

# Structural Refinement of Gd-doped nano-sized $\text{Fe}_3\text{O}_4$ Powder

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Magnetic nano-sized powder has been widely studied due to their various application fields such as high density magnetic storage, biomedical and catalysts. The monodispersed hydrophilic magnetic fluids with nano-sized  $(\text{Gd}_{0.1}\text{Fe}_{0.9})\text{O}\cdot\text{Fe}_2\text{O}_3$  powder was prepared by sonochemical method. The surfactant of lecithin was adsorbed onto the magnetic particles by ultrasonication. In order to determine the occupancy and site preference of Gd in  $\text{Gd}_x\text{Fe}_{1-x}\text{Fe}_2\text{O}_3$ , the Rietveld refinement and electron paramagnetic resonance (EPR) spectroscopy were carried out. The converged weighted  $R$ -factor,  $R_{wp}$ , and the goodness-of-fit indicator,  $S$  ( $= R_{wp} / R_e$ ) were 6.99 % and 1.26 for  $(\text{Gd}_{0.1}\text{Fe}_{0.9})\text{O}\cdot\text{Fe}_2\text{O}_3$ . ERP spectra measured at room-temperature showed that the introduction of impurities resulted in diminishing of spontaneous magnetic field of ferrite nanoparticles with a subdomain size. These results suggest that the structural refinement may be applied to determine the crystal structural parameters of various nanopowder such as site occupancies, lattice parameters, atomic coordinates and atomic displacements.