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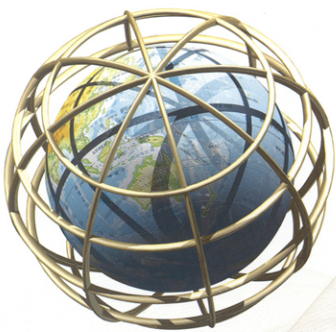

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QA01

Mössbauer study of iron ordering in mixed valence system $LuFe_2O_4$

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$LuFe_2O_4$ has shown charge ordering on triangular plane, spontaneous polarization, and sequential phase transition scheme associated with the charge ordering in the mixed valence system[1]. N. Ikeda *et al.*[2] reported that the effect of spontaneous polarization was observed in $LuFe_2O_4$ by the ordering of the Fe^{2+} and Fe^{3+} ions. Single crystalline $LuFe_2O_4$ was grown by the floating zone method. The crystallographic and magnetic properties of the sample were measured using X-ray diffractometer (XRD), Mössbauer spectroscopy, and vibrating sample magnetometer (VSM). The crystal structure was found to be a two-dimensional layered-type rhombohedral with space group *R3-mh*. The magnetic Néel temperature (T_N) was determined to be 250 K from the M-T curve and Mössbauer spectra. Just below T_N, the magnetic moment has large value and shows a abrupt change in M-T curve. The Mössbauer spectra have been taken at various temperatures ranging from 4.2 to 360 K as shown in Fig. 1. We confirmed that the charge ordering of Fe^{3+} and Fe^{2+} ions was begun below 350 K, magnetic superstructure of the different ionic state was formed around 320 K. and Fe ions with different ionic state formed the superstructure around 320 K. The isomer shift value of Fe^{2+} doublet increases with decreasing temperature from 320 to 235 K. At low temperature, Mössbauer spectra consisted of four sextets with magnetic ordering. The magnetic hyperfine fields Hhf as a function of the temperature for sets of Fe^{3+} and Fe^{2+} on $LuFe_2O_4$, accord with the Brillouin curve B(S) for S=1/2 and S=2, respectively. We interpret that the microscopic electron structure of the Fe^{3+} ions is in low spin state.

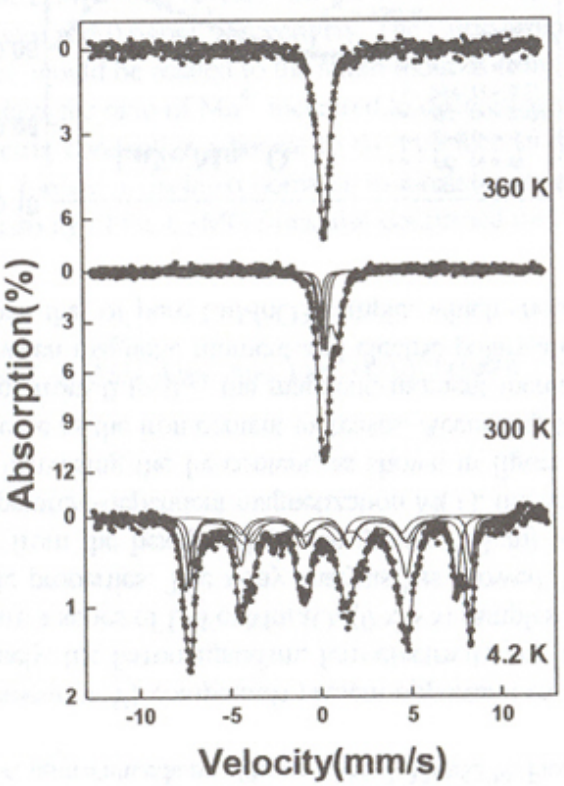

Fig. 1. Mössbauer spectra of $LuFe_2O_4$ at 4.2, 300, and 360 K.

REFERENCES

[1] Y. Yamada, K. Kitsuda, S. Nohdo and N. Ikeda, Phys. Rev. B **62**, 12167 (2000).

[2] N. Ikeda, H. Ohsumi, K. Ohwada, K. Ishii, T. Inami, K. Kakurai, Y. Murakami, K. Yoshii, S. Mori, Y. Hoichi and H. Kitô, Nature **436**, 1136 (2005).