Streszczenie rozprawy doktorskiej mgr inż. Katarzyny Winiarczyk

pt. *Hyperfine interactions in surface modified magnetite nanoparticles.*

The application of nanoparticles in science and technology is associated with the precise characterization of their physical properties. Due to numerous advantages (low toxicity, biocompatibility, superparamagnetic behaviour), magnetite nanoparticles are the most desirable candidates for use in a human body, for example as contrast agent in magnetic resonance imaging, in drug delivery, or in magnetic hyperthermia treatment. This dissertation is devoted to organizing the available knowledge and enriching it with information about the influence of synthesis conditions on the magnetic properties of magnetite, with particular emphasis on hyperfine interactions.

The main goal of this study was to determine the influence of certain factors on the parameters of hyperfine interactions and on the physicochemical properties of magnetite nanoparticles. These factors were: synthesis method, concentration of the precipitating agent (ammonium base), size of Fe_3O_4, surface modification of nanoparticles with organic compounds (dimercaptosuccinic acid, oleic acid, chitosan, gelatine) or dispersion in solution. The implementation of the main goal was to carry out a series of magnetite syntheses by co-precipitation method, both in unmodified and surface-modified form with surfactants. The next step was the detailed structural and morphological characterization of the obtained nanoparticles. Characterization was done by means of X-ray diffraction, transmission electron microscopy, dynamic light scattering technique and infrared spectroscopy. The parameters of hyperfine interactions were determined on the basis of Mössbauer spectroscopy.

An interesting issue is also the potential use of magnetite nanoparticles in the form of ferrofluid in magnetic fluid hyperthermia. Taking this aspect into account, calorimetric studies of aqueous suspensions of magnetite nanoparticles were carried out in order to determine the ability of nanoparticles to generate heat in an external, alternating magnetic field.

The analysis of the research presented in this thesis and the conclusions, allow for well-thought-out planning of the synthesis process of nanocrystalline materials and consequently, obtaining materials with the desired properties. The research also confirms the heating ability of the prepared nanoparticles in an external, alternating magnetic field. The key conclusion was that the transition of nanoparticles from a steady state to a superparamagnetic state depends on many factors including: temperature, size of nanoparticles, method of synthesis, dispersion, type and amount of surfactant used to modify the surface.

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