ISPMM/ISAMT 2001

International Symposium on Physics of Magnetic Materials

International Symposium on Advanced Magnetic Technologies

Grand Hotel
Taipei, Taiwan
May 13-16, 2001

Hosted By:
Chinese Association for Magnetic Technology, Taiwan
Institute of Physics, Academia Sinica, Taiwan
Opto-Electronics & Systems Labs., ITRI, Taiwan

Sponsored By:
Department of Industry Technology, MOEA, Taiwan
Industrial Development Bureau, MOEA, Taiwan
National Science Council, Taiwan
Ministry of Education, Taiwan
MAGNETIC AND ELECTRON TRANSPORT PROPERTIES IN $\text{Co}_{0.1}\text{Fe}_{0.9}\text{Cr}_2\text{S}_4$

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Sample of $\text{Co}_{0.1}\text{Fe}_{0.9}\text{Cr}_2\text{S}_4$ has been studied with Mössbauer spectroscopy, x-ray, SQUID magnetometer and magnetoresistance (MR). The crystal structure was determined to be cubic spinel with its lattice constant $a_0=9.999$ Å. The Mössbauer spectra were recorded from 4.2 K to room temperature. The asymmetric line broadening is observed and considered to be dynamic Jahn-Teller distortion. The unusual reduction of magnetic hyperfine field below 100 K may be explained in terms of cancellation effect between the mutually opposite orbital current field ($H_o$) and Fermi contact field ($H_c$). Isomer shift value of the sample at room temperature was 0.58 mm/s, which means that charge state of Fe ions was ferrous in character. The Curie temperature ($T_C$) was 178 K. The MR peak was observed at 192 K about 10 % at an applied field 2 T. The activation energy above the Curie temperature was calculated to be 50 meV. The conduction mechanism of Mn perovskites is accompanied with electron hopping between heterogeneous Mn$^{3+}$ and Mn$^{4+}$, but in this sample there is no heterovalence in iron ions. The three strengths of superexchange interactions $J_{a,b}$, $J_{a,c}$, and $J_{b,c}$ were calculated to be $-10.5$, $4.5$, and $7.6$ K, respectively. The conduction mechanism in this sample was completely different from double exchange which was characteristic of Mn perovskites.

The present studies were supported by the Korea Science and Engineering Foundation (97-070 2-0401-5), and by the Brain Korea 21 Program.