6th International Conference on Nanotechnologies and Biomedical Engineering Proceedings of ICNBME-2023, September 20–23, 2023, Chisinau, Moldova - Volume 1: Nanotechnologies and Nano-biomaterials for Applications in Medicine

Nanocomposite Films Based on Photosensitive Azopolymer with Gold Nanoparticles: Synthesis, Film Deposition, Diffractive Optical Elements Recording and Characterization

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https://doi.org/10.1007/978-3-031-42775-6_7

Abstract

In the present study, the photosensitive nanocomposite was fabricated based on azopolymer and Au nanoparticles (Azo-Au NPs). For the first time, the synthesized polymeric poly-N-(2,3-epoxypropyl) carbazole with azo dye SY 3 (PEPC-co-SY 3) was the basis of the nanocomposite. As a medium for polarization holographic recording, thin films of a nanocomposite a number of concentrations deposited on a glass slide by the rod coating method were studied. Diffraction gratings were recorded on films by direct and single-stage polarization holography. For recording, the polarization states of the beams were P-P, S-S, and ± 45 º and left-right circular. In nanocomposites, the optical path of the beam is defined by the summary changes in surface topography and refractive index. The periodically modulated polarization/amplitude interference patterns produced by the gratings were investigated by in situ measurements of the diffraction efficiency (DE) kinetics in the first diffraction order when the DE saturation value was reached. A maximum DE value of 35% was obtained for the nanocomposite PEPC-co-SY3 with 0.0006mg/ml of Au NPs. The gratings were studied using a polarization-sensitive digital holographic microscope to reveal their optical phase features using the full-field method. The surface relief was measured by AFM. A comparison of the behavior of azopolymer films during the recording of surface relief gratings with and without Au NPs was carried out. The results of diffraction gratings recording by the polarization holography method

are presented, confirming the possibility of recording not only amplitude and phase of light, as in scalar holography, but also polarization states.

Keywords: photosensitive nanocomposites, azopolymers, nanoparticles, thin films

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