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DU-04. Mössbauer studies for spinel-type ACr_2S_4 (A=Cd and Fe).

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The spinel-type $CdCr_2S_4$ has attracted much interest because of its multiferroic properties [1]. These have been explained with the presence of magnetic ordering in the system. We have studied Mössbauer spectra for samples $Cd_{1-x}Fe_xCr_2S_4$ (x=0.3, 0.5 and 1.0) with Cd replaced with Fe on tetrahedral (A) site to ensure the magnetic ordering between cadmium and chromium. Mössbauer spectra of samples have been measured in the temperature ranges of 4.2 ~ 300 K. We find that all Fe ion states are ferrous ions with a tetrahedral coordination from isomer shift values at room temperature, which are 0.51, 0.50 and 0.60 mm/s, respectively. The Néel temperatures (T_N) of $Cd_{1-x}Fe_xCr_2S_4$ (x=0.0, 0.3, 0.5 and 1.0) increase with substitution Cd with Fe at

tetrahedral site, and the values are 97 [2], 110, 135 and 172 K, respectively. Magnetic behavior can be explained with ion configuration and spin interaction between either tetrahedral-octahedral sites or intra-atoms. The magnetic structure changes to ferrimagnetic from ferromagnetic with increasing Fe ions on A site, which is caused by the magnetic order becoming antiparalled with increasing Fe ions. The Mössbauer spectrum at 4.2 K is asymmetric for all the samples. It can be explained by ferrous ion of Jahn-Teller ion induced distortion and intra-atomic *d-d* interaction between Fe^{2+} ($3d^6$) and Cd^{2+}($4d^{10}$) due to crystal field splitting ΔE. Furthermore, the contribution of angular moment of Fe^{2+} enhances the asymmetric line of Mössbauer spectra at 4.2 K.

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