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Mgr Katarzyna Durak
(Studia Doktoranckie, Instytut Fizyki UMCS)

„Hyperfine interactions in surface modified magnetite nanoparticles”

The growing interest in magnetite nanoparticles, has its justification in their wide application. Mostly, iron oxides are used in the biomedical field, especially as contrast agent in magnetic resonance imaging, in drug delivery, or in magnetic hyperthermia treatment. Due to their numerous advantages (low toxicity, biocompatibility, unique physical properties), magnetite nanoparticles are the most desirable candidates for use in a human body. Moreover Fe_3O_4 NPs exhibit superparamagnetism at room temperature, which means that they can be manipulated by influence of an alternating external magnetic field. Superparamagnetism is a form of magnetism, characteristic for ferromagnetic or ferrimagnetic materials, with sufficiently small nanoparticles. Reducing the size of ferromagnetic material to a certain critical volume, causes that the creation of the domain structure becomes unfavorable (the energy of creating domain walls exceeds the energy gain resulting from the division of the molecule into domains). Then, such material is treated as single-domain. Due to the small size, the magnetic energy of anisotropy is smaller or comparable with the thermal energy of crystal lattice vibrations. This results in overcoming the energy barrier, which in turn leads to spontaneous magnetization vector fluctuations of the nanoparticle.

Free nanoparticles exhibit a natural tendency to aggregate. In such systems, the magnetic properties and blocking temperature of nanoparticles will be influenced by not only by their size and type but also dipole interactions between the nanoparticles. Therefore, one of the main issues in the synthesis of magnetically stable nanoparticles is to prevent their agglomeration during synthesis. A quite effective method to counteract this process consists in covering of the nanoparticle surface with appropriate coatings. In the present investigation, magnetite nanoparticles were synthetized by coprecipitation method from alkaline solution and coated with organic acid DMS. The aim of the research is broaden knowledge of the interparticles interactions between surface modified magnetite in a form of ferrofluids and powder. The influence of temperature, size, surface modification and nanoparticle concentrations in ferrofluids on magnetic properties are investigated.

Uprzejmie zapraszam wszystkich pracowników, doktorantów i studentów Instytutu Fizyki.

Dr hab. Ryszard Zdyb, prof. UMCS
Dyrektor IF UMCS