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Magnetic Properties and Magnetoresistance in $Fe_{1-x}Cr_2S_4$ (x=0.0, 0.04, 0.08)

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Abstract
Samples of iron deficient polycrystalline $Fe_{1-x}Cr_2S_4$ (x=0.0, 0.04, 0.08) have been studied with Mössbauer spectroscopy, x-ray photoelectron spectroscopy (XPS), vibrating sample magnetometer (VSM) and magnetoresistance (MR) measurement. The effects of a small Fe-deficiency and conduction mechanism on $FeCr_2S_4$ are discussed. The Mössbauer spectra were recorded from 13 K to room temperature. In the temperature range from 13 K to 120 K the asymmetric line broadening is observed and it is believed to result from dynamic Jahn-Teller distortion. Isomer shift value indicates that the charge's state of Fe ions is ferrous in character. The Curie temperature of the samples (x=0.0, 0.04, 0.08), was determined to be 172, 170, 169 K, respectively. However, as Fe deficiency increases, the peaks on MR vs temperature dependence occur at 171, 174, and 186 K for the samples with x=0.0, 0.04, and 0.08, respectively. It is concluded that the conduction mechanism in these systems is different from the double exchange mechanism in a point that there are no mixed iron charge valences.