

Mössbauer Studies of Perovskite $\text{Gd}_{0.5}\text{Sr}_{0.5}\text{FeO}_{3-y}$

Chul Sung KIM* and Young Rang UHM

Department of Physics, Kookmin University, Seoul 136-702

Jung Chul SUR

Department of Physics, Wonkwang University, Igsan 570-749

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Perovskite powder $\text{Gd}_{0.5}\text{Sr}_{0.5}\text{FeO}_{3-y}$ was studied by X-ray diffraction, Mössbauer spectroscopy, vibrating samples magnetometry, and Mohr's salt analysis. $\text{Gd}_{0.5}\text{Sr}_{0.5}\text{FeO}_{3-y}$ was synthesized by using the solid-solid reaction method. The crystal structure was found to be orthorhombic with lattice parameters, $a_0=5.531 \text{ \AA}$, $b_0=5.608 \text{ \AA}$ and $c_0=7.724 \text{ \AA}$. Mössbauer spectra of $\text{Gd}_{0.5}\text{Sr}_{0.5}\text{FeO}_{3-y}$ have been taken at various temperatures ranging from 4.2 to 600 K. The spectrum pattern at 4.2 K consisted of four sets of six Lorentzians, and the magnetic hyperfine fields are found to be 275, 486, 514 and 540 kOe. The Néel temperature, T_N , was found to be 478 K. Mohr's salt analysis for $\text{Gd}_{0.5}\text{Sr}_{0.5}\text{FeO}_{3-y}$ demonstrated the existence of the mixed valence states, Fe^{3+} (73 %) and Fe^{4+} (27 %), and $y=0.11$ at room temperature. It is notable that Fe^{5+} was created at 4.2 K. The magnetic susceptibility show that the superexchange interaction was antiferromagnetic.