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Structure and spin glass behavior in $\text{La}_{0.77}\text{Mg}_{0.23-x}\square_x\text{MnO}_3$ ($0 \leq x \leq 0.2$) manganites

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Abstract:

We have synthesized the vacancy manganites $\text{La}_{0.77}\text{Mg}_{0.23-x}\square_x\text{MnO}_3$ powders, with $x = 0, 0.05, 0.1, 0.15$ and 0.2 by the solid state reaction method. X-ray diffraction analysis using Rietveld refinement has proven that all the compounds under investigation crystallize in the orthorhombic structure with $Pnma$ space group. The result of Rietveld refinements shows that the magnesium vacancies modify the structural parameters such as the $Mn-O$ bond length, the $Mn-O-Mn$ angles and the volume. Zero-field-cooled and Field-cooled thermomagnetic curves and the thermal variation of AC-susceptibility show a paramagnetic-ferromagnetic transition for both compounds and exhibit the onset of a spin glass-like state at lower temperatures. The increase of the magnesium-vacancy content lowered the Curie magnetic transition temperature (T_C) from $T_C = 140.82 K$ for $x = 0.0$ to $T_C = 128.22 K$ for $x = 0.2$. The irreversibility temperature observed from the ZFC and FC magnetization splitting is also modified from $131.65 K$ for $x = 0.0$ to $118.78 K$ for $x = 0.20$. The irreversibility is associated to the presence of ferromagnetic clusters and spin-glass phase like behavior.

Keywords: X-ray diffraction analysis, Curie temperature, AC-magnetic susceptibility.

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