EFFECT OF HOLMIUM ADDITION ON THE ELECTRICAL TRANSPORT PROPERTIES OF POLYCRISTALLINE LCMO MANGANITES

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ABSTRACT

This research is done to measure the "Effect of Holmium addition on the electrical transport properties of polycrystalline LCMO manganite". The different value of Ho which is at x = 0.00, 0.15, 0.30 was added to LCMO and grind it to make them mixed together. After that the entire sample was calcine at 900°C for 12 hours at the rate 3°C per minute. Then the sample was press to make it into a pellet and sinter at 1300°C. Then this sample was measure by using instruments such as four point probe and scanning electron microscope. I found that, the electrical resistivity as a function of temperature at zero field, $\rho(0,T)$ for $(La_{1-x}Ho_x)_{0.67}Ca_{0.33}MnO_3$ for x = 0.00,0.15,0.30 show semiconducting behavior above Tp and metallic behavior below Tp by usng four point probe. With increasing Ho doping, the metal-insulator transition temperature Tp shift to lower temperature and the resisitivity is increase which is for x = 0.00, T_{MI} is 256 K with resistivity value 1.48 mΩ.cm. While for x = 0.15, T_{MI} was observed at 152 K with resistivity value 66.5 mΩ.cm. For sample x = 0.30, T_{MI} is 140 K with resistivity value 214 mΩ.cm. the transport mechanism also can be explained by Double Exchange mechanism, Jahn Teller effect.and Jahn Teller polaron. The investigation of the grain size and examination of the composition of sample was done by using a Scanning electron microscope. It found that the Ho is coexisting with the pure LCMO. When the adding of Holmium is increasing, the brightness which is representing the Holmium is more clear to seen.

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The adding of Ho into a pure LCMO can decrease the uses of magnetic in our material. It is because of Ho is a nonmagnetic iron and have a high melting temperature and high resistance. The aim of Ho adding in this composite is to introduce nonmagnetic phases in the surface or interface of LCMO grains and to study the effects on the electrical transport properties and magnetic properties.

The phase diagram of $La_{1-x}Ca_xMnO_3$ is indeed very rich and interesting as shown in Figure 1.1 as a function of Ca concentration x and temperature . At low doping levels, the lattice structure in ground state is orthorhombic, and the magnetic structure is type-A anti ferromagnetic (P. Schiffer et. al, 1995) This magnetic structure can be considered as ferromagnetic planes coupled anti ferromagnetically. The proposed canted anti ferromagnetism (CAF) is nowadays considered as coming from phase separation at nano-meter scales (E. Dagotto et. al, 2003). It is very interesting to note the coexistence of the ferromagnetic and insulating phases (FI) between 0.1 and 0.17. At rational doping of $x = 3/8$, the highest Curie temperature ($\sim$ 260 K) is observed. The 50% doping presents one