Title: Magnetism in transition metal oxides
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Abstract:
The $CoFe_2O_4$ nanocrystals are highly attractive due to their magnetic properties - large coercivity (up to 2 T at low temperatures) with moderate saturation magnetization (80 $A.m^2.kg^{-1}$), remarkable chemical stability and mechanical hardness. Upon RE doping, a significant change of the properties is expected. This thesis is focused on investigation of $Co_{1-x}La_xFe_2O_4$, x = 0.05 – 0.5 and $CoLa_xFe_{2-x}O_4$ x = 0.05 – 0.2 nanoparticles prepared by sol-gel and microemulsion method, respectively, with varying particle size according to the final heat treatment. In the former case, the particles were embedded in amorphous $SiO_2$ matrix, while in the latter case, the samples were matrix-free. The samples were characterized using X-ray diffraction and Mössbauer spectroscopy. Measurements of the temperature dependence of the ZFC-FC magnetization revealed that the blocking temperature is above the room temperature. The values of coercivity and saturation magnetization strongly depend on particles size determined by method of preparation. The higher coercivity values of about 2 T at 10 K show the samples prepared by the sol-gel method. The obtained results are discussed in the context of preparation method, particle size and level of La doping.

*Keywords*: $CoFe_2O_4$ nanoparticles, sol-gel method, microemulsion route, high coercivity