

## **Hybrid Nanostructures with Magnetic, Luminescent and Conductive Functions for Biomedical Application**

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The polymer-magnetic materials attract a great attention due to their practical application in novel technologies and investigations. Of particular interest is the use of functionalized polymer capsules as drug carriers, microreactors and sensors. Multifunctionality of hybrid nanocomposites may be realized by providing various functions – magnetic, conductive or fluorescent, etc.

In the present work firstly we obtained the hybrid composites with all three functions – magnetic, luminescent and conductive, by modification of the polystyrene-magnetite nanocapsules by luminescent BaZrO<sub>3</sub> nanocrystals and by conducting shell of the polyaniline [1]. Obtaining hybrid composites were characterized by SEM, FTIR, XRD, EDAX analysis and cathodoluminescence (CL). It was found that adsorption of BaZrO<sub>3</sub> nanocrystals on polystyrene (PS) shell of nanoparticles leads to modification of CL spectra of BaZrO<sub>3</sub> with appearance of new bands at  $E = 1.9, 2.15, 2.45, 3.0$  and  $3.96$  eV; a conducting polymer did not affects the shape of CL spectrum. By XRD analysis it is found that modification of luminescence spectra in composites is caused by changing in substructure of nanocrystals under influence of PS matrix: decreasing of lattice parameter for nano-BaZrO<sub>3</sub> in composite; chemical interaction between PS and BaZrO<sub>3</sub> confirmed by FTIR spectra [2]. So, the described modifications of CL spectra can be connected with structural changes of BaZrO<sub>3</sub> nanograins under influence of the PS matrix.

Labelling of capsules by luminescent substances provides a possibility to trace their pathways within a tissue, whereas loading them with magnetic nanoparticles allows manipulation by an external magnetic field gradient. Conductive polymer shell provides a possibility to control the behavior of nanoparticles by an electric field, and track their movements in biological environments. Proposed method of surface modification may be used for developing biosensors and diagnostic methods in medicine.

1. Aksimentyeva O. , Savchyn V. , Dyakonov V. , Demchenko P. , Horbenko Yu. Modification of polymer-magnetic nanoparticles by luminescent and conducting substances // *Molec.Cryst.Liq.Cryst.* – 2014. – Vol. 590. – P. 35–42.
2. Aksimentyeva O. , Savchyn V. , Opaynych I. , Demchenko P. , Horbenko Yu. Effect of polymer matrix on the structure and luminescence properties of barium zirconate nanocrystals // *Chem.Met&Alloys.* – 2013. – Vol. 6. – P. 177–182.