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ABSTRACTS

CR-03. The effect of non magnetic ion substitution for the $\text{FeCr}_{2-x}\text{M}_x\text{S}_4$ ($\text{M}=\text{Ga}, \text{In}$) by Mössbauer spectroscopy. *B. Son*¹, *S. Kim*¹, *I. Shim*¹, *K. Joo*² and *C. Kim*¹. *1. Department of Physics, Kookmin University, Seoul, South Korea; 2. Department of Physics, Myongji University, Yongin, Kyungki, South Korea*

The sulphur spinel $\text{FeCr}_{2-x}\text{M}_x\text{S}_4$ ($\text{M}=\text{Ga}, \text{In}$) have been studied with Mössbauer spectroscopy, x-ray diffraction (XRD), and vibrating sample magnetometer. The XRD patterns for samples $\text{FeCr}_{2-x}\text{M}_x\text{S}_4$ ($\text{M}=\text{Ga}, \text{In}$; $x=0.1, 0.3$) reveal a single phase, which the Ga and In ions are partially occupied to the tetrahedral (A) site. The Néel temperature for the Ga substituted samples increases from 178 to 182 K, with increase from $x=0.1$ to 0.3. While, they decreases from 173 to 158 K, for the In substituted samples of the $x=0.1$ and 0.3, respectively. The Mössbauer spectra were collected from 4.2 K to room temperature. We have analyzed the Mössbauer spectra using eight Lorentzian lines fitting method for the $\text{FeCr}_{2-x}\text{In}_x\text{S}_4$ ($x=0.1$) at 4.2 K, yielding the following results; $H_{\text{hf}}=146.0$ kOe, $\Delta E_{\text{Q}} = 1.88$ mm/s, $\theta = 36^\circ$, $\phi = 0^\circ$, $\eta = 0.6$, and $R=1.9$. The Ga ions enter into the both sites octahedral (B) and tetrahedral (A), simultaneously the same amounts of Fe ions migrate from the A to the B site, this result is an agreement with XRD results, too. The ΔE_{Q} of the A and B site in Mössbauer spectra of the samples $\text{FeCr}_{2-x}\text{Ga}_x\text{S}_4$ ($x=0.3$) are 0.83 and 2.94 mm/s, respectively. While they are 0.54 and 1.54 mm/s for the $\text{FeCr}_{2-x}\text{In}_x\text{S}_4$ ($x=0.3$). It is noticeable that the ΔE_{Q} for the Ga doped samples are larger than that of the corresponding In doped samples, in spite of the larger ionic radius for In ions. The bond lengths of Cr-S, for the Ga and In doped samples ($x=0.3$) are found to be 2.41 and 2.43 Å, respectively. We interpret that the larger covalence effect from the smaller bond length induces a large asymmetric charge distribution. Finally, it gives a large quadrupole interaction.