

Study on the Magnetic Behavior of In-doped Nickel Chromite by Using Mössbauer Spectroscopy

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$\text{NiCr}_{1.9-z}^{57}\text{Fe}_{0.1}\text{In}_x\text{O}_4$ ($x = 0.0, 0.1, 0.3, \text{ and } 0.5$) was prepared by using a sol-gel method. The crystal structure at room temperature was determined to be a normal cubic spinel with space group $Fd\bar{3}m$. An analysis of the x-ray diffraction patterns was performed using a Rietveld refinement method while the Bragg R_B and R_F factors were below 5%. The magnetic Néel temperature decreased from 150 K to 77 K with increasing In concentration, which was confirmed by zero-field-cooled (ZFC) magnetization at applied fields under 100 Oe and by Mössbauer spectra measured at various temperatures. Magnetic hysteresis loops of the samples at 77 K showed drastically increasing magnetization and decreasing coercivity with increasing In concentration. The Mössbauer spectra of the samples were measured at various temperatures ranging from 4.2 to 295 K. The isomer shift value showed that the charge states of the iron ions are ferric. The Mössbauer spectra showed two magnetic phases with two different magnetic spin direction sites for the Cr^{3+} ion state. Mössbauer spectra below 77 K showed 6 sharp absorption lines and the linewidth became broader with increasing temperature, which indicates a Jahn-Teller distortion and relaxation.

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