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Structural, Magnetic and Magnetocaloric Properties of Iron-Doped $Nd_{0.6}Sr_{0.4}MnO_3$ Perovskite

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Abstract : The influence of Fe-doping on the structural, magnetic and magnetocaloric properties of $Nd_{0.6}Sr_{0.4}Fe_xMn_{1-x}O_3$ ($0 \leq x \leq 0.5$) were investigated. The samples were synthesized by auto-combustion Sol-Gel method. The phase purity, crystallinity, and the structural properties for all prepared samples were examined by X-ray diffraction. XRD refinement indicates that the samples are crystallized in the orthorhombic single-phase with Pnma space group. Temperature dependence of magnetization measurements under a magnetic applied field of 0.02 T reveals that the samples with (x=0.0, 0.1, 0.2 and 0.3) exhibit a paramagnetic (PM) to ferromagnetic (FM) transition with decreasing temperature. The Curie temperature decreased with increasing Fe content from 256 K for x =0.0 to 80 K for x =0.3 due to increasing of antiferromagnetic superexchange (SE) interaction coupling. Moreover, the magnetization as a function of applied magnetic field (M-H) curves was measured at 2 K, and 300 K. the results of such measurements confirm the temperature dependence of magnetization measurements. The magnetic entropy change|ΔSM | was evaluated using Maxwell's relation. The maximum values of the magnetic entropy change |-ΔSMax |for x=0.0, 0.1, 0.2, 0.3 are found to be 15.35, 5.13, 3.36, 1.08 J/kg.K for an applied magnetic field of 9 T. Our result on magnetocaloric properties suggests that the parent sample $Nd_{0.6}Sr_{0.4}MnO_3$ could be a good refrigerant for low-temperature magnetic refrigeration.

Keywords : manganite perovskite, magnetocaloric effect, X-ray diffraction, relative cooling power
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