

Effect of Fe substitution on structural and magnetic properties of NiCr_2O_4

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At room temperature, the normal oxide spinel NiCr_2O_4 is tetragonally distorted and crystallizes in the $I4_1/amd$ space group due to cooperative Jahn-Teller ordering driven by the orbital degeneracy of tetrahedral Ni^{2+} . The ferrimagnetic Curie temperature (T_C) for NiCr_2O_4 is 74 K. The magnetic moments of NiCr_2O_4 are composed of a ferrimagnetic (longitudinal) and an antiferromagnetic (transverse) component. Exchange interaction between the magnetic cations influences the overall magnetic properties of the compound. Present work focuses on the modification of structural and magnetic properties upon substituting Fe at Cr sites in NiCr_2O_4 with the motivation of changing the magnetic exchange interaction. In order to do so, single phase $\text{Ni}(\text{Cr}_{0.5}\text{Fe}_{0.5})_2\text{O}_4$ samples were prepared by co-precipitation techniques with controlling $p\text{H}$ of precipitation. Upon Fe substitution, crystal structure was not affected much contrary to the earlier reports. The oxidation state of each element was determined using X-ray photoelectron spectroscopy (XPS). T_C was found to increase dramatically above 300 K, confirmed both from temperature and field dependent dc-magnetization studies.