

Neutron diffraction and Mössbauer studies on $\text{Fe}_{1-x}\text{Cr}_2\text{S}_4$ ($x=0.0, 0.04, 0.08$)

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Polycrystalline samples of $\text{Fe}_{1-x}\text{Cr}_2\text{S}_4$ ($x=0.0, 0.04, 0.08$) have been studied with x-ray and neutron powder diffraction, Mössbauer spectroscopy, magnetization, and magnetoresistance (MR) measurements. Neutron diffraction patterns were obtained at various temperature ranges from 10 K to room temperature. Neutron diffraction on FeCr_2S_4 above 10 K shows that there is no crystallographic distortion and reveals antiferromagnetic ordering, with the magnetic moment of Fe^{+2} ($-3.52 \mu_B$) aligned antiparallel to Cr^{3+} ($2.72 \mu_B$). Mössbauer spectra shows asymmetric line broadening in the temperature range from 13 to 170 K and it is considered to be dynamic Jahn–Teller stabilization. The charge states of the iron ions are ferrous in character. With increasing Fe deficiency, the peak of maximum magnetoresistance of $x=0.0, 0.04$, and 0.08 , occurred at 171, 174, and 186 K, respectively. The increasing temperature of the MR peak position is interpreted as due to an enhancement of activation energy. © 2002 American Institute of Physics.

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