EFFECT OF Cr^{3+} ION SUBSTITUTION AT THE Mn SITE OF $La_{0.5}Ca_{0.5}Mn_{1-x}Cr_xO_3$ (x = 0, 0.03, 0.05) MANGANITE ON ELECTRICAL RESISTIVITY AND MAGNETORESISTANCE

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ABSTRACT

EFFECT OF Cr^{3+} ION SUBSTITUTION AT THE Mn SITE OF $La_{0.5}Ca_{0.5}Mn_{1-x}Cr_xO_3$ (x = 0, 0.03, 0.05) MANGANITE ON ELECTRICAL RESISTIVITY AND MAGNETORESISTANCE.

This study examined the effect of Cr^{3+} ion substitution at the Mn-site of $La_{0.5}Ca_{0.5}Mn_{1-x}Cr_xO_3$ (x = 0.00, 0.03, and 0.05) on electrical resistivity and magnetoresistance (MR). The samples were prepared via the solid-state reaction method, and electrical transport measurements were conducted using the four-point probe technique in the temperature range of 30 K to 300 K, under both zero magnetic field and an applied field of 0.8 T. The undoped compound (x = 0.00) exhibited a metal–insulator transition (T_{MI}) at 110 K, which increased to 127 K for x = 0.03 and significantly decreased to 84 K for x = 0.05. These variations are attributed to the suppression and alteration of the double-exchange mechanism. MR measurements revealed that for x = 0.00 and x = 0.03, MR decreased with increasing temperature, likely due to thermal agitation hindering spin alignment. In contrast, the x = 0.05 sample exhibited significantly higher MR values across the entire temperature range, along with the presence of multiple resistivity peaks—suggesting magnetic inhomogeneities and possible magnetoelectronic phase separation. These findings confirm that Cr^{3+} doping at the Mn-site in $La_{0.5}Ca_{0.5}MnO_3$ modifies both the electrical and magnetic phases, and that the doping level exerts a significant influence on the overall transport behavior. The results may provide valuable insights for the design of magnetoresistive materials in future spintronics and magnetic sensor applications.

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