Abstract

Magnetic nanoparticles have received extensive attention in the biomedical research, e.g. as prospective contrast agents for T_2-weighted magnetic resonance imaging. The ability of a contrast agent to enhance the relaxation rate of ^{1}H in its vicinity is quantified by relaxivity. The main aim of this thesis is to evaluate the transversal relaxivity of ε-$Fe_{2-x}Al_xO_3$ nanoparticles coated with amorphous silica or citrate — its dependence on external magnetic field, temperature and thickness of silica coating — by means of nuclear magnetic resonance. The aluminium content $x = 0.23(1)$ was determined from XRF, the material was further characterised by XRPD, Mössbauer spectroscopy, DLS, TEM and magnetic measurements. The size of magnetic cores was ~ 21 nm, the thickness of silica coating $\sim 6, 10, 17$ and 21 nm. Magnetization of the ε-$Fe_{2-x}Al_xO_3$ nanoparticles increased by ~ 30 % when compared to ε-Fe_2O_3. The saturating dependence of relaxivity on external magnetic field and on the linear decrease with increase of thickness of silica coating contravene the theoretical model of motional averaging regime (MAR); nevertheless, the temperature dependence acquired in 0.47 T and 11.75 T may be explained by MAR. In comparison to ε-Fe_2O_3 nanoparticles, the relaxivity of examined samples was higher for particles with silica coating thinner than 10 nm; no considerable difference in relaxivity for thicker coatings is in contradiction to the prediction of MAR. The relaxivity was comparable to commercial superparamagnetic iron oxide contrast agents. The thesis provides experimental data still rare in the literature, showing thus the shortcomings of theoretical models of relaxivity available at present. Very low cytotoxicity enables the future use of examined nanoparticles for *in vivo* studies and prospectively in human medicine.