MOLECULAR PHYSICS REPORTS **32** (2001) 87-93

MAGNETIC AND ELECTRON TRANSPORT PROPERTIES IN SULPHUR SPINEL

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Abstract: Magnetic properties and magneoresistance of $FeCr_2S_4$, $Co_{0.1}Fe_{0.9}Cr_2S_4$ and $Cu_{0.5}Fe_{0.5}Cr_2S_4$ prepared by a usual ceramic method have been studied by *X*-ray diffraction, Mössbauer spectroscopy, *SQUID*, vibrating sample magnetometer (*VSM*), and magnetoresistance (*MR*) measurement. Magnetoresistance measurements of the sample $FeCr_2S_4$ exhibits semiconducting behavior in region below the 140 K and occurring of metal-insulator transitions around the Néel temperature. When the Fe ions were substituted with the Co as much as 10% relative to the iron metal, the Néel temperature was 178 K and the maximum *MR* ratio in $H = 1.6$ T was 8% at 192 K. Mössbauer spectra were recorded from 12 K to room temperature. Below the Curie temperature the asymmetric line broadening was observed and considered to be dynamic Jahn-Teller distortion. Isomer shift value of $Co_{0.1}Fe_{0.9}Cr_2S_4$ at room temperature was 0.58 mm/s, which means that charge state of Fe ions was ferrous in character. The evidence that iron ions are ferrous in character led to the conclusion that conduction mechanism in this sample is different from the double exchange mechanism in Mn Perovskite. On the other hand, when the Fe ion was replaced with Cu ion as much 50% its electronic property was changed drastically and showed ferric character.