INFLUENCE OF GOLD NANOPARTICLES ON THE PROPERTIES OF SILICON OXIDE/POLYMER SYSTEMS

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Abstract

Metal–polymer nanocomposites are investigated as promising photonic materials (for optical data storage, optical waveguides, sensors, electrochromic smart windows, solid-state lasers, screen displays, etc.). Properties of nanocomposites depends on the sizes of the particles, polymer and the manner in which systems are organized to form structures. Some metal nanoparticles dispersed in a dielectric medium possess an unique effect called surface plasmon resonance. Among them the gold-nanoparticles (GNP) are well known for their attractive chemical and optical properties. These features allows to create nanocomposites with unique properties for various applications in photonics.

In work transparent low-scattering nanocomposites were developed based on UV-curable acrylate and SiO2 nanoparticles (10 wt. %) plus gold-nanoparticles. The aggregation of gold nanoparticles was prevented using the appropriate monomers and introduction of SiO2 nanoparticles during the preparation of the composites.

Properties of nanocomposites were investigated in dependence of concentration of nanoparticles and treatment conditions. The plasmon resonance of Au nanoparticles was observed after UV curing for all samples. Introduction GNP (concentration up to 0.5 wt. %). causes an increase in the Vickers hardness of all the composites. Influence of GNP on optical parameters and polymerization processes were investigated using surface plasmon resonance measurements, AFM, TEM as well as Raman scattering.

Using these materials diffraction gratings with efficiency up to 70% (layer thickness - 60 um) were obtained by method of holographic recording without any additional treatment.

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