Magnetic, electrical transport and impedance spectroscopy studies on Ti substituted La0.67Sr0.33MnO3 ceramics.

Abstract

La0.67Sr0.33Mn1-xTixO3 samples with x = 0.0, 0.2, 0.4 and 0.6 have been prepared using the conventional solid-state reaction method. The structure, magnetic and electrical transport properties as well as the impedance spectroscopy of the samples were investigated. The powder XRD analysis showed that all samples were single phase with rhombohedral perovskite structure. The magnetization curve suggests that the Ti substituted samples exhibit weak ferromagnetic behaviour. The highest magnetoresistance (MR) value was obtained for sample x = 0.2 at temperature 200 K and field 1 T, which was 32.5%. Low field magnetoresistance (LFMR) effect was observed for the x = 0.0 sample. The metal-like resistivity curve for the x = 0.0 sample was best fitted with $\rho = \rho o + \rho 2T2$ equation, indicating the grain boundary effects and electron-electron scattering process contribution. Semiconductor-like transport behaviour was observed for the Ti substituted samples and can be fitted by variable range hopping (VRH) and small polaron hopping (SPH) mechanisms. The activation energy of the samples increased when the Ti composition increased. An equivalent circuit was proposed for the impedance plot with a series of two parallel RC circuits. The grain, grain boundary and electrode resistance values increased with Ti composition due to the reduction of the Mn3+ / Mn4+ ratio.

Keyword: Electrical transport; Impedance spectroscopy; Magnetoresistance.