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Transparent light-guided plates based on TiO₂/Rhodamine6G composite thin films

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Abstract

Transparent light-guided plates for solar cell application from nano titanium dioxide (TiO₂), rhodamine 6G (R6G) and poly methyl methacrylate (PMMA) composite films were prepared by spin coating technique on glass substrates. Effects of the annealing temperatures and times on the formation of the TiO₂ crystalline film that acted as an initial model for the light-scattered layer in solar concentrators were investigated. Physical and morphological properties of the TiO₂ film were characterized by X-ray diffraction (XRD), scanning electron microscope (SEM) and atomic force microscope (AFM). After the annealing process, TiO₂ films obviously formed in the anatase phase with the enlarged crystallite size and the high rough surface by the increase of the annealing temperature and the treating time. Meanwhile, the optical properties of the TiO₂ thin films were analyzed via a UV-Vis spectrophotometer. The transparency of the film was significantly affected by the annealing temperature and the aging time. Moreover, the light scattering performance of the TiO₂ layer cooperated with Rhodamine6G in the PMMA matrix as the preliminary model of light-guide plate was investigated by fluorescence spectra. Strong light emission from the light-guide plate could be significantly enhanced by the existence of the TiO₂ crystalline layer acting as the scattering film. Optimized performance of the planar light-guide plate incorporated with Rhodamine6G dye and the light-scattered TiO₂ layer was obtained from the film annealed at 500°C for 5 h.

Keywords— Annealing temperature, Solar concentrator, Spin coating, Titanium dioxide.

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