2012, Volume 7, Number 7, p. 696-700

Nanostructured Polymer/CdS Photoluminescent Thin Films

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https://doi.org/10.1166/jno.2012.1420

Abstract

Polymer fluorescent nanocomposite materials are of interest for practical applications as well as from the point of view of understanding the mechanisms of carrier transport, energy transfer, recombination and luminescence. We present here experimental results on polymer-based nanocomposite material made of styrene with butyl methacrylate (SBMA) (1:1), isothiocyanato-chalcone (ITCC) and inorganic semiconductor CdS. The concentration of CdS semiconductor nanoparticles was varied in the range 0–20%. Thin film composite samples have been characterized by UV-VIS absorption, photoluminescence spectroscopy, X-ray diffraction, and atomic force microscopy (AFM). Examination of thin films by AFM shows that the surface of the composite can be described as quasi-ordered structure consisting of conic-shaped elements with 25–50 nm height. The average CdS particle size estimated from the X-ray diffraction pattern correlates with the corresponding value obtained from the UV-VIS absorption spectrum, and it was found to vary in the range from 9 to 17 nm. The PL emission spectra have been registered at room temperature. The nanocomposite samples exhibit a strong photoluminescence (PL) band in the range 400–650 nm under the excitation of UV nitrogen laser beam = 337 nm, with the PL maximum varying slightly in dependence of the concentration of CdS nanoparticles. The observed luminescence is supposed to originate from the radiative recombination involving various donor and acceptor centers.