Title: NMR in magnetic systems

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Abstract: Magnetically ordered iron oxides, namely magnetite, maghemite, hexagonal ferrite M or system Fe-B, with nano or submicron dimensions of particles are the main subject of study of the presented thesis. The materials were investigated mainly by ^{57}Fe nuclear magnetic resonance (NMR). The results were thoroughly analyzed and compared with the results obtained by other methods (Mössbauer spectroscopy, ZFC/FC magnetic measurement, X-ray diffraction or TEM). In case of the maghemite nanoparticles a regular distribution of vacancies in octahedral positions was verified by the help of NMR in external magnetic fields and at various temperatures. The experimental results were also compared with ab-initio calculations. In thin layers of barium M type hexaferrite, effects of reduced particle size on ^{57}Fe NMR spectra were observed. The NMR methods were also successfully applied to investigation of system FeMoCuB of amorphous and nanocrystalline ribbons, where ^{57}Fe NMR was able to resolve formation of different phases in dependence on the process of preparation. Due to different NMR excitation conditions of signal from strontium M type hexaferrite and maghemite, the partial separation of the NMR signals of individual phases could be realized in composite materials maghemite/hexaferite. Finally, the presented work shows results of ^{57}Fe NMR measurements of superparamagnetic nanoparticles and comparison with more common methods for studying of superparamagnetic nanoparticles.

Keywords: NMR, iron oxides, nanoparticles, thin films, structure, superparamagnetism