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

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Magnetic ordering of $Cd_{1-x}Fe_xCr_2S_4$ ($0.0 \leq x \leq 1.0$) with Cd replaced by Fe on tetrahedral (A) site is studied by Mössbauer spectroscopy and vibrating sample magnetometer as a function of temperature and external magnetic field. We find that all Fe ion states are ferrous ions with a tetrahedral coordination from isomer shift values at room temperature. The Curie temperatures (T_C) for the $Cd_{1-x}Fe_xCr_2S_4$ ($0.0 \leq x \leq 1.0$) increase with Cd replaced by Fe at tetrahedral site. The magnetic behavior can be explained with ion configuration and spin interaction between either tetrahedral-octahedral sites or intra-atoms. The magnetic structure changes from ferromagnetic to ferrimagnetic with increasing Fe ions on tetrahedral site, which is caused by the magnetic order becoming antiparallel 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. Furthermore, the contribution of angular moment of Fe^{2+} enhances the asymmetric line of Mössbauer spectra at 4.2 K. © *2009 American Institute of Physics*. [DOI: 10.1063/1.3072380]