Development of polymer nanocomposites for photonic applications

J. Burunkova[1], G. Alkhalil[1], S. Molnar[2], A. Csik[3], **S. Kokenyesi[2]**,

[1] ITMO University, St. Petersburg, Russia, [2] Institute of Physics, University of Debrecen, Debrecen, Hungary, [3]ATOMKI, Debrecen, Hungary.

kiki@science.unideb.hu, tel.+3652509201

New smart materials and technologies are under intensive research and development worldwide, they should satisfy combined requirements of nanotechnology, nano-electronics, nano-photonics, etc. We were developing such materials at our laboratories as well [1,2].

The aim of the present work was development, selection of light sensitive polymer nanocomposites with combined functionalities, applicable for direct, one step optical recording of certain photonic elements like diffraction gratings, sensor elements on hard or flexible substrates. Multifunctional acrylate-based nanocomposites, which contain oxide, chalcogenide, gold nanoparticles and are sensitive to different laser irradiation at the stage of single step polymerization-optical recording process were investigated. The technology of few monomer matrix-nanoparticles-initiator mixtures was developed for creation of layers used for optical recording. More complex systems based on nanocomposite inserted to porous glass matrix were also created.

Optical stability or sensitivity to photo-induced changes at simple recording-readout processes with low light intensities (mW/cm^2) was measured first. In addition, the optical hardness and threshold intensities for polymerized layers, elements were measured with femto- and nanosecond lasers illumination. Luminescence parameters of proper nanocomposites with rear earth elements were investigated and connected with possible sensor applications of such materials.

These complex measurements resulted data for prototyping, planning parameters of holographic gratings or matrices, waveguides with efficient, tunable amplitude-phase modulation in nanocomposite polymer layers.

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References

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