Programme and Abstracts

International Conference on the Applications of the Mössbauer Effect

LE CORUM Conference Centre

Esplanade Charles de Gaulle
Montpellier, France
THE STUDY OF SUPEREXCHANGE INTERACTION OF ORDERED Li_0.5Fe_{1.0}Rh_{1.5}O_4

Kun Uk Kang\textsuperscript{1} and Chul Sung Kim\textsuperscript{1}
\textsuperscript{1}Department of Physics, Kookmin University, Seoul 136-702, Korea

Li_{0.5}Fe_{1.0}Rh_{1.5}O_4 has been made in air by the direct composition method. Magnetic properties of the sample were studied by Mössbauer technique without and in 60 kOe external field and SQUID magnetometer. X-ray diffraction patterns were analyzed by the Rietveld refinement method. The x-ray pattern of x = 1.50 is characterized by additional reflection (200) that is described by 1:1 ordered structure of Li, Fe at tetrahedral (A) site and can be assigned to the space group F43m. Figure 1 shows such ordered structure around Octahedral (B) site. The lattice constant (a_0) is 8.4348 Å. Mössbauer spectra were measured in 60 kOe external field parallel to the gamma-ray. The spectra at the liquid helium temperature show that the iron ions occupy both A and B sites. Two sites are in ferric states. The spectra measured from 4 K to the Néel temperature show the characteristic magnetic behavior which result from the ordered distribution of nearest neighbor ions of A site around Fe in B site. The Néel temperature has been determined 260 ± 3 K.

The temperature dependences of the magnetic hyperfine fields at the \textsuperscript{57}Fe nuclei at two crystallographic iron sites are analyzed using the Néel theory of ferrimagnetism and Figure 2 shows the reduced magnetic hyperfine fields (H(T)/H(0)) for the A and B sites as functions of the reduced temperature (T/T_\text{N}). The inter-sublattice superexchange interaction is found to be antiferromagnetic with a strength of J_{A,B} = -3.78 k_B while the intrasublattice superexchange interactions are ferromagnetic with strengths of J_{A-A} = 5.40 k_B and J_{B-B} = 7.39 k_B. The Debye temperatures of the tetrahedral and octahedral sites are determined to be 388 and 464 ± 3 K, respectively.

![Figure 1. Ordered Cation Distribution at tetrahedral site around Fe at Octahedral (16e) site. : Fe ion at (4a) site, Li ion at (4c) site.](image1)

![Figure 2. Reduced hyperfine field H(T)/H(0) of ferric ions at octahedral (B) and tetrahedral(A) sites as a function of reduced temperature (T/T_\text{N}).](image2)