

Crystallographic and Magnetic Properties in $\text{CoFe}_{2-x}\text{Cr}_x\text{O}_4$

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Co-Cr ferrite has been studied with Mössbauer spectroscopy, X-ray diffraction, and vibrating sample magnetometry (VSM). The crystal structure for this system is a spinel structure, and the lattice constants are in accordance with Vegard's law. The Mössbauer spectra consist of two six-line patterns corresponding to Fe^{3+} at the tetrahedral (*A*) and the octahedral (*B*) sites. The Néel temperature decreases linearly with Cr concentration, suggesting the superexchange interaction Co-O-Fe link is stronger than that for the Cr-O-Fe link. The Debye temperatures for the *A* and the *B* sites of $\text{CoFe}_{1.9}\text{Cr}_{0.1}\text{O}_4$ are found to be $\theta_A=827\pm 5$ K and $\theta_B=218\pm 5$ K. Atomic migration of $\text{CoFe}_{1.9}\text{Cr}_{0.1}\text{O}_4$ starts near 295 K and increases rapidly with increasing temperature to such a degree that 64 % of the ferric ions at the *A* sites have moved over to the *B* sites at 600 K. The VSM data showed that the saturation magnetization decreased with increasing quantity of Cr ions.