Poster

Magnetism of gallium cuboferrites

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Magnetic nanoparticles have been and continue to be the focus of researchers, as it has been observed that the transition from microparticles to nanoparticles leads to huge changes in the physical and chemical properties of the material. Biofunctionalization and reproducibility of nanosystems prepared by various methods usually cost a lot of effort. As a result of these treatments, materials are obtained that give a different magnetic response. Examples of such a material are magnetites substituted with trivalent cations [1-5]. Particularly, the properties of gallium cubo-ferrites are poorly understood. The main objective of the preparation of $Ga_xFe_{3-x}O_4$ with $0 \leq x \leq 0.8$ series was to further the knowledge of their superparamagnetic behavior. With this purpose, nanoparticles between 11 and 15 nm were prepared from the optimized protocol based on the Massart method [6]. According to room temperature X-ray and neutron diffraction measurements the obtained reverse spinel structures have been confirmed as the single phases. The unit cells have been contracted with increase of gallium content. Moreover, diffraction data have proved the progressive incorporation of Ga^{3+} in the $Fd\bar{3}m$ structure, with the occupation in tetrahedral 8a site. The Mössbauer spectra confirmed that the relative contribution of sextets associated with Fe^{3+} ions in the tetrahedral sites weakens as a function of the increasing gallium content in the system. This is accompanied by a growing input of superparamagnetic fluctuations. The soft magnetic series of $Ga_xFe_{3-x}O_4$ has been quickly saturated disclosing neglectable coercive fields.

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