

STUDY OF FERRITES  $\text{SrTb}_2\text{Fe}_2\text{O}_7$ ,  $\text{SrEu}_2\text{Fe}_2\text{O}_7$  BY MÖSSBAUER EFFECT

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Mössbauer effect measurements of hyperfine interaction of  $^{57}\text{Fe}$  nucleus at various temperatures in  $\text{SrEu}_2\text{Fe}_2\text{O}_7$ <sup>(1)</sup> and  $\text{SrTb}_2\text{Fe}_2\text{O}_7$ <sup>(2)</sup> are discussed. A spin reorientation of iron in  $\text{SrTb}_2\text{Fe}_2\text{O}_7$  was observed at 4.2 K. Transition temperature from antiferromagnetic to paramagnetic state was estimated as:  $T_N = 544 \pm 2$  K for  $\text{SrEu}_2\text{Fe}_2\text{O}_7$  and  $T_N = 542 \pm 1$  K for  $\text{SrTb}_2\text{Fe}_2\text{O}_7$ . The effective magnetic field in both compounds near the transition temperature can be described by the power law:  $H(T) = H_0 D(1 - T/T_N)^\beta$  with  $\beta = 0.29$  for  $\text{SrEu}_2\text{Fe}_2\text{O}_7$  and  $\beta = 0.28$  for  $\text{SrTb}_2\text{Fe}_2\text{O}_7$ . Nearly the same critical parameters  $\beta$  were obtained following the method of Heller<sup>(3)</sup> where the difference in the temperature computed from the above equation for the measured  $H_{\text{eff}}$  is expressed as  $\Delta T/T_N = 1 - T/T_N - (H/H_0 D)^{1/\beta}$ . The values  $\beta = 0.285 \pm 0.05$  for  $\text{SrEu}_2\text{Fe}_2\text{O}_7$  and  $\beta = 0.279 \pm 0.005$  for  $\text{SrTb}_2\text{Fe}_2\text{O}_7$  were estimated from the plots of  $\Delta T/T_N$  versus  $T/T_N$ . As  $\beta$  is a model dependent critical exponent it is possible to conclude that both compounds behave as a tri-dimensional Ising system for which  $\beta = 1/3$ . The iron in both compounds is in the  $\text{Fe}^{3+}$  high spin state and the main contribution to  $\Delta E_Q$  comes from the lattice. This part was estimated by point charge lattice sum calculation. The results of the calculation are given in the following table together with the experimental data.

Sample	T [K]	$\eta^{\text{cal}}$	$\Delta E_Q^{\text{cal}}$ (mm/s)	$\eta^{\text{exp}}$	$\Delta E_Q^{\text{exp}}$ (mm/s)
$\text{SrEu}_2\text{Fe}_2\text{O}_7$	300	0.11	0.69	0.16	0.70
$\text{SrTb}_2\text{Fe}_2\text{O}_7$	300	0.57	-0.43	0.20	0.66

The disagreement between the calculated and the measured value of  $\Delta E_Q$  of  $\text{SrTb}_2\text{Fe}_2\text{O}_7$  could be explained by uncertainty of the positions of ions from ref. 4. The latest more accurate data for the positions of ions in the  $\text{SrEu}_2\text{Fe}_2\text{O}_7$  unit cell bring the calculated value for  $\Delta E_Q$  closer to the measured one. This indicates strong dependence of  $\Delta E_Q^{\text{cal}}$  from the changes of ion parameters in the lattice.

## References

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4. D.Samaras, A.Collomb, J.C.Joubert, E.F.Bertaut, J. Sol. State Chem. 12 (1975) 127