INFLUENCE OF Sr^{2+} SUBSTITUTION AT Ca SITE OF DIVALENT-DOPED $La_{0.5}Ca_{0.5-x}Sr_xMnO_3$ (x = 0, 0.10, 0.20) MANGANITE ON ELECTRICAL RESISTIVITY AND MAGNETORESISTANCE

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This Final Year Project Report entitled **"Influence of Sr^{2+} substitution at the Ca site of divalent-doped $La_{0.5}Ca_{0.5-x}Sr_xMnO_3$ (x = 0, 0.10, 0.20) manganite on electrical resistivity and magnetoresistance"** was submitted by Nurul Imani Binti Zulkipli in partial fulfilment of the requirements for the Degree of Bachelor of Science (Hons) Physics, in the Faculty of Applied Science, and was approved by

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ABSTRACT

INFLUENCE OF Sr^{2+} SUBSTITUTION AT Ca SITE OF DIVALENT-DOPED $La_{0.5}Ca_{0.5-x}Sr_xMnO_3$ (x = 0, 0.10, 0.20) MANGANITE ON ELECTRICAL RESISTIVITY AND MAGNETORESISTANCE

Manganites with the general formula $La_{1-x}A_xMnO_3$ (A = Ca and Sr) are well known for their colossal magnetoresistance effect, where a material's resistivity changes drastically under a magnetic field. This property makes them promising candidates for magnetic sensors and spintronic applications. The effect of Sr substitution at the Ca site in $La_{0.5}Ca_{0.5-x}Sr_xMnO_3$ (x = 0, 0.10, 0.20) manganites on electrical resistivity and magnetoresistive properties was studied. The samples were prepared using a solid-state reaction technique, which involved the sequential processes of weighing, grinding, calcination, pelletizing, and sintering. The electrical resistivity of the samples was measured using the four-point probe technique over a temperature range of 30 K to 300 K, under applied magnetic fields of 0 T and 0.8 T. The measurements revealed a metal-insulator transition (MI) in all samples. The transition temperature (T_{MI}) decreased with increasing Sr content. Specifically, at 0 T, the T_{MI} shifted from 110 K (x = 0) to 54 K (x = 0.20), and the overall resistivity decreased significantly with increasing Sr concentration. In addition, an enhanced magnetoresistance (MR) effect was observed for the x = 0.20 sample, which is attributed to spin-dependent interfacial tunneling enhanced under a low magnetic field of 0.8 T. The magnetoresistance peaked at x = 0 and decreased progressively with further Sr doping, likely due to stabilized ferromagnetic ordering. This stabilization led to a reduction in the rate of e_g electron hopping and elongation of the Mn-O bond length, thereby weakening the double exchange mechanism. This study is significant as it highlights the impact of A-site cation substitution on the structure property relationships in manganites. As potential candidates for magnetoresistance and spintronic applications, the results demonstrate that Sr^{2+} substitution effectively modifies the electrical properties of La-based manganites.

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