

Structure and Thermopower of Solid Solution of Nickelocuprates
 $\text{La}_{2-x}\text{Sr}_x\text{Cu}_{1-y}\text{Ni}_y\text{O}_4$

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Abstract

A series of materials represented by $\text{La}_{2-x}\text{Sr}_x\text{Cu}_{1-y}\text{Ni}_y\text{O}_4$ has been prepared using a basic carbonate coprecipitation technique. The disappearance of superconductivity at higher Ni contents usually accompanies the localization of carriers at low temperatures. A metal-like temperature dependence ($dR/dT > 0$) occurs up to $x = 0.36$ and $y = 0.2$ with a metal-non-metal transition at low temperatures. In comparison with $\text{La}_{1.85}\text{Sr}_{0.15}\text{Cu}_{1-y}\text{Ni}_y\text{O}_4$, the metal-non-metal transition can be 'tuned' by varying the Sr content at a given Ni content. For non-metallic samples and those materials which show localization at low temperatures, their conductivity follows the form $\exp[-(T_0/T)^\nu]$ with $\nu = 1/4$ or $1/2$ (variable-range hopping law), indicating that the localization of carriers is caused by disorder. When considering the effects of carrier concentrations and disorder in the system $\text{La}_{2-x}\text{Sr}_x\text{Cu}_{1-y}\text{Ni}_y\text{O}_4$, the phonon-drag contribution seems to play a part in their thermopower.