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Origin of superconducting carriers in "non-doped" T′-(La, RE)$_2$CuO$_4$ (RE = Sm, Eu, Gd, Tb, Lu, and Y) HIDEKI YAMAMOTO, AKIO TSUKADA, NTT Basic Research Labs., MASUMI NODA, Tokyo University of Science, MICHIO NAITO, Tokyo University of Agriculture and Technology — We have reported the isovalently-substituted new superconductors T'-La$_{2-x}RE_x$CuO$_4$ (T_c ∼20-25K) prepared by MBE with no effective dopant. As regards the origin of the carriers in these nominally non-doped superconductors, there seems to be two possible scenarios: (i) oxygen deficiencies at the regular oxygen sites serve as a source of effective electron carriers, and (ii) they are not Mott insulators and have intrinsic carriers. Since precise information on the site- specific occupancy of oxygen is very difficult to obtain, alternatively, we investigated the in-plane lattice constant a_0 with changing RE concentration x, with a view to examining possible a_0 expansion due to electron doping. In each RE substitution, the $a_0$of the T'-La$_{2-x}RE_x$CuO$_4$linearly decreases with increasing x, whose extrapolation to x=2 agrees well with the reported value for bulk T'-RE_2CuO$_4$. Thisvariation can simply be understood based on the difference in the ionic radius of RE^{3+}vs La^{3+}, suggesting that these superconductorsare not electron-doped, at least substantially, and that the second scenario is the more plausible. This conclusion is also supported by the results of transport and photoemission experiments.

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