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Structural, microstructural, electrical and magnetic studies on La_2CoMnO_6 produced via combustion synthesis

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Abstract – In this work we present structural, electrical and magnetic studies on La_2CoMnO_6 complex perovskite produced by combustion synthesis. X-ray diffractograms reveal that the sample treated at 1300°C presents a single phase Pbnm-orthorrombic structure. Rietveld refinements (plotted by the PowderCell 2.4 software) show a good fitting between the La_2CoMnO_6 pattern and the experimental diffractions results, where Co and Mn have 3+ valences. Measurements of DC magnetization *vs.* temperature, M(T), exhibit a ferromagnetic (FM) transition, which depends on magnetic field, and the DC magnetization *vs.* magnetic field reveal a Ferromagnetic-Paramagnetic transition. In addition, AC resistivity measurements suggest a metal-semiconductor behavior.

The mixed valences of transition-metal ions, and the charge disproportionation, appear to be some of the common features of the magnetic perovskite $A_2BB'O_6$. Perovskites LaMO3 form, with M=Mn, CO and Ni, has demonstrated antiferro-, dia- and paramagnetic behaviors respectively. Doubles perovskites formula like La_2MnMO_6, traditionally has demonstred ferromagnetic behavior and is a promising candidate for devices based on intergrain-tunnelling magnetoresistance [1-4].

The samples were prepared by combustion synthesis, where aqueous solutions of metal-nitrates and fuel, like urea, in stoichiometric amounts. After the combustion, the resulting powder was pelletized and thermally treated between 800 - 1300°C for 24h with intermediate gridding. X-rays diffraction (XRD) patterns were acquired by a Siemmens D5000 diffractometer with CuKα radiation. DC magnetization measurements *vs.* temperature and magnetic field were conducted using a MPMS magnetometer by Quantum Design. The electrical measurements *vs.* temperature were performed in a home built apparatus using the four-probe method.

X-rays diffractogram shows that the treated sample at 1300°C presents single phase Pbnm-orthorrombic structure. Field-dependence of the DC magnetization shows ferromagnetic hysteresis loops at 10K, 150K and 200K (Fig.1).Temperature-dependence of the DC magnetization exhibits a ferromagnetic order with temperature transition reducing of 140K to 65K when the magnetic field increases to 5 kOe (Fig.2). AC resistivity measurements reveal that these materials have metal-semiconductor characteristics with temperature transition near to 200K (Fig.3).

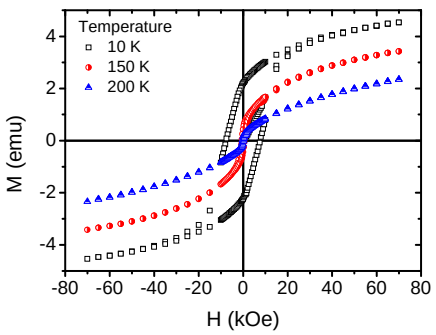

Fig. 1 - DC magnetization hysteresis curves of La_2CoMnO_6 sample annealed at 1300 °C in air for 12h.

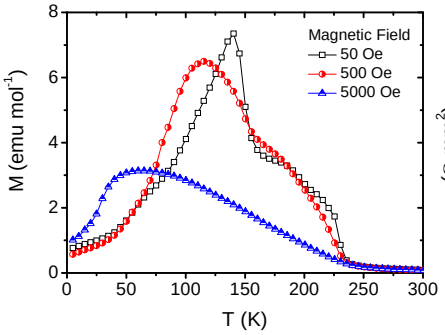

Fig. 2 – DC susceptibility *vs.* temperature of La_2CoMnO_6 thermally treated at 1300 °C in air for 12h.

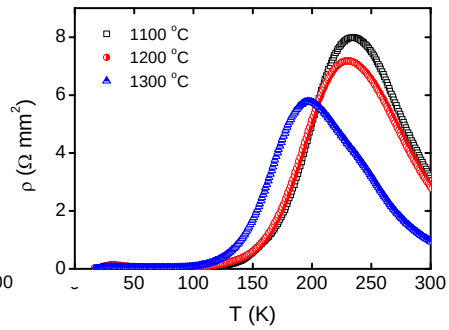

Fig. 3 - Resistivity *vs.* temperature of La_2CoMnO_6 treated in different temperatures.

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