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Metal-insulator transition in $Nd_{1-x}Eu_xNiO_3$: Entropy change and electronic delocalization

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ABSTRACT

The metal-insulator (MI) phase transition in $Nd_{1-x}Eu_xNiO_3$, $0 \le x \le 0.35$, has been investigated through the pressure dependence of the electrical resistivity

MI transition temperature (T_{MI}) increases with increasing Eu substitution and decreases with increasing pressure. Two distinct regions for the Eu dependence of dT_{MI}/dP were found: (i) for $x \leq 0.15$, dT_{MI}/dP is nearly constant and ~−4.3 K/kbar; (ii) for $x \geq 0.15$, dT_{MI}/dP increases with x and it seems to reach a saturation value ~−6.2 K/kbar for the $x = 0.35$ sample. This change is accompanied with a strong decrease in the thermal hysteresis in $\rho(P, T)$ between the cooling and warming cycles, observed in the vicinity of T_{MI}. The entropy change (ΔS) at T_{MI} for the sample $x = 0$, estimated by using the dT_{MI}/dP data and the Clausius-Clapeyron equation, resulted in $\Delta S \sim 1.2$ J/mol K, a value in line with specific heat measurements. When the Eu concentration is increased, the antiferromagnetic (AF) and the MI transitions are separated in temperature, permitting that an estimate of the entropy change due to the AF/Paramagnetic transition be carried

much smaller than that expected for a $s = 1/2$ spin system. The analysis of $\rho(P, T)$ and $C_P(T)$ data indicates that the entropy change at T_{MI} is mainly due to the electronic delocalization and not related to the AF transition.

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