-based nanocomposite materials are introduced. Low-dimensional TiO₂ structures were successfully synthesized by hydrothermal method starting from natural mineral and their composites were utilized as a potential material in practical optical applications. Nanocomposite films of electrospun N-doped TiO₂ nanofibers and TiO₂ nanoparticles Degussa (P25) were utilized as working electrode of typical dye-sensitized solar cells (DSSCs). The energy conversion efficiency (η) of the device tended to increase with increasing calcined temperature of the fibers with specific nanofiber loading content, indicating the significant enhancement in the device performance by the incorporation of the nanofibers. TiO₂/V₂O₅ nanocomposites were synthesized by sonochemical and hydrothermal process and then mixed with conventional mechanical milling process. As-prepared composites was utilized as energy storage material. The significant variation of charge storage properties of the composites under ultraviolet irradiation were achieved by varying V₂O₅ content in the composite. Next, synthesis of photosensitive Ag-doped SiO₂/TiO₂ hybrid composite films using for fabrication of the photo patterning by photo mask lithography technique is represented. The optical properties in the visible region of the photosensitive hybrid film were enhanced by the incorporation of Ag nanoparticles into the hybrid films. The fabrication of optical element utilizing as-prepared thin films was carried out by photo masking technique. Finally, TiO₂-based/PMMA/R6G composite thin films were prepared and employed as an effective light scattering layer in light-guided plate and optical concentrator applications.