Nanocomposites and nanomaterials

Low-field magnetization and effective anisotropy of core-shell ferrite nanoparticles

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Magnetic nanoparticles have been used in a number of important technological and medical applications [1,2]. Fabrication of core-shell magnetic nanoparticles may open a way to achieve advanced magnetic characteristics and ensure their tunability. However, the progress in this direction is hindered by a lack of reliable and predictive tools to optimize the nanoparticle parameters, in particular to customize their magnetic anisotropy.

In this paper, low-field magnetization is analyzed for $M_1Fe_2O_4/M_2Fe_2O_4$ (M_1, M_2 = Fe, Co) core-shell nanoparticles [1]. The approach developed in [2] is employed to simulate temperature behavior of magnetization and extract the values of effective anisotropy constant K_{eff}. It is shown that both the K_{eff} value and features of its temperature dependence can be purposely tuned by varying the composition and size of the nanoparticle components.

The results obtained are useful for optimizing and tailoring the parameters of core-shell spinel ferrite magnetic nanoparticles for their use in a number of technological and medical applications.

1. *Yelenich O.V., Solopan S.O, et al.* Synthesis and properties of MFe_2O_4 (M = Fe, Co) nanoparticles and core-shell structures // Sol St Sci. - 2015. - **46**. - P. 19-26.
2. *Zhang Q., Castellanos-Rubio I., et al.* Model driven optimization of magnetic anisotropy of exchange-coupled core-shell ferrite nanoparticles for maximal hysteretic loss // Chem Mater. - 2015. - **27**. - P. 7380-7387.