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Mössbauer studies of CMR compound $\text{La}_{0.67}\text{Ca}_{0.33}\text{Mn}_{0.97}^{57}\text{Fe}_{0.03}\text{O}_3$

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Abstract

The perovskite $\text{La}_{0.67}\text{Ca}_{0.33}\text{Mn}_{0.97}^{57}\text{Fe}_{0.03}\text{O}_3$ compound has been prepared by sol-gel method. Colossal magnetoresistance and magnetic properties of $\text{La}_{0.67}\text{Ca}_{0.33}\text{Mn}_{0.97}^{57}\text{Fe}_{0.03}\text{O}_3$ has been studied using X-ray diffraction pattern, Rutherford back-scattering spectroscopy, Mössbauer spectroscopy and vibrating sample magnetometer. Crystalline $\text{La}_{0.67}\text{Ca}_{0.33}\text{Mn}_{0.97}^{57}\text{Fe}_{0.03}\text{O}_3$ was a cubic perovskite structure with a lattice parameter $a_0 = 3.859 \text{ \AA}$. Mössbauer spectra of $\text{La}_{0.67}\text{Ca}_{0.33}\text{Mn}_{0.97}^{57}\text{Fe}_{0.03}\text{O}_3$ have been taken at various temperatures ranging from 4.2 K to room temperature. Analysis of ^{57}Fe Mössbauer spectrum data has considered nearest-neighbor interactions and anisotropic hyperfine field fluctuation. Analysis of ^{57}Fe Mössbauer data in terms of the local configurations of Mn atoms has permitted the influence of the magnetic hyperfine interaction to be monitored. The saturation magnetization of $\text{La}_{0.67}\text{Ca}_{0.33}\text{Mn}_{0.97}^{57}\text{Fe}_{0.03}\text{O}_3$ is found to be 68 emu/g at 77 K. The Curie temperature, T_C , is determined to be 210 K. The temperature dependence of the resistance under zero and 10 kOe applied field shows that a semiconductor-metal transition, $T_{\text{SC-M}}$, occurs at 200 K. The relative magnetoresistance, MR, is about 45%. © 2000 Elsevier Science B.V. All rights reserved.

Keywords: Sol-gel; Colossal magnetoresistance; Mössbauer; Anisotropic hyperfine field fluctuation
