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Analysis of Thermoelastic Properties of $MgSiO_3$ and $ScAlO_3$ Perovskites

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We have determined the thermoelastic properties of $MgSiO_3$ and $ScAlO_3$ perovskites using Modified Rigid Ion Model (MRIM). We have found that the evaluated thermoelastic properties reproduce well the corresponding experimental data, implying that the Modified RIM represents properly the elastic nature of these perovskite systems. The results of the present investigation can be further improved by including the ferromagnetic spin wave contribution and Jahn-Teller distortion effect in the framework of Modified RIM. Besides, we have reported the cohesive and the thermal properties of these compounds. The results obtained by us are discussed in detail.
Keywords: Specific heat; Manganites; CMR Materials; Debye temperature; Thermoelastic properties.

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Nature of Electrical Transport in the Paramagnetic Phase of Manganites

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One of the issues concerning the divalent doped manganites that have eluded unanimity has been the nature of electrical transport in the paramagnetic (PM) phase above the Curie temperature (T_C). Several models, such as, the small polaron hopping in the adiabatic limit and the Mott variable range hopping represented by $\rho(T) = ATexp(\frac{E_A}{k_BT})$ and $\rho(T) = \rho_0 \exp(\frac{T_0}{T})$ respectively, have been used to explain the conduction in the PM phase. In the present paper we report the electrical transport in variety of thin films and bulk samples of manganites. We have explored the epitaxial thin films of $La_{0.88}Sr_{0.12}MnO_3$, $La_{0.70}Sr_{0.30}MnO_3$, $Nd_{0.60}Sr_{0.40}MnO_3$ and $Nd_{0.50}Sr_{0.50}MnO_3$; and polycrystalline bulk and thin films of $Nd_{0.60}Sr_{0.40}MnO_3$ and $La_{0.70}Ca_{0.30-x}Ag_xMnO_3$. The electrical transport in the PM phase of the fully oxygenated epitaxial thin films is best described by the small polaron hopping in the adiabatic limit, while in case of polycrystalline thin films and bulk samples the Mott variable range provides better fitting. In oxygen deficient epitaxial films, the electrical resistivity is better described by the Mott VRH model rather than the small polaron hopping model. This suggests that the presence of disorder is one of the key factors in determining the nature of electrical transport in manganites. In less disordered systems, such as the epitaxial thin films, the small polaron hopping in the adiabatic limit is the appropriate mechanism. The presence of disorder favors the Mott VRH type conduction as in case of the oxygen deficient epitaxial thin films and polycrystalline bulk and thin film samples. We have also probed the temperature dependence of the activation energy (E_A) and the Mott parameter (T_0) in the range $T_C<T<400$ K. In the higher temperature region, both E_A and T_0 remain nearly temperature independent but just above T_C both the parameters start decreasing. This could be due to carrier delocalization caused by the nucleation and growth of small fraction of the FM phase just above T_C, that is, in the PM phase. As the temperature decreases the FM phase fraction increases leading to a continuous decrease in E_A and T_0. In case of epitaxial thin films the activation energy is found to be depending on the film thickness and hence also on the biaxial strain that arises due to film-substrate lattice mismatch.