

Mössbauer Studies of Perovskite $\text{La}_{0.67}\text{Ca}_{0.33}\text{Mn}_{1-x}\text{Fe}_x\text{O}_3$

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Abstract

The perovskite of $\text{La}_{0.67}\text{Ca}_{0.33}\text{Mn}_{1-x}\text{Fe}_x\text{O}_3$ ($x = 0, 0.01, 0.03, \text{ and } 0.05$) compounds have been studied with Mössbauer spectroscopy, vibrating sample magnetometer (VSM), and x-ray diffractometer. The $\text{La}_{0.67}\text{Ca}_{0.33}\text{Mn}_{1-x}\text{Fe}_x\text{O}_3$ powders have been prepared by sol-gel processing method. Mössbauer spectra of $\text{La}_{0.67}\text{Ca}_{0.33}\text{Mn}_{1-x}\text{Fe}_x\text{O}_3$ powders have been taken at various temperatures ranging from 4.2 K to room temperature. The line width of each Lorentzian 6-line at 4.2 K was broaden in proportion as doped ^{57}Fe increased. 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 values of the isomer shifts show that all the iron ions are in the ferric (Fe^{3+}) state. The temperature dependence of the resistance under zero and 10 kOe applied magnetic field shown that a semiconductor-metal transition temperature, T_{SC-M} , decreased from 274 to 155 K in proportion as doped ^{57}Fe increased. The relative magnetoresistance (MR) of the $\text{La}_{0.67}\text{Ca}_{0.33}\text{Mn}_{0.97}\text{Fe}_{0.03}\text{O}_3$ is about 45 % at the $T_{SC-M} = 210$ K.