Photoluminescent nanocomposite materials based on SBMA copolymer and *CdS*

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Abstract

We present experimental results on copolymer-based nanocomposite made of styrene with butyl methacrylate (SBMA) (1:1) and inorganic semiconductor *CdS*. Thin film composite samples have been characterized by UV-Vis absorption and photoluminescent spectroscopy, as well as by transmission electron microscopy. Transmission electron microscope (TEM) examination confirms a relatively narrow distribution of *CdS* nanoclusters in the SBMA matrix, which covers the range 2-10 nm. On the other side, the average *CdS* particles size estimated from the position of first excitonic peak in the UV-Vis absorption spectrum was found to be 2.8 nm and 4.4 nm for two samples with different duration of thermal treatment, which is in good agreement with photoluminescence (PL) experimental data. The PL spectrum for *CdS* nanocrystals is dominated by near-band-edge emission. The relatively narrow line width (40-45 nm) of the main PL band suggests the nanoparticles having narrow size distribution. On the other side, relatively low PL emission from surface trap states at longer wavelengths were observed in the region 500-750 nm indicating on recombination on defects.

Key words: nanocomposite, polymer matrix, photoluminescence, exciton

1. Introduction

Nanocomposite (NC) materials have attracted attention in both fundamental studies as well as technical applications [1-5]. This is basically due to the possibility of tuning of their physical and chemical parameters through varying the size of incorporated nanoparticles. The polymers are widely used in the technology of preparation of nanocomposite materials in the quality of matrix that serves for assembling the nanoparticles into clusters and for avoiding the agglomeration, as a matrix in self-assembling nanomaterials that induce ordering and anisotropic orientation, as well as acting as a functional element [1,4,6]. The polymer-inorganic nanocomposite materials possess important advantages, among them, mechanical strength, a simple technology and low cost. They are characterized by ease of processing and control of the shape of materials, and can be prepared by different methods of spin-coating, casting, extrusion, etc. [6-11].

NC materials based on inorganic semiconductors incorporated in polymeric or in glass matrix exhibit advanced optical properties and stability during the long time exploitation in comparison to purely polymer-made devices [1,6,10]. Because of the quantum confinement of electrons and photons inorganic semiconductor nanoparticles used in the nanocomposites exhibit physical and chemical properties which are different from the properties of corresponding bulk materials, and this can be used for fine tuning of the properties of nanocomposite structures [2,7,12]. Among various inorganic nanoparticles *CdS* have received great attention because of their attractive properties and potential for application in photonics and optoelectronics [13-17]. Further investigation of the polymer-based nanocomposites are equally important for understanding the mechanism of transport and photoluminescence in these materials, developing of materials with advanced characteristics, as well as for possible minimizing the toxicity of *Cd*-based materials.

In the present work we report preparation and characterization of photoluminescent polymer-inorganic nanocomposite thin films based on copolymer styrene and butylmethacrylate (SBMA) (1:1) and inorganic semiconductor *CdS*.

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