

Abstract Submitted
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Ga Site Determination in $Ga_xFe_{3-x}O_4$ Nanoparticles VANESSA POOL, Montana State University, MICHAEL KLEM, C. CHORNEY, Montana Tech, ELKE ARENHOLZ, Berkeley Nat. Lab, YVES IDZERDA, Montana State University, CENTER FOR BIO-INSPIRED NANOMATERIALS COLLABORATION — In this study, magnetic $Ga_xFe_{3-x}O_4$ nanoparticles with gallium doping ($x=.15$ to 1) were measured using X-ray absorption spectroscopy (XAS) and X-ray magnetic circular dichroism (XMCD) to ascertain the Ga dopant site in the spinel structure and the affect of the Ga on the overall electronic structure of the nanoparticle. Ga has been doped into Fe_3O_4 nanoparticles by mixing $Fe(acac)_3$, 1,2-hexadecanediol, benzyl ether, oleic acid, and oleylamine under evacuated conditions. A Neel-Arrhenius plot of the frequency-dependent alternating-current Magnetic Susceptibility (ACMS) measurements showed these particles to be weakly interacting with a reduction of the cubic anisotropy energy term with Ga concentration. The XAS and XMCD spectra were compared to powder standards and molecular-orbital calculations to determine that the Ga dopant is substituting into the tetrahedral A-site of the spinel structure, resulting in an overall increase (up to 50 percent) in the total moment of the material. Interestingly, the element specific XMCD spectra show that the average Fe moment is observed to increase with Ga concentration, a result consistent with the replacement of A-site Fe by Ga.

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