

## Crystallographic and Magnetic Properties of $\text{FeGa}_2\text{S}_4$

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$\text{FeGa}_2\text{S}_4$  has been fabricated and studied by using X-ray, Mössbauer and magnetic measurements.  $\text{FeGa}_2\text{S}_4$  has a trigonal crystal structure (space group  $P3(-)m1$ ), with lattice constants of  $a_0 = 3.669 \text{ \AA}$  and  $c_0 = 12.096 \text{ \AA}$ , respectively. The cation and the anion parameters are determined to be  $\text{Fe}(0,0,1/2)$ ,  $\text{Ga}(1/3,2/3,0.208)$ ,  $\text{S}_1(1/3,2/3,0.863)$  and  $\text{S}_2(1/3,2/3,0.390)$  by using the Rietveld refinement. The sample is a semiconductor and shows an antiferromagnetic behavior. The Mössbauer spectra show a severely distorted 8-line shape, which indicates a large electric quadrupole contribution at low temperature. Magnetic hyperfine field and electric quadrupole interactions at 4.2 K have been analyzed, yielding the following results:  $H_{hf} = 129.9 \text{ kOe}$ ,  $\Delta E_Q = 2.20 \text{ mm/s}$ ,  $\theta = 65^\circ$ ,  $\varphi = 0^\circ$ ,  $\eta = 0.5$  and  $R = 2.50$ , where  $\theta$  and  $\varphi$  are the polar and the azimuthal angles, respectively,  $\eta$  is the asymmetric parameter and  $R$  is the ratio of the electric quadrupole interaction to the magnetic dipole interaction.

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