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Magnetic and electrical response of Co-doped $\text{La}_{0.7}\text{Ca}_{0.3}\text{MnO}_3$ manganites/insulator system

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ABSTRACT

We present a systematic study of the structural, magnetic and electrical properties of $\text{La}_{0.7}\text{Ca}_{0.3}\text{MnO}_3$ (LCMO) and $\text{La}_{0.7}\text{Ca}_{0.3}\text{Mn}_{0.95}\text{Co}_{0.05}\text{O}_3$ (LCMCOO) perovskite manganites. Most of the work is devoted to the electrical properties with a thorough discussion about different models for both the metallic and insulator states. With a view to understand the conduction mechanism in these materials, the resistivity of both materials was measured over a temperature range 5–300 K and in a magnetic field up to 1 T and the data were analysed by using several theoretical models. It has been observed that the metallic part of the temperature dependent resistivity (ρ) curve fits well with $\rho = \rho_0 + \rho_{2CB} T^{-2CB}$, indicating the electron-magnon scattering processes in the conduction of these materials. On the other hand, in the high temperature paramagnetic insulating regime, the adiabatic small polaron and VRH models fit well, thereby indicating that polaron hopping might be responsible for the conduction mechanism.