Nanocompounds and nanomaterials

Determination of superparamagnetic nanoparticles size distribution from nonlinear magnetic susceptibility measurement

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Among different applications of biocompatible magnetic nanoparticles in biomedical technologies are the cell separation, immunoassay, magnetic resonance imaging (MRI), drug and gene target delivery, hyperthermia therapy etc. [1]. Most of theme requires that particles are small enough to have the superparamagnetic properties. But nanoparticles agglomerate very easily. That's why a search for new methods of fabrication of well separated superparamagnetic nanoparticles remains relevant. Among different ways of avoiding agglomeration of particle one is the manufacturing of composite particles of the core-shell type [2]. The core of the particles of iron oxide is superparamagnetic and the polymer shell covering it does not allow them to agglomerate. For the practical use of any technology of magnetic nanoparticles fabrication it is important to have instruments to measure their magnetic moment, size and size distribution. A full characterization usually requires a complex of different techniques that is difficult to use in the routine measurements. That's why simple and easy to use express methods are needed. A new method of their size log-normal distribution parameters determination is proposed. Its advantage is the relative simplicity of measurement in limited field range and higher sensitivity for narrow distributions than approximation of magnetization curve. It allows obtaining the size distribution parameters of magnetic core for composite core-shell particles what is more difficult to do by means of electron microscopy or dynamic light scattering techniques.

1. *Gupta A., Gupta M.* Synthesis and surface engineering of iron oxide nanoparticles for biomedical applications. // Biomaterials.-2005.**-26.-**P. 3995-4021.
2. *Gao M., Li W., Zhang Z., Yang B.* Synthesis and Characterization of Superparamagnetic Fe_3O_4@SiO_2 Core-Shell Composite Nanoparticles // World Journal of Cond. Matter Physics.-2011.**-1.** -P. 49-54.