THE EFFECTS OF ELECTRICAL TRANSPORT PROPERTIES ON MICROSTRUCTURE OF $(La_{1-X}Bi_X)_{0.7}Ag_{0.3}MnO_3$ CERAMICS.

SITI MUNIRAH BINTI MD RAZAK

Final Year Project submitted in Partial Fulfillment of the Requirements for the Degree of Science (Hons.) Physics in the Faculty of Applied Sciences, University Teknologi Mara

MAY 2011

ACKNOWLEDGEMENTS

Upon completion of this project, I would like to express my gratitude to my parties. My heartfelt thanks goes to my supervisor, Madam Zakiah Binti Mohamed for her fully supported, supervision, encouragement and charitable materials needed in this final year project.

A special thankful to Head of Physics Programme, Dr Ri Hanum Yahaya Subban for the guide, support without any complaining and also for their encourage, comment and suggestion.

Special thank also goes to my beloved friends, without them I did not make this project this perfectly because they give me so many suggestions, critics and also their cooperation.

Last but not least, I would like to express my appreciation to my parents and my siblings for their understanding, support, inspiration, and their love while completing this project. Without them, I may not be able to finish it on time.

TABLE OF CONTENTS

ABSTRACT

A detailed investigation of electrical transport properties on monovalent atom of silver (Ag) and bismuth atoms (Bi) doped polycrystalline of $(La_{1-x}Bi_x)_{0.7}Ag_{0.3}MnO_3$ pellets. The sample of $(La_{1-x}Bi_x)_{0.7}Ag_{0.3}MnO_3$ known as colossal Magnetoresistance (CMR). The sample of $(La_{1-x}Bi_x)_{0.7}Ag_{0.3}MnO_3$ with composition of x = 0.00, 0.10, 0.15, 0.20 were prepared by conventional solid state reaction method. The scanning electron microscope (SEM) used to determine the surface morphologies for the samples, X-ray diffractometer (XRD) to analyze the structure of the samples and the resistivity and metal-insulator transition temperature (T_{MI}) measurement was determined by using Standard four point probe. The grains sizes of the samples become larger and softer with increasing the Bi^{3+} doping of x. The samples also identified as a rhombohedral structure with space group $R\bar{3}c$. For the electrical transport properties, the resistivity is increased while the T_{MI} is decreased when the composition of x is increased. From the graph of intensity (a.u) versus 2θ (deg) curves of $(La_{1-x}Bi_x)_{0.7}Ag_{0.3}MnO_3$ with x=0.00,0.10, 0.10 and 0.20, the two peaks below and above the metal-insulator transition temperature were found. The peak below the T_{MI} is the metallic region and double exchange (DE) mechanism plays on it while above $T_{MI,}$ it is known as insulator region and the Jahn Taller mechanism plays on it.

CHAPTER 1

INTRODUCTION

1.1 Background

Doped perovskite manganites $Re_{1-x}AxMnO_3$, where Re is a rare earth ion such as La, Pr, Nd etc., and A an alkaline earth ion, such as Ca, Sr, Ba etc., have been a focus of major research activity following the discovery that their magnetoresistance is two or more orders of magnitude larger than in normal metals (colossal magnetoresistance or CMR). All of them show a bewildering variety of phases and phase transitions involving electronic, magnetic and structural changes depending on the doping x, temperature T, and ionic species Re and A as well as external perturbations.

The manganese based perovskite oxides also will dramatically change their electrical resistance in the present of magnetic field. The magnetoresistance is associated with a ferromagnetic-to paramagnetic phase transition. The prototypical CMR compound is derived from the parent compound, perovskite $LaMnO_3$. When whole doped at a concentration of 20–40% holes/Mn ion, for instance by Ca or Sr substitution for La, the material displays a transition from a high-temperature paramagnetic insulator to a low-temperature ferromagnetic metal. Near the phase transition temperature, which can exceed room temperature in some compositions, large magnetoresistance is observed.