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Synthesis and magnetic properties of geometrical frustration system $Ni_{0.3}Fe_{0.7}Ga_2S_4$

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We have investigated crystallographic and magnetic properties for $Ni_{0.3}Fe_{0.7}Ga_2S_4$ by x-ray, Mössbauer spectroscopy, and superconducting quantum-interference device (SQUID) magnetometry. X-ray analysis for polycrystalline $Ni_{0.3}Fe_{0.7}Ga_2S_4$ indicates trigonal structure with space group P-3m1. Fig 1. shows the temperature dependence of susceptibility χ in zero-field-cooled (ZFC) and field-cooled (FC) magnetization under 100 Oe for $Ni_{0.3}Fe_{0.7}Ga_2S_4$. The magnetic behavior shows an antiferromagnetic character with Curie-Weiss temperature, θ_W = -149 K and the strong frustration factor, f = 5.63 defined as $|\theta_W|/T_N$. The effective moment was obtained to be μ_{eff} = 4.34 μ_B, which has almost same result of calculation, μ_{eff} = 4.41 μ_B with only assuming spin contribution. The Mössbauer spectra show severely distorted 8-line shape due to large electric quadrupole interaction at 4.2 K. The charge state of Fe ions is ferrous (Fe^{2+}) as characterized by isomer shift δ = 0.60 mm/s at room temperature.

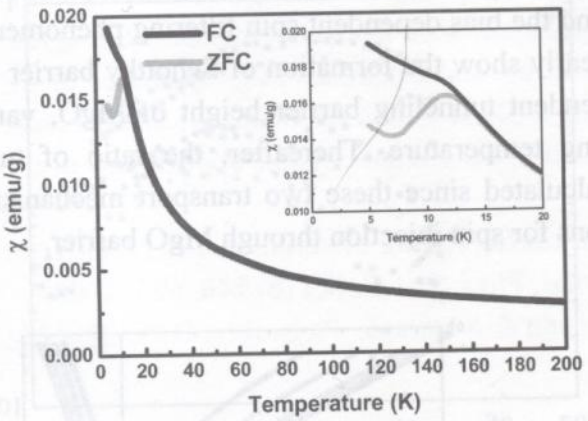

Fig1. The susceptibility for SQUID magnetometer data, under H = 100 Oe, and zero-field-cooled (ZFC) and field–cooled (FC) curve for $Ni_{0.3}Fe_{0.7}Ga_2S_4$.