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Investigation of magnetic properties on spin-ordering effects of FeGa_2S_4 and FeIn_2S_4



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ABSTRACT

We have studied crystal and magnetic properties of chalcogenides FeGa_2S_4 and FeIn_2S_4 with X-ray diffractometer (XRD), magnetic property measurement system (MPMS), magnetometer, physical property measurement system (PPMS), and Mössbauer spectrometer. The crystal structure has 2-dimension triangular lattice structure with $P-3m1$ of FeGa_2S_4 , while FeIn_2S_4 has inverse spinel with space group $Fd3m$. The AC magnetic susceptibility measurements show that FeGa_2S_4 is an insulating spin glass material, exhibiting geometrical frustration, unlike in the antiferromagnetic [AFM] metallic spin glass FeIn_2S_4 . From hysteresis (M-H) curves at 4.2 K, FeGa_2S_4 has spin-flop behavior with an angle of 120° of triangle, as against linear slope of FeIn_2S_4 due to anti-parallel spin. The gap energy by splitting of $^5T_{2g}$, Δ_1 and electric quadrupole splitting ΔE_Q of FeIn_2S_4 are much higher than that of FeGa_2S_4 at 4.2 K because FeGa_2S_4 is geometrically frustrated magnet having degenerate ground state at low temperature.

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