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Critical Behaviour and Filed Dependence of Magnetic Entropy Change in K Doped Manganites $Pr_{0.8}Na_{0.2-x}K_xMnO_3$ (X = .10 And .15)

Authors : H. Ben Khlifa, W. Cheikhrouhou-Koubaa, A. Cheikhrouhou

Abstract : The orthorhombic $Pr_{0.8}Na_{0.2-x}K_xMnO_3$ (x = 0.10 and 0.15) manganites are prepared by using the solid-state reaction at high temperatures. The critical exponents (β, γ, δ) are investigated through various techniques such as modified Arrott plot, Kouvel-Fisher method, and critical isotherm analysis based on the data of the magnetic measurements recorded around the Curie temperature. The critical exponents are derived from the magnetization data using the Kouvel-Fisher method, are found to be β = 0.32(4) and γ = 1.29(2) at TC ~ 123 K for x = 0.10 and β = 0.31(1) and γ = 1.25(2) at TC ~ 133 K for x = 0.15. The critical exponent values obtained for both samples are comparable to the values predicted by the 3D-Ising model and have also been verified by the scaling equation of state. Such results demonstrate the existence of ferromagnetic short-range order in our materials. The magnetic entropy changes of polycrystalline samples with a second-order phase transition are investigated. A large magnetic entropy change deduced from isothermal magnetization curves, is observed in our samples with a peak centered on their respective Curie temperatures (TC). The field dependence of the magnetic entropy changes are analyzed, which shows power-law dependence ΔSmax ≈ a(μ0 H)n at the transition temperature. The values of n obey the Curie Weiss law above the transition temperature. It is shown that for the investigated materials, the magnetic entropy change follows a master curve behavior. The rescaled magnetic entropy change curves for different applied fields collapse onto a single curve for both samples.

Keywords : manganites, critical exponents, magnetization, magnetocaloric, master curve
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