Magnetic properties of the monoclinic $FeRh_2Se_4$

Chul Sung Kim, In Bo Shim, Min Yong Ha, and Chang Sik Kim
Department of Physics, Kookmin University, Seoul 136-702, Korea

Jae Yun Park
Department of Materials Science and Engineering, Incheon University, Incheon 402-749, Korea

$FeRh_2Se_4$ has been studied by x-rays, Mössbauer spectroscopy, and superconducting quantum interference device (SQUID) magnetometry. Mössbauer spectra of $FeRh_2Se_4$ have been taken at various temperatures ranging from 4.2 to 550 K. Magnetic hyperfine and quadrupole interactions at 4.2 K have been fitted, yielding the following results: $H=161.6$ kOe, $\frac{1}{2}e^2qQ(1+\frac{1}{3}\eta^2)^{1/2}=-0.93$ mm/s, $\theta=61°$, $\phi=0°$, and $\eta=0.1$. The temperature dependence of the quadrupole splitting, calculated in terms of direct lattice-sum calculations using x-ray crystallographic data, is in good agreement with experimental values up to 550 K. The axial field parameter $\Delta_1=2.0|\lambda|$, the rhombic field parameter $\Delta_2=3.3|\lambda|$, and the covalency factor $\alpha^2=0.65$ were obtained. Magnetic susceptibility measurements by dc SQUID magnetometry show that superexchange interactions between Fe^{2+} ions are antiferromagnetic.