# Size-dependent magnetic properties of ordered $Li_{0.5}Fe_{2.5}O_4$ prepared by the sol-gel method

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Size-dependent magnetic properties of ordered Li ferrites prepared by the sol-gel method have been studied by x-ray diffraction, vibrating-sample magnetometer, and Mössbauer spectroscopy. X-ray-diffraction patterns were analyzed using Rietveld refinement. Samples annealed below 500 °C have the cubic spinel structure with a small amount of $\alpha$-$Fe_2O_3$ and $\gamma$-$Fe_2O_3$. As the annealing temperature increases over 500 °C, hematite and maghemite phases disappear and the single-phase spinel structure (space-group $P4_332$) with ordered cation distribution on the octahedral site is seen. Particle sizes determined by x-ray analysis range from 37 nm to 87 nm, respectively, as the annealing temperature increases from 450 °C to 700 °C. The saturation magnetization is ~46 emu/g for the sample annealed below 500 °C and increases up to 63.3 emu/g for the sample annealed at 700 °C, while the coercivity of the samples has a maximum value of 152.5 Oe at 500 °C. Mössbauer spectral analysis revealed that there was 29% $\gamma$-$Fe_2O_3$ in the sample annealed at 450 °C. The ordered cation distribution by the local symmetry reduction of sublattice gives a reasonable interpretation about the magnetic properties of nanosize particles. © *2006 American Institute of Physics*. [DOI: 10.1063/1.2169468]