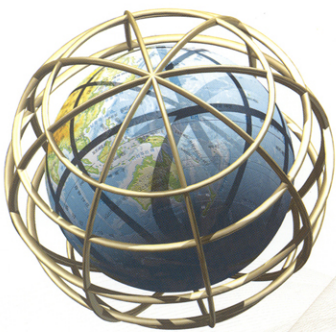
ISAMMA2007

The 1st International Symposium on Advanced Magnetic Materials
May 28-June 1, 2007, Jeju, Korea



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PE07

The Site Dependence on of Microscopic Interaction on Ferrous Ion for the Fe Spinel

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Chalcogenide spinel MCr_2X_4 (M = Fe, Cu, Co, Cd; X = S, Se) materials have various physics properties such as colossal magnetoresistane (CMR) effect, spin-frustration effects, metallic conduction, large magneto-optical effect, relaxor ferroelectricity and colossal magnetocapactive effect[1-3]. These features were attributed to competition of isomorphic ions with the topological frustration, Jahn-Teller distortion, and geometric frustration of magnetic moment. Here, we report the magnetic properties of the $FeCr_2S_4$ and $FeIn_2S_4$ with special emphasis on cation ordering related to the quadrupole interactions.

$FeIn_2S_4$ and $FeCr_2S_4$ exhibits cubic spinel structure *Fd3m*. $FeIn_2S_4$ is an inverse spinel, with In atoms occupying both tetrahedral (A) and octahedral (B) sites. On the other hand, $FeCr_2S_4$ has a normal spinel with Fe atoms occupying A site and Cr atoms occupying B site. The determined lattice constant a_0 for $FeCr_2S_4$ and $FeIn_2S_4$ were $a_0 = 10.011$ and $a_0 = 10.616$ Å, respectively.

The Mössbauer spectra of $FeCr_2S_4$ and $FeIn_2S_4$ have been studied. The Néel temperatures were found to be 175 and 15 K for the $FeCr_2S_4$ and $FeIn_2S_4$, respectively, by Mössbauer spectroscopy. It can be understood as the strength of inter-sublattice exchange interaction Fe^{2+}(A)-S^{2-}-Cr^{3+}(B) is stronger than that of the intra-sublattice exchange interaction Fe^{2+}(B)-S^{2-}-Fe^{2+}(B). The $FeCr_2S_4$ shows a single line resonance spectrum with an isomer shift of 0.72 mm/s at room temperature, while $FeIn_2S_4$ at room temperature has an isomer shift of 0.74 mm/s and a electric quadrupole splitting (ΔE_Q) of 3.22 mm/s. The charge state of Fe ions is ferrous (Fe^{2+}) as characterized by isomer shift (δ) for the samples. We interpret that the presence of the ΔE_Q is attributed to the trigonal field at the octahedral site, according to Fe^{2+} ions enter to octahedral B site.

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