ELECTRICAL TRANSPORT ANALYSIS OF Sr^{2+} SUBSTITUTION AT THE Ca SITE OF DIVALENT-DOPED $La_{0.5}Ca_{0.5-x}Sr_xMnO_3$ (x = 0.00, 0.10, 0.20) MANGANITE USING SCATTERING AND HOPPING MODELS

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Final Year Project Report Submitted in Partial Fulfilment of the Requirements for the Degree of Bachelor of Science (Hons) Physics in the Faculty of Applied Sciences Universiti Teknologi MARA

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This Final Year Project Report entitled **"Electrical transport analysis of Sr^{2+} substitution at the Ca site of divalent-doped doped $La_{0.5}Ca_{0.5-x}Sr_xMnO_3$ (x = 0.00, 0.10, 0.20) manganite using scattering and hopping models"** was submitted by Siti Zainatul Ain Binti Mat Sait 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

ELECTRICAL TRANSPORT ANALYSIS OF Sr^{2+} SUBSTITUTION AT THE Ca SITE OF DIVALENT-DOPED $La_{0.5}Ca_{0.5-x}Sr_xMnO_3$ (x = 0.00, 0.10, 0.20) MANGANITE USING SCATTERING AND HOPPING MODELS

This research explores the effect of Sr^{2+} ion replacement at the Ca-site in divalent-doped $La_{0.5}Ca_{0.5}MnO_3$ manganites, which are a type of perovskite-structured materials exhibiting fascinating magnetic and electronic transport characteristics. While $La_{0.5}Ca_{0.5-x}Sr_xMnO_3$ is recognized for its metal-insulator transition and charge-ordering characteristics, a detailed comprehension of the impact of different Sr^{2+} doping concentrations (x = 0.00, 0.10, 0.20) on electrical resistivity remains limited. The objectives of this research are to synthesize $La_{0.5}Ca_{0.5-x}Sr_xMnO_3$ samples via the solid-state method and to evaluate their temperature-dependent electrical transport properties using scattering and small polaron hopping (SPH) models. All synthesized samples were characterized via resistivity measurements taken over a temperature range of 30–300 K under zero magnetic fields (0 T) and with a magnetic field of 0.8 T. The metals region ($T < T_{MI}$) best fit a combination scattering model ($\rho = \rho_0 + \rho_{2.5}T^{2.5}$), with clear trends of decreasing residual resistivity (ρ_0) and scattering coefficient ($\rho_{2.5}$) as Sr content increased which is indicative of enhanced conduction and higher connectivity between various grains. The insulating region ($T > T_{MI}$) best matched the SPH model of carrier transport with activation energy (E_a) showing the consistent decrease away from zero as compared to the structural disorder caused by the Sr^{2+} substitution and thus, further confirming better carrier mobility. Overall, these findings shows that Sr^{2+} doping not only reduces structural disorder and lattice distortion but also significantly enhances electrical transport, thus offering a promising route for optimizing manganites in next-generation electronic and spintronic applications.

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