Mössbauer studies of the Cr doped ordered perovskite

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The Cr doped ordered perovskite $Sr_2Fe_{0.93}Cr_{0.07}MoO_6$ powder has been prepared by a solid-state reaction method. The chemical composition and the crystalline structure of the sample were confirmed with the Rutherford backscattering spectrometer spectrum and x-ray diffraction pattern analysis. The crystalline structure was determined to be tetragonal with lattice parameters a_0 = 5.572 Å and c_0 = 7.900 Å, respectively. The magnetic properties of the $Sr_2Fe_{0.93}Cr_{0.07}MoO_6$ have been studied by the vibrating sample magnetometer and the Mössbauer spectroscopy. The saturation magnetization and the coercive force were 26.5 emu/g and 101.2 Oe at room temperature. Mössbauer spectra measurements of the $Sr_2Fe_{0.93}Cr_{0.07}MoO_6$ have been taken at various temperatures ranging from 15 to 450 K. Mössbauer lines are shape at 13 K and the line broadening increased with the temperature increased. Analysis of Mössbauer spectra has considered with next nearest-neighbour interactions [1] and the anisotropic hyperfine field fluctuation. The spin-flip process of the magnetic moment in fine particles is described by a flip frequency f [2] of the $f = f_0 \exp[-KV/k_BT]$, where f_0 is a frequency factor, K is the effective anisotropy energy per unit volume and V is the particle volume. In order to explain the Mössbauer line broadening and 1, 6 and 3, 4 line-width difference, we used the blume-Tjon [3] expression for the line shape of the Mössbauer spectra in the presence of fluctuating magnetic field which jumps between the value of $+H$ and $-H$ along the z-axis (asymmetry parameter η=0) with an average frequency f. H is assumed to jump stochastically between the two directions parallel to the electric fields gradient principle axis, $\theta=0°$ ($+H$) and 180°($-H$). The anisotropic field fluctuation of $+H$ (P_+ = 0.85) was great than $-H$ (P_- = 0.15). We also calculated anisotropy energy dependence on the frequency factor and the temperature from the relaxation rate. The Curie temperature was determined to be 450 K using the thermal scan method.

References

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