

Effects of dilution on magnetic and transport properties of $\text{La}_{0.7}\text{Ca}_{0.3}\text{Mn}_{1-x}\text{M}_x\text{O}_3$

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Abstract: Magnetic and transport properties of $\text{La}_{0.7}\text{Ca}_{0.3}\text{Mn}_{1-x}\text{M}_x\text{O}_3$ ($\text{M} = \text{Al}, \text{Ti}$) are studied. The dilution of the Mn network results in a weakening of the ferromagnetism, a deterioration of the metallic conductivity, and a strong enhancement of the magnetoresistance. Although T_c linearly decreases with x in the low substitution ranges for both M series, the scaling behavior $T_c(\text{np})$ previously observed for $\text{La}_{0.7}\text{Sr}_{0.3}\text{Mn}_{1-x}\text{M}_x\text{O}_3$ is no longer obtained. Extrapolations of the $T_c(\text{np})$ linear curves to $T_c = 0\text{K}$ give np values much smaller than one. These results suggest that, according to a molecular-field approximation, antiferromagnetic superexchange between Mn ions is significant in $\text{La}_{0.7}\text{Ca}_{0.3}\text{MnO}_3$, in contrast to what was observed in $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$. Additionally, the structural data of the Al-substituted samples suggest that variations of the eg -electron bandwidth W cannot explain the decrease in T_c in magnetically diluted manganites. ?? 2008 The American Physical Society.

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