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ABSTRACTS

HR-04. The effect of manganese ions in $MnCr_{1.98}{}^{57}Fe_{0.02}O_4$ by Mössbauer spectroscopy. *K. Choi*[1], S. Kim[1] and C. Kim[1] *1. Physics, Kookmin Univ., Seoul, South Korea*

The main scope of the present study is to examine the weak geometrical frustration and multiferroic effect in $M Cr_2O_4$ (M = Co, Mn)[1, 2]. Co^{2+} and Mn^{2+} ions occupy the A site, Mn^{2+} ($3d^5$) exhibits a half-filled shell with a total spin S = 5/2 and zero orbital moment and Co^{2+} ($3d^7$) has S = 3/2 and small spin-orbit effects[3]. Geometrical frustration was affected among the B sites forming the pyrochlore lattice relation with magnetic ions of A sites. We have substituted a small amount of Fe ions for Cr sites and investigated the magnetic behavior of Fe ions, on atomic scale, using Mössbauer measurement. Polycrystalline $MnCr_{1.98}{}^{57}Fe_{0.02}O_4$ compound was prepared by wet-chemical process. The crystal structure was found to be single-phase cubic spinel with space group of Fd3(-)m. The lattice constant a_0 and the internal structural parameter (x) of the oxygen were determined to be 8.444 Å and 0.263, respectively. Mössbauer spectra of $Mn_{1.98}{}^{57}Fe_{0.02}O_4$ were taken from 4.2 to 295 K. The absorption spectra at 4.2 K show that the well developed two sextets are superposed with small difference of hyperfine field ($H_{hf}1$= 485 and $H_{hf}2$= 475 kOe). Isomer shift values (δ) of doublets are found to be 0.42 and 0.43 mm/s relative to the Fe metal, respectively, which are consistent with the high spin Fe^{3+} charge state. Above the Néel temperature (T_N = 45 K) paramagnetic doublet is observed. We note that even though the magnetic hyperfine fields on B-site are similar a noticeable difference of the Néel temperatures is shown between two samples ($M_{1.98}{}^{57}Fe_{0.02}O_4$ (M = Co, Mn)). It is interpreted is terms of A-B super-exchange interaction with related ionic bond lengths.

[1]. K. Tomiyasu, et al., Phys. Rev. B., 74, 024413 (2004). [2]. Y. Yamasaki, et al., Phys. Rev. Lett. 96, 207204 (2006). [3]. N. Tristan, et al., Phys. Rev. B., 72, 174404 (2005).