Nanocomposites and nanomaterials

The properties of volume polymer/Ag nanoparticles gratings formed by holographic method

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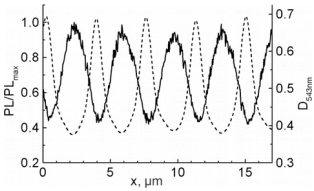
The properties of gratings with Λ = 3.5 μm formed by Ag nanoparticles (Ag NPs) periodic distribution in polymer matrix were studied. It was established that the grating was formed due to the volume modulation of NPs and polymer concentration and also due to surface relief appearance. It was found that the Ag NPs with size >1 nm were generated in the minima of interference pattern. The Ag NPs were almost absent behind the zones of its prevailing localization. The grating surface relief profile was non-sinusoidal. The atom-force and confocal microscopy data matching was shown that the relief depressions correspond to the absorption maximum in the structure, i.e. the Ag NPs are consists in the relief depressions.



The luminescence in the grating strokes under excitation in different spectral ranges was observed. The luminescence intensity spatial distribution (solid line in figure) was counter-phase relative to the absorption distribution of the exciting light (dotted line in figure).

The grating luminescence spectra were transformed during post-processing. The photoinitiating system luminescence bands with maxima 445 nm and 450 nm were observed in the spectrum after recording. We observed the degradation of these spectral bands and the appearance of a new band with a maximum at 500 nm, which belong to radiation of silver clusters with a size <1 nm. An investigation of the grating luminescence spectrum showed that the structure of the spectrum remains constant in polymer and Ag-enriched strokes, while the luminescence intensity is substantially reduced in strokes containing NPs. The luminescence intensity increases for Ag clusters with a size <1 nm. It can be concluded that the grating was formed by periodic distribution of polymer with NPs of a different size: of about 5 nm, and less than 1 nm. We assume that fast formation of a crosslinked polymer grid in the light areas prevents the creation of Ag-NPs with a size >1 nm.

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