

This thesis is aimed at studying of magnetic iron oxide particles of submicron and nanoscale dimensions by means of nuclear magnetic resonance (NMR). ^{57}Fe NMR investigations were carried out in composite bentonite/maghemite with respect to temperature of calcination (T_{calc}) during the sample preparation and in magnetite submicron powders with respect to various range of the particles size. One of the main findings is that increasing T_{calc} improves resolution in the NMR spectra, which is most likely connected with higher degree of atomic ordering in the spinel structure. Evaluating the integral intensities of NMR spectra allowed us to determine the relative content of maghemite phase in particular samples of the series: the content rapidly grows for T_{calc} up to ~ 420 deg. An approach to distinguish signal from tetrahedral and octahedral irons was developed and tested on pure maghemite sample. Analysis based on vacancy-distribution models was performed in the spinel structure and the results were compared to the experiment.

^{57}Fe NMR spectra in submicron magnetite samples were found to differ markedly from spectrum of a single crystal. It was concluded that the investigated powders possess high amount of defects in the crystal structure or contain additional phase (probably closely related to the maghemite phase).