

Study of Electronic Phase Diagram of Electron-doped Superconductors by FET

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Discovery of undoped superconductors, $\text{La}_{2-x}\text{RE}_x\text{CuO}_4$ ¹ and RE_2CuO_4 ² (RE = rare-earth element), brought a question about an electronic phase diagram of electron-doped superconductors. In the phase diagram, the superconducting (SC) region is adjacent to the antiferromagnetic (AF) region and the superconductivity suddenly appears at the SC-AF boundary with maximum T_c . The discovery is apparently against the phase diagram. Superconductivity in electron-doped superconductors is very sensitive to impurity oxygen at the apical site, whose presence is detrimental to achieving superconductivity. It is hard to control only doping level of charge carrier by conventional sample preparation technique. Hence, we have tried to control the doping level by FET. The T_c of $\text{La}_{1.9}\text{Ce}_{0.1}\text{CuO}_4$ increases with reducing electrons by FET. This result suggests that optimum doping level (x) of $\text{La}_{2-x}\text{Ce}_x\text{CuO}_4$ is $x < 0.1$ and $x = 0.15$ is not a universal optimum doping level for electron-doped cuprates. Our result support the new phase diagram for $\text{Nd}_{2-x}\text{Ce}_x\text{CuO}_4$ ³.

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²O. Matsumoto *et al.*, Phys. Rev. B **79**, 100508 (2009).

³O. Matsumoto *et al.*, Physica C **469**, 924 (2009).