

**STRUCTURAL CHARACTERIZATION OF
 $\text{La}_{0.7-x}\text{A}_x\text{Ca}_{0.3}\text{MnO}_3$ (A = Nd, Sm, Gd; x = 0.0, 0.1)
MANGANITES WITH RARE-EARTH IONS
SUBSTITUTION**

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ABSTRACT

STRUCTURAL CHARACTERIZATION OF $\text{La}_{0.7-x}\text{A}_x\text{Ca}_{0.3}\text{MnO}_3$ (A = Nd, Sm, Gd; x = 0.0, 0.1) MANGANITES WITH RARE-EARTH IONS SUBSTITUTION

In this study, the structural properties of polycrystalline $\text{La}_{0.7-x}\text{A}_x\text{Ca}_{0.3}\text{MnO}_3$ (A = Nd, Sm, Gd; x = 0.0, 0.1) manganites samples were systematically investigated. The samples were synthesized using a conventional solid-state reaction method, which involved precise weighing, thorough grinding, calcination, pelletization, and high-temperature sintering. X-ray diffraction analysis confirmed that all samples crystallize in a single-phase orthorhombic perovskite structure, corresponding to the *Pnma* space group, with no detectable secondary phases or impurities. Substitution of trivalent rare-earth ions Nd^{3+} , Sm^{3+} , and Gd^{3+} at the La^{3+} site led to a reduction in lattice parameters and unit cell volume compared to the undoped $\text{La}_{0.7}\text{Ca}_{0.3}\text{MnO}_3$ sample. This decrease is attributed to the smaller ionic radii of Nd^{3+} , Sm^{3+} , and Gd^{3+} relative to La^{3+} . Fourier-transform infrared spectroscopy revealed the characteristic Mn-O stretching vibration around 600 cm^{-1} , confirming the perovskite bonding environment. Scanning electron microscopy analysis indicated inhomogeneous grain distribution in the $\text{La}_{0.7}\text{Ca}_{0.3}\text{MnO}_3$ sample, whereas substitution with rare-earth ions resulted in a more uniform grain morphology. Energy-dispersive X-ray spectroscopy further verified the elemental composition of La, Ca, Mn, O, Nd, Sm, and Gd, demonstrating successful incorporation of the dopants. These results indicate that structural modifications induced by rare-earth substitution can effectively tune the lattice characteristics of $\text{La}_{0.7-x}\text{A}_x\text{Ca}_{0.3}\text{MnO}_3$ manganites, which may have significant implications for their potential applications in magnetic, electronic, and spintronic devices.

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