10TH JOINT MMM/INTERMAG CONFERENCE

JANUARY 7-11, 2007

BALTIMORE, MARYLAND

ABSTRACTS

GX-08. Exceptional magnetic properties of Fe substituted nickel chromite. *S. Park*[1] and C. Kim[1]*1. Department of Physics, Kookmin University, Seoul, South Korea*

The $NiCr_{2-x}Fe_xO_4$ (x=0.0, 0.1, 0.3, 0.5) compounds were fabricated with using the sol-gel method. The ultimate single phase samples were obtained for annealed 12 hr in atmosphere at 1000 °C. The $NiCr_2O_4$ is a ferrimagnet cubic normal spinel above the 305 K, in which Ni^{2+} ions occupy the tetrahedral-sites and Cr^{3+} ions occupy the octahedral-sites. Also the $NiCr_{2-x}Fe_xO_4$system there is a cubic to tetragonal(c/a<1) transition for the Fe concentration $x \leq 0.2$ below the room temperature.[1] The crystalline structure of $NiCr_2O_4$ is determined to be a tetragonal structure with lattice constants a_0 = 5.840 Å and c_0 = 8.429 Å at 295 K by Rietveld refinement. The $NiCr_{2-x}Fe_xO_4$(x=0.0, 0.1, 0.3, 0.5) samples are a cubic structure at room temperature. For the sample with x=0.1,the lattice constant is determined to be a_0 = 8.319 Å with a cubic(*Fd-3m*) structure. The magnetic Néel temperature(T_N) of the $NiCr_2O_4$ is determined to be 82 K by zero field cold magnetization curves under the 100 Oe applied field. With the increasing Fe substitution, the TN increased. For the sample with x=0.1, the magnetic ordering temperature is determined to be T_N =135 K. Mössbauer spectra of the Fe substituted $NiCr_{2-x}Fe_xO_4$ were measured at various temperatures ranging from 4.2 to 295 K. For the sample with x=0.1, the Mössbauer spectra exhibit that there are two magnetic phases, which are due to the two different sites of the Cr^{3+} state.[2] The spectrum at 4.2 K was fitted to two magnetic components of the magnetic hyperfine fields H_{hf} = 488 and 472 kOe and isomer shifts δ = 0.29 and 0.28 mm/s, respectively. The electric quadrupole splittings(ΔE_Q) were found to be nearly zero values below the T_N =135 K. For the spectrum at 295 K, the ΔE_Q are observed with large values of 0.54 and 0.37 mm/s, respectively. The values of the isomer shifts show that all temperature ranges are in the ferric(Fe^{3+}) state. The Mössbauer spectra below the T_N show that the line broadening with the Jahn-Teller distortion and accompanying relaxation effects.

[1] R. J. Arnott etc. al., J. Phys. Chem. Solids 25, 161(1964). [2] K. Tomiyasu etc. al., Phys. Rev. B 70, 214434 (2004).