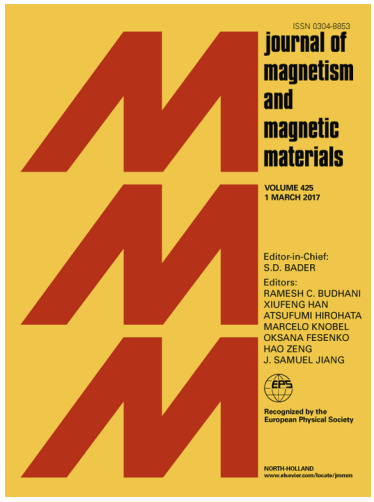

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Critical properties and field dependence of the magnetic entropy change in $Pr_{0.8}K_{0.2}MnO_3$ ceramic: A comparison between solid-solid state and sol-gel process

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Abstract

We have performed a systematic study of the critical properties of $Pr_{0.8}K_{0.2}MnO_3$ manganite synthesized using two various methods in the vicinity of the ferromagnetic-paramagnetic phase transition. Our compound was successfully prepared by using the solid state reaction at high temperatures and Pechini sol–gel method. The X-ray diffraction pattern shows that all our samples adopt an orthorhombic structure with Pnma space group. Moreover, the critical exponents β, γ and δ are estimated through various techniques such as the modified Arrott plot, the Kouvel–Fisher method and the critical isotherm analysis founded on the data of the magnetic measurements on record near the Curie temperature. Compared to standard models, the estimated critical exponents are close to the theoretical values of 3D-Heisenberg model for the sample elaborated by solid state reaction and tricritical mean-field model for the sample elaborated by the sol–gel method. These results indicate the presence of a ferromagnetic short-range order in our samples. The calculated values using the Widom scaling equation are proximate to those obtained values from critical isotherm M (T_C, $\mu_0 H$). The accuracy of the critical exponents values was confirmed with the scaling hypothesis, the magnetization curves fall onto two sides independents below and above T_C. Interestingly, the change of the universality class is due to the relevant the diminution of grain size. These results imply that the critical behavior of our samples depended sorely on the synthesis technique.

Keywords:
Manganites, Critical exponents, Magnetization, Magnetic phase transition, Landau theory.

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