

Effect of Apical Oxygen Replacement by Chlorine on Thermodynamic Properties in $\text{Ca}_{1.82}\text{Na}_{0.18}\text{CuO}_2\text{Cl}_2$ Single Crystal

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We report the reversible magnetization of the $\text{Ca}_{2-x}\text{Na}_x\text{CuO}_2\text{Cl}_2$ ($x = 0.18$) single crystal for H/c up to 1.2 T to study the effect of oxygen replacement by chlorine at the apical site. The super-conducting transition temperature T_c (27 K) of this single crystal is the highest reported in this family. Various thermodynamic parameters, such as the penetration depth, the coherence length, the critical field $H_c(0)$, the upper critical field $H_{c2}(0)$ and the Ginzburg-Landau parameter; are also reported. Compared to the iso-structural compound $\text{La}_{1.82}\text{Sr}_{0.18}\text{CuO}_4$ with apical oxygen, $\text{Ca}_{1.82}\text{Na}_{0.18}\text{CuO}_2\text{Cl}_2$ has two significant differences: (1) the Cooper pair density is quite reduced, and (2) the anisotropic nature is more enhanced. From these observations, chlorine at the apical site is thought to be less effective than oxygen in supplying charge carriers to the CuO_2 planes; as a result, the interlayer coupling between the CuO_2 planes is weakened.

keywords : Apical Oxygen, Oxychloride