UNIVERSITI TEKNOLOGI MARA

EFFECTS OF DOPING ON MAGNETIC AND TRANSPORT PROPERTIES OF $La_{0.85-x}Sm_xAg_{0.15}MnO_3$, $La_{0.8-x}M_xAg_{0.2}MnO_3$ ($M=Sm^{3+}$, Dy^{3+}), $(1-x)La_{0.8}Ag_{0.2}MnO_3/xBiFeO_3$ AND $Pr_{0.6}Ca_{0.4-x}Ba_xMnO_3$ MANGANITES

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Thesis submitted in fulfillment
of the requirements for the degree of
Doctor of Philosophy

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

In this study, four manganites series with starting compositions $La_{0.85-x}Sm_xAg_{0.15}MnO_3$($x$=0-0.2), $La_{0.8-x}M_xAg_{0.2}MnO_3$ (M=Dy^{3+}, Sm^{3+}, x=0-0.15), (1-y)$La_{0.8}Ag_{0.2}MnO_3$/$y$$BiFeO_3$ (y=0wt%-3.5wt%) and $Pr_{0.6}Ca_{0.4-x}Ba_xMnO_3$ (x=0-0.3) were prepared by solid-state reaction method in order to elucidate their physical properties. For $La_{0.85-x}Sm_xAg_{0.15}MnO_3$ (x=0-0.2) and $La_{0.8-x}M_xAg_{0.2}MnO_3$ (M=Sm^{3+}, Dy^{3+}, x=0-0.15) series, the resistivity and magnetic measurements showed all samples exhibit transition from insulating to metallic behavior accompanying a paramagnetic to ferromagnetic transition as the temperatures was decreased. For x=0, two metal-insulator, MI transition peaks were observed at T_{P1} and T_{P2} in the resistivity curves. Both peaks and Curie temperature, T_c shifted to lower temperatures with increasing $Dy^{3+}$and Sm^{3+}, indicating that the substitution weakened the double exchange process and enhanced the Jahn-Teller effect. The magnetoresistance peak was observed around T_{p1} for all samples. The observed double peak behavior in the $\rho(T)$ curve is suggested to be due magnetic inhomogeneity of the samples. Our result also showed that the inhomogeneity was strongly influenced by the lattice effect. For (1-y)$La_{0.8}Ag_{0.2}MnO_3$/$y$$BiFeO_3$ (y=0wt%-3.5wt%) composite series, the resistivity and susceptibility measurements showed both metal-insulator transition temperatures, T_{MI} and paramagnetic-ferromagnetic transition temperature, T_c decreased with increasing BFO content indicating weakening of the double exchange, DE mechanism. The MR peak was observed around T_{MI} for all samples which is ascribed to the intrinsic MR effect. Below the peak, the MR increased almost linearly with decreasing temperature for all samples and this ascribed to the phenomena of extrinsic MR. The highest MR% (at 40 K) was observed for the x=1.5% sample which showed a MR of more than twice that of the undoped (x=0%) sample. This extrinsic effect is suggested to be related to improved spin polarize tunneling of conduction electrons between grains under external field as a result of improved spin alignment. It is suggested that BFO induced some kind of magnetoelectric coupling between BFO and LAMO leading to the enhancement of the process. For $Pr_{0.6}Ca_{0.4-x}Ba_xMnO_3$ (x=0-0.3) series, the electrical and magnetic measurements showed that the x=0 sample exhibit insulating behavior and an antiferromagnetic to paramagnetic transition behavior. On the other hand, Ba-doped samples exhibit transition from insulating to metallic behavior accompanying a paramagnetic to ferromagnetic transition as the temperatures were decreased. Both T_c and T_{MI} of samples increase with increasing Ba concentration. Magnetoresistance, MR behavior indicates intrinsic MR mechanism for x=0.1 which changed to extrinsic MR for x> 0.2 as a result of Ba substitution. The weakening of charge ordering and inducement of ferromagnetic-metallic (FMM) state as well as increased in both T_c and T_{MI} indicating enhancement of double exchange mechanism which is suggested to be related to the increase of tolerance factor, τ and increase of e_g-electron bandwidth as $<r_A>$ increase with Ba substitution.

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