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Effect of 20% Cr-doping on structural and electrical properties of $\text{La}_{0.67}\text{Ca}_{0.33}\text{MnO}_3$ perovskite

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Abstract

Structural and electrical properties of $\text{La}_{0.67}\text{Ca}_{0.33}\text{Mn}_{1-x}\text{Cr}_x\text{O}_3$ ($x= 0$ and 0.2) manganites are studied in this work. The samples were prepared using Pechini sol-gel method at 1173 K. Rietveld analysis of X-ray diffraction (XRD) patterns shows the formation of pure crystalline phase with orthorhombic *Pnma* structure with a decrease of the unit cell volume and crystalline domain size when increasing Cr-content. Electrical properties of the samples have been investigated using complex impedance analysis in 180-320 K temperature range with varying frequency between 40 and 10^6 Hz. For both samples, frequency dependence of imaginary part of impedance (Z'') shows the existence of relaxation phenomenon. The impedance study using Nyquist representation revealed the appearance of semicircle arcs and an equivalent circuit of the type of $R_1+(R_2//Z_{CPE})$ has been proposed to explain the impedance results. The conductance curves were analyzed by Jonscher power law and the deduced activation energy values are close to those calculated from relaxation time indicating that relaxation process and conductivity have the same origin.

Keywords: Perovskites; Rietveld analysis; Complex impedance spectroscopy; Relaxation time; Electrical equivalent circuit; Conductance.

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