Surface modification and magnetic study of widely Ga-doped magnetite nanoparticles

K. Rećko,[1] M. Orzechowska,[2] U. Klekotka,[3] D. Satuła,[1] W. Olszewski,[1] D. Soloviov,[4,5,6] A. Beskrovnyi,[4] J. Waliszewski,[1,4] M. Biernacka,[1] and K. Szymański[1]

[1] *Faculty of Physics, University of Bialystok, K. Ciołkowskiego 1L, 15-245 Białystok, Poland*
[2] *Doctoral School of Sciences and Natural Sciences, University of Bialystok, K. Ciołkowskiego 1K, 15-245 Białystok, Poland*
[3] *Faculty of Chemistry, University of Bialystok, K. Ciołkowskiego 1K, 15-245 Białystok, Poland*
[4] *Frank Laboratory of Neutron Physics, Joint Institute for Nuclear Research Joliot-Curie 6 141980 Dubna, Moscow region, Russia*
[5] *Moscow Institute for Physics and Technology, Dolgoprudny, 141701 Russia*
[6] *Institute for Safety Problems of NPP, 36-a Kirova St, 07270, Chornobyl, Kyiv, Ukraine*

In recent years, magnetic nanoparticles have been widely used in biomedicine for drug delivery, magnetic resonance imagining or hyperthermia [1,2]. Magnetites doped with *3d* ions, and Ga^{3+}: $Ga_xFe_{3-x}O_4$ with $0 \leq x \leq 1.4$, form a group of innovative materials [3-5]. Gallium nano-ferrites seem to be promising biomaterials that exhibit superparamagnetic fluctuations up to temperatures well above 315 K. X-ray and neutron diffraction, transmission electron microscopy, magnetization, and Mössbauer spectroscopy measurements were collected for nanoparticles synthesized by different methods. The reverse spinel structures of core and core-shell gallium ferrites have been confirmed as single phases. The in-site occupancy preference as a function of gallium dopant is discussed. The nanosystems have been quickly saturated disclosing neglectable coercive fields with the spontaneous magnetization at the range of 2 emu/g - 58 emu/g. Independently of the synthesis method, for the nanoparticles of gallium content $x > 0.8$, the superparamagnetic contribution becomes the dominant one.

References:

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This work was supported by the National Science Centre under grant OPUS no 2018/31/B/ST3/00279 and the Polish Government Plenipotentiary for JINR in Dubna (Project no PWB/168-10/2021) and the Polish Ministry of Science and Higher Education under subsidy for maintaining the research potential of the Faculty of Physics, University of Bialystok.