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Biosynthesized Magnetic (Zn_xFe_{1-x})Fe_2O_4 Nanoparticles. C.J. Rawn[1], L.W. Yeary[2], J.-W. Moon[3], B.C. Chakoumakos[1], M.E. Madden[3], T.J. Phelps[3], L.J. Love[2], [1]Materials Science and Technology Div., [2]Engineering Science and Technology Div., [3]Environmental Sciences Div., Oak Ridge National Lab., Oak Ridge, TN.

Magnetic nanoparticles are needed for rapidly expanding applications in the biomedical and engineering fields. The biomineralization process used for this study is of interest due to the synthesis at relatively low temperatures that produces nanoparticles without milling. These factors reduce processing costs and the method is promising for its scale up ability to produce large quantities of material. Nanoparticle magnetite with Zn substituting for some of the Fe has been synthesized at 60° C by a biologically induced mineralization method using thermophilic bacteria. Pure magnetite and magnetite with increasing amounts of Zn have been studied using time-of-flight powder neutron diffraction, X-ray powder diffraction, TEM, and magnetic susceptibility. The addition of Zn increases the lattice parameter, the background, and the peak width. The latter two results suggest an increase in disorder, a decrease in crystallinity, and/or a decrease in crystallite size. Rietveld refinements show that the Zn prefers the tetrahedral site in the structure and the refined site occupancies for the samples with Zn are x = 0.629(7) and x = 0.804(7) atom per formula unit with corresponding lattice parameters of a = 8.4040(1) and a = 8.4253(1) Å compared to the sample without Zn that has a lattice parameter of a = 8.36965(6).

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