Nanocomposites and nanomaterials

Synthesis and properties of nanoparticles of M-type hexagonal ferrites $Ba_{0.7}Sr_{0.3}Fe_{12-2x}Co_xTi_xO_{19}$

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Nanoscale M-type barium hexaferrites (BHFs) are promising materials for the production of new generation of permanent magnets, high-density data recording and storage systems, various up-to-date microwave devices, etc. M-type BHF nanoparticles can also find different medical applications, for example, for treating septic wounds and chronic periodontitis, as antitumor ferromagnetic implants for embolizing tumor [1] and as hyperthermia inductors using magnetically hard particles [2]. For these applications, it is necessary to obtain weakly-agglomerated single-domain nanoparticles with controlled shape anisotropy, a high level of saturation magnetization (M_S) and controllable coercive force (H_c).

In this study, nanoparticles of M type BHF were obtained by precipitation from solutions and sol-gel method. The study of fractal structure of obtained precipitated precursors allowed to determine the conditions of formation of monodisperse (d ~ 60 nm) weakly-agglomerated nanoparticles of BHF. The possibility to influence the shape of the particles by varying the ratio of gelling agents (citrate acid and ethylene glycol) at sol-gel synthesis have been shown. Nanoparticles of BHF were obtained with the plate- and rod-like shape anisotropy.

It has been shown that heterovalent substitution in the cation sublattice of BHF allow to change the value of H_c from 150 to 5400 Oe. This indicates the prospect of resulting M-type BHF nanoparticles for different applications.

1. *A.M. Granov et al.,* The role of dispersive medium in antitumor effect of ferromagnetic implant // Med. Academ. Journal – 2013 – **13**, N2 – P. 33-38.
2. *Bronislav E. Kashevsky et al*., Magnetic hyperthermia with hard-magnetic nanoparticles // J. Magn.Magn. Mat. – 2015 - **380**- P. 335–340.