

# Nanocomposites and nanomaterials

## The impact of Fe<sub>3</sub>O<sub>4</sub> nanoparticles size on their magnetic properties

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Magnetism of nanoparticles is an important information carrier and what is especially valuable – can be implemented through industrial means. This action at a distance in combination with a typical of magnetic field penetration into human body tissues opens many new applications, including transport and purposeful delivery of biomagnets to a corresponding biological object [1]. Magnetism can be exhibited in a greater number of new nanomaterials. Actually, it should be possible that non-ferromagnetic bulk materials exhibit ferromagnetic-like behavior when prepared in a nanorange. Magnetic biomaterials are widely used in medicine. Such applications are perspective in case the clearly defined and checked interaction between magnetic nanoparticles and living cells is provided.

Nanoparticles of Fe<sub>3</sub>O<sub>4</sub> due to a high degree of dispersivity are in a superparamagnetic state. In this case a magnetic moment of the like particle changes its orientation spontaneously and randomly or due to thermal fluctuations [2]. When external magnetic field is absent superparamagnetics have on average a zero magnetic moment. i.e. they behave like paramagnetics with a high magnetic susceptibility. As known, superparamagnetic properties of Fe<sub>3</sub>O<sub>4</sub> particles at room temperature are exhibited, when reaching an average diameter  $D < 25$  nm. With increasing sizes of Fe<sub>3</sub>O<sub>4</sub> particles to microsized the magnetic properties change. These particles have already a hysteresis loop. Pursuant will change their properties.

Synthesis of such nanomaterials with stable properties is not completely elaborated, since besides the size factor the character of their building microgeometry, functional properties and methods of identification should be considered. Special attention should be paid to sizes, topography and biocompatibility of initial nanoparticles. Just these parameters finally determine the functional properties.

1. De Crozals G., Bonnet R., Farre C., Chaix C. Nanoparticles with multiple properties for biomedical applications: A strategic guide // *Nano Today*.-2016.- **11**, N 4.-P. 435-463.
2. Duriagina Z.A., Holyaka R.L., Borysyuk A.K. Automated widely diapazon mahnetometer for magnetic alloys phase analysis: development and application // *Uspehi Fiziki Metallov*.-2013.-**14**. N 1.-P. 33-66.