Microstructural Effect on the Transport Behaviour in Sol-Gel Grown LCMO Manganites

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Abstract

In this communication, we present the microstructural effects on the electrical transport and insulator - metal (I-M) transition temperature (T_P) in nanostructured $La_{0.7}Ca_{0.3}MnO_3$ (LCMO) manganites, synthesized using Sol - Gel method. XRD studies and Rietveld refinement of the data confirms the single phase orthorhombic structure having P_{nma} space group (No. 62). Microstructural investigations, using SEM, show that, at higher sintering temperature, the dissolution of the neck like feature in between grains is observed. It is reported that, the thickness of grain boundaries, necking between the grains and smaller grain size affect the transport in manganites. The surface to volume ratio (D^{-1}) is the key factor in nanostructured materials which increases with reduction in grain size. The magnetotransport measurements on the LCMO samples studied show a strong dependence of MR on the grain morphology. The observation of appreciable low field MR (LFMR), at 5K, has been explained in the light of modifications in grain morphology and Spin Polarized Tunneling (SPT) whereas the high field MR (HFMR) decreases due to the intrinsic contribution around T_P. Grain morphology induces an interplay between the low temperature LFMR and HFMR around T_P in nanostructured LCMO. The dependence of resistivity, T_P, LFMR and HFMR on D^{-1} has been discussed in detail.

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