

**ELECTRICAL TRANSPORT ANALYSIS OF  $\text{Sr}^{2+}$  SUBSTITUTION AT THE  
Ca SITE OF DIVALENT-DOPED  $\text{La}_{0.5}\text{Ca}_{0.5-x}\text{Sr}_x\text{MnO}_3$  ( $x = 0.00, 0.10, 0.20$ )  
MANGANITE USING SCATTERING AND HOPPING MODELS**

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This Final Year Project Report entitled **“Electrical transport analysis of Sr<sup>2+</sup> substitution at the Ca site of divalent-doped doped La<sub>0.5</sub>Ca<sub>0.5-x</sub>Sr<sub>x</sub>MnO<sub>3</sub> (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 $\text{Sr}^{2+}$ SUBSTITUTION AT THE Ca SITE OF DIVALENT-DOPED $\text{La}_{0.5}\text{Ca}_{0.5-x}\text{Sr}_x\text{MnO}_3$ ( $x = 0.00, 0.10, 0.20$ ) MANGANITE USING SCATTERING AND HOPPING MODELS**

This research explores the effect of  $\text{Sr}^{2+}$  ion replacement at the Ca-site in divalent-doped  $\text{La}_{0.5}\text{Ca}_{0.5}\text{MnO}_3$  manganites, which are a type of perovskite-structured materials exhibiting fascinating magnetic and electronic transport characteristics. While  $\text{La}_{0.5}\text{Ca}_{0.5-x}\text{Sr}_x\text{MnO}_3$  is recognized for its metal-insulator transition and charge-ordering characteristics, a detailed comprehension of the impact of different  $\text{Sr}^{2+}$  doping concentrations ( $x = 0.00, 0.10, 0.20$ ) on electrical resistivity remains limited. The objectives of this research are to synthesize  $\text{La}_{0.5}\text{Ca}_{0.5-x}\text{Sr}_x\text{MnO}_3$  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 ( $T < T_{\text{MI}}$ ) best fit a combination scattering model ( $\rho = \rho_0 + \rho_{2.5}T^{2.5}$ ), with clear trends of decreasing residual resistivity ( $\rho_0$ ) 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 ( $T > T_{\text{MI}}$ ) 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  $\text{Sr}^{2+}$  substitution and thus, further confirming better carrier mobility. Overall, these findings shows that  $\text{Sr}^{2+}$  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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