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Magnetotransport Studies on $Pr_{0.7}Ca_{0.3-x}Sr_xMnO_3$

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Polycrystalline samples of $Pr_{0.7}Ca_{0.3-x}Sr_xMnO_3$ for ($x \geq 0.0$ to 0.3), have been prepared by conventional solid-state reaction method. X-ray diffraction (XRD) of all the samples of this series were analyzed by Rietveld refinement and were found to be single phase, in orthorhombic structure, space group PNMA. Magnetic and transport measurements were carried out on polycrystalline samples to determine the ordering temperatures. We observe that Tc of the samples increases with the increase in Sr concentration. In order to investigate if there is any thermal hysteresis in the R-T behaviour, we have measured R(T) while cooling as well as heating in zero magnetic field and also in presence of magnetic field. The magnetoresistance (MR) and the temperature coefficient of resistance (TCR) percentage were also calculated at their respective insulator-metal transition temperatures. The Sr-rich sample exhibits MR of about 96%. The results are explained on the basis of cation size mismatch and their influence on the structure underlying the importance of structure-property relations in modifying the properties of these oxide materials.

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Phase Separation Induced by Cation Disorder in $(La,Y)_{2/3}(Sr,Ca)_{1/3}MnO_3$

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In colossal magnetoresistance materials, magnetic and electric transport properties vary sensitively with changing chemical pressure. The chemical pressure directly influences electron hopping between nearest neighbor Mn ions by modifying Mn-O band distance and Mn-O-Mn band angle. The chemical pressure can be varied by introducing ions with different size into A-site of perovskite structure. In the present work, the samples with different A-site cation disorder were synthesized. The hole concentration and average A-site cation radius are kept unchanged while A-site cation disorder increases linearly by Y and Sr co-doped in $La_{2/3}Ca_{1/3}MnO_3$. XRD and Rietveld refinements indicate that, as expected, Y and Sr substitute La and Ca at A-site and the crystal structure as well as the average ions radii of A-site are kept unchanged. Some significant effects occur in the transport properties which is ascribed to A-site cation disordering due to that both the average A-site radius and hole concentration remain unchanged. All these samples exhibit a PM to FM and insulator-to-metal transitions and the transition temperature T_C and T_{MI} decreases while transition width increases with increasing A-site cation disordering. T_{MI} is usually 10 K higher than T_C for small cation disorder samples. However, with increasing cation disorder, T_{MI} is about 60 K lower than T_C. The resistivity increases in magnitude while magnetization decreases with increasing cation disordering. The metal-to-insulator transition for small cation disorder samples can be well described by a percolative model which indicates FM-metal state and AFM-insulator state assuredly coexist in the transition interval. It reveals that cation disordering suppresses the long-range FM-metal state which resulting inducing a phase separation behavior in large cation disorder samples.

Keywords: cation disordering, phase separation, percolative model