

Magnetic property and charge ordering effect in polycrystalline LuFe_2O_4

Bong Kyu Bang, Taejoon Kouh, and Chul Sung Kim^{a)}

Department of Physics, Kookmin University, Seoul 136-702, Republic of Korea

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The charge ordering effect in LuFe_2O_4 powder is investigated with the vibrating sample magnetometer and Mössbauer spectroscopy. The crystal structure of LuFe_2O_4 shows the two-dimensional layered type rhombohedral($R\bar{3}m$) structure. The lattice constants are found to be $a_0=3.439 \text{ \AA}$ and $c_0=25.258 \text{ \AA}$ by the Rietveld refinement. The Néel temperature (T_N) is determined to be 250 K. The Mössbauer spectra consist of four sextets indicating the magnetic ordering below T_N , where three sets are assumed to be Fe^{3+} phases and the other is Fe^{2+} at 4.2 K, and two doublets splitting in a paramagnetic region. At room temperature, the electric quadrupole splittings (ΔE_Q) of two doublets are 0.22 ± 0.01 and 0.67 ± 0.01 mm/s, respectively. The isomer shift value of a doublet with smaller ΔE_Q is 0.18 ± 0.01 mm/s relative to the Fe metal, which is consistent with the Fe^{3+} valence state, while the value of a doublet with larger ΔE_Q is 0.83 ± 0.01 mm/s indicating Fe^{2+} state. The Mössbauer spectra suggest that the observed asymmetry below 370 K is due to the charge ordering effect between Fe^{2+} and Fe^{3+} . © 2008 American Institute of Physics.

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