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Electron-doping Effect and the Electronic State in the Undoped (Ce-free) Superconductor $T'-La_{1.8}Eu_{0.2}CuO_{4-\delta}$

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In undoped (Ce-free) RE_2CuO_4 ($RE =$ rare earth) with the Nd_2CuO_4 -type (T' -type) structure, the superconductivity has been observed without carrier doping by removing excess oxygen [1]. To clarify the electronic states of the undoped superconductor, it is necessary to investigate the doped carrier-concentration dependence of T_c in RE_2CuO_4 with a single kind of blocking layer. It has been reported so far that T_c decreases through the hole doping in Sr- and Ca-substituted $T'-La_{1.8}Eu_{0.2}CuO_{4-\delta}$ (T' -LECO) [2, 3]. Accordingly, we have synthesized samples of $T'-La_{1.8}Eu_{0.2}CuO_{4-y}F_y$ (T' -LECOF) and investigated the electron-doping effect on T_c .

T' -LECOF samples were obtained by the fluorination of T' -LECO samples prepared by the low-temperature synthesis method [4] using NH_4F . Superconducting samples of T' -LECOF were obtained by the reduction annealing in vacuum. From the powder X-ray diffraction and EPMA measurements, it has been found that the obtained samples are confirmed to be of the single phase and that the content of F is confirmed to be almost the same as the nominal one. The magnetic susceptibility measurements have revealed that T_c increases with increasing y , exhibits the maximum value of $\sim 23K$ at $y = 0.025$ and decreases. The dome-like dependence of T_c on the doped carrier concentration shown in the figure is explained in terms of the pairing mediated by spin fluctuations based on the $d-p$ model calculation [5].

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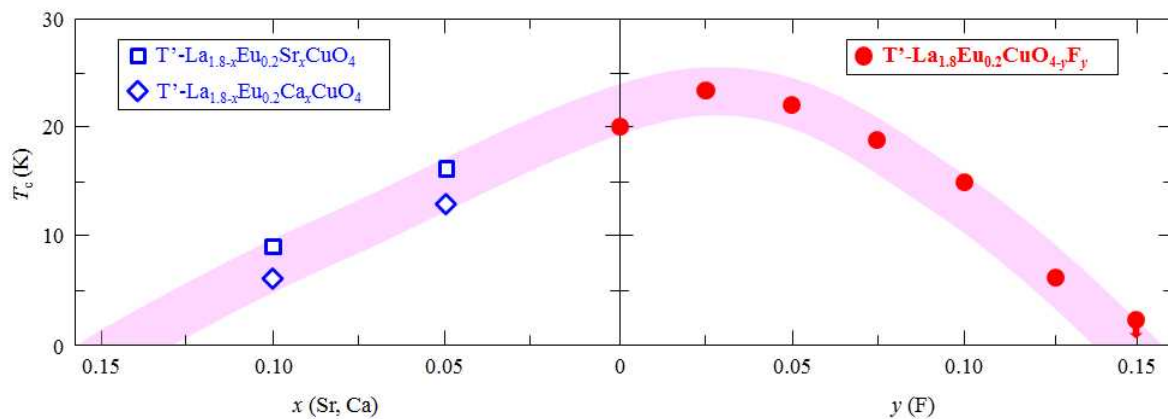


Fig. Dependence of T_c on the doped carrier concentration for $T'-La_{1.8-x}Eu_{0.2}M_xCuO_{4-y}F_y$ ($-M = Sr, Ca$).

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