59TH ANNUAL CONFERENCE ON

MAGNETISM AND MAGNETIC MATERIALS

3-7 NOVEMBER 2014 • HONOLULU, HAWAII

ABSTRACTS

AIP Publishing

IEEE MAGNETICS 56 YEARS

Jointly sponsored by AIP Publishing, LLC and the IEEE Magnetics Society

CT-09. Spin reorientation in multiferroic spinel $Co_{0.5}Fe_{0.5}Cr_2O_4$ with Mössbauer spectroscopy. *B. Myoung*[1] and C. Kim[1] *1. Physics, Kookmin University, Seoul, Republic of Korea*

We have reported on magnetic properties of multiferroic spinel $Co_{0.5}Fe_{0.5}Cr_2O_4$,[1] especially spin-ordering, spin-reorientation, and charge re-distribution. With the Rietveld refinements the crystal structure was determined to be a normal cubic spinel with space group *Fd-3m* and with cation distribution of $[Co^{2+}_{0.5}Fe^{2+}_{0.5}]^A[Cr^{3+}_2]^BO^{2-}_4$. It is remarkable that the Co and Fe ions exclusively enter into the octahedral (*A*) sites, while the Cr ions enter into the tetrahedral (*B*) sites. Fig.1 shows the temperature dependence of the magnetization and magnetic hyperfine field H_{hf} of $Co_{0.5}Fe_{0.5}Cr_2O_4$ by using SQUID magnetometer and Mössbauer analysis. Curie temperature, T_C = 86 K was decided by the temperature where H_{hf} = 0 (Fig. 1). Also, we have determined that conical spiral magnetic ordering temperature T_S is 20 K due to the slope change of M-T curve around 20 K, which coincides with that of H_{hf} curve, as shown in Fig. 1. Furthermore, the slope of the curve on electric quadrupole splitting E_Q decreases above T_S = 20 K. This suggests that the change in E_Q around T_S comes from charge distribution due to the spin-relocation arising from distortion of each tetrahedral site around Fe^{2+} ion above T_S. That is, $Co_{0.5}Fe_{0.5}Cr_2O_4$ has ferrimagnetic spin-order below T_S, while above T_S, there is conical-spiral spin ordering. Isomer shift value (0.89 mm/s ≤ δ ≤ 0.93 mm/s) by Mössbauer analysis shows that the charge states are ferrous(Fe^{2+}) as $[Co^{2+}_{0.5}Fe^{2+}_{0.5}]^A[Cr^{3+}_2]^BO^{2-}_4$ at all temperature range. T_{JT} temperature in Jahn-teller distortion is T_{JT} = 155 K, since E_Q decreases rapidly above T_C = 86 K and disappears around 155 K as shown in Fig. 2.

[1] K. Singh, A. Maignan, C. Simon, and C. Martin, Appl. Phys. Lett. **99**, 172903 (2011).

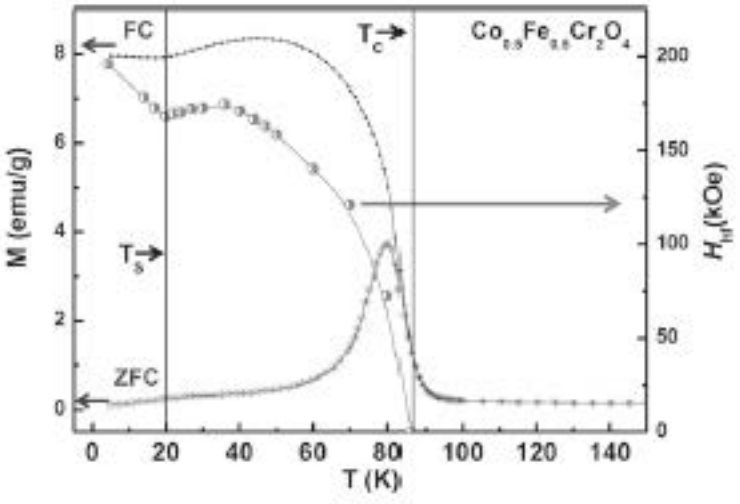

Fig. 1. Temperature dependence of zero-field-cooled (ZFC) and field-cooled (FC) magnetization curves under 1000 Oe and hyperfine field H_{hf} of $Co_{0.5}Fe_{0.5}Cr_2O_4$ ranging from 4.2 to 300 K.