$La_{0.80}Ag_{0.15}MnO_3$ magnetic nanoparticles for self-controlled magnetic fluid hyperthermia

M. Kovalik,[1] M. Zentková,[1] M. Mihalik,[1] M. Kubovčíková,[1] M. Vavra,[2] M. Mihalik jr.,[1] Z.L. Bujňáková,[3] J. Briančin,[3] M. Perovic,[4] M. Boškovic,[4] M. Fitta,[5] and R. Pelka[5]

[1]*Institute of Experimental Physics SAS, Watsonova 47, 040 01 Košice, Slovakia*
[2]*Institute of Chemistry Faculty of Science, P.J.Šafárik University, Moyzesova 11, 04001 Košice, Slovakia*
[3]*Institute of Geotechnics SAS, Watsonova 45, 04001 Košice, Slovakia*
[4]*Institute of Nuclear Sciences "VINCA", P.O. Box 522, 11001 Belgrade, Serbia*
[5]*Institute of Nuclear Physics Polish Academy of Sciences, Radzikowskiego 152, 31-342 Krakow, Poland*

In our paper we report on synthesis, characterization and magnetic properties of colloidal suspension based on $La_{0.80}Ag_{0.15}MnO_3$ nanosized particles. Nanosized particles were prepared by the glycine-nitrate method. The proper magnetic properties with the Curie temperature of about T_C = 318 K and 323 K were obtained by annealing at 800°C in air or O_2 atmosphere. Powder XRD measurement at room temperature revealed that the particles crystallize in rhombohedral crystal structure, R-3c space group, and the average size of nanoparticles varies between 25 to 40 nm. SEM analysis revealed that the particles form aggregates. Ultrasonic treatment and mechanical milling in agate bowl was performed to favour their disaggregation. Nanoparticles were functionalized with anionic sodium dodecyl sulfate (SDS) or dextran as a surfactant in distilled water. In the case of SDS functionalized particles the water based colloidal suspension was prepared in a laboratory circulation mill MiniCer. Size distribution of sample after ball milling has unimodal distribution, with the size fraction from 40 to 120 nm. Zeta-potential after half year from preparation of sample remain stable, around -40mV ($\pm 1,5mV$). Particles size distribution of dextran functionalized sample varying from 20 up to 100 nm was narrowed by etching in citrid acid. Preliminary hyperthermia measurements indicate increase of temperature by high frequency measurements 808kHz/0.024T from room temperature to 38.1°C in 13 min. Both samples display superparamagnetic behavior and colloids have the same T_C as powder. Our study shows that the rise in temperatures by these nanoparticles could be safely controlled around Curie temperature T_C.

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