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MAGNETOELECTRIC RESPONSE OF $La_{0.5}Ca_{0.5}MnO_3$ (LCMO) OBTAINED BY PECHINI METHOD

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Abstract – $La_{0.5}Ca_{0.5}MnO_3$ nanoparticles were prepared by polymeric precursor method (PECHINI). Homogeneity and phase-purity are achieved at temperatures as low as 600 ºC. Structural characterization of the powders was carried out using X-ray powder diffraction (XRD), scanning electron Microscopy (SEM) and by Transmission Electron Microscopy (TEM). The magnetic transition was determined by measuring the AC susceptibility (χ). The ceramic Powders obtained were sintered at 1200ºC for two hours. The resistivity of the sample has been measured at low temperatures using the four probe technique. Magnetoresistive effect was investigated.

Mixed valence manganites $Ln_{1-x}A_xMnO_3$, where Ln is a trivalent rare earth and A is a divalent alkaline-earth or monovalent alkali metal, have been the subject of broad research because of their unusual magnetic, transport properties and giant magnetoresistance effect. This kind of materials have great potential for use in a wide range of applications, like sensors, permanent magnets, catalysts, pigment, etc. Recently the attention has been placed on their magnetic and electrical properties, leading the wide investigations on the giant magnetoresistance (GMR), electronic and microelectronic devices and the possible use as the electrode materials for solid-oxide fuel cell (SOFC).

Since the electrical and magnetic properties depend strongly on their preparation routes, several routes have been used to prepare the bulk polycrystalline samples of perovskite type lanthanum manganese oxides. The polymeric precursor method (Pechini) [1] has been less used in the synthesis of manganites although it has many advantages, such as low temperature processing, control of the molecular structure, atomic-scale homogeneity of the elements and small particle size (the order of Å).

In this work we report the magnetoelectric response of $La_{0.5}Ca_{0.5}MnO_3$ (LCMO) obtained by Pechini method. The nanoparticles were prepared by polymeric precursor method (PECHINI). Homogeneity and single phase are achieved at temperatures as low as 600 ºC, as show in Fig. 1. Particle size (between 3-5 nm) and regular morphology were determined by TEM and SEM. A ferromagnetic–paramagnetic phase transition occurs at approximately 190 K, as show in Fig. 2. The obtained ceramic powders were pressed and sintered at 1200ºC for two hours. Resistivity measurements were performed using the conventional four-probe method in the temperature range 50–300 K. The magnetoresistance properties were measured as a function of magnetic field applied to 0 and 1 T.

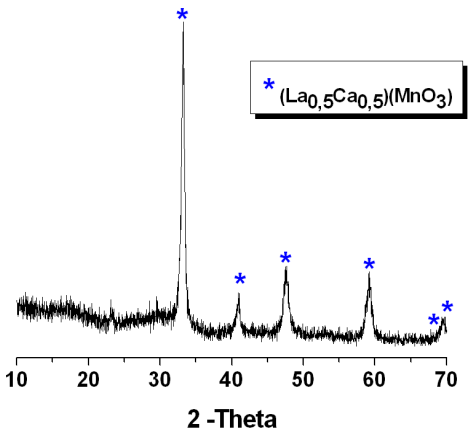

Figure 1: X-ray diffraction patterns of powders of LCMO obtained from the Pechini method.

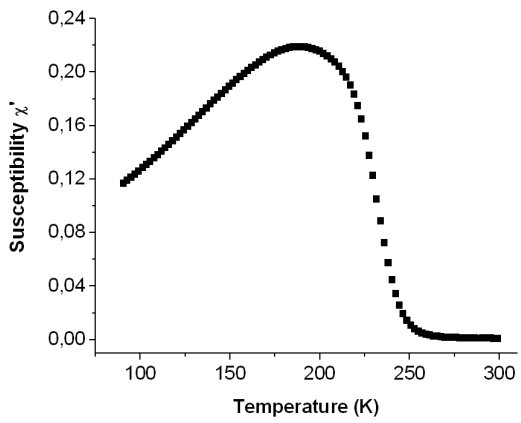

Figure 2: Magnetic susceptibility of LCMO nanopowders.

[1] M.P. Pechini Method of preparing lead and alkaline earth titanates and niobates and coat-ing method using the same to form a capacitor, US Patent No. 3,330,697. Julio 11, 1967.