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Superconductivity in undoped T'-RE_2CuO_4 with $T_C > 30$ K MICHIO NAITO, OSAMU MATSUMOTO, AYA UTSUKI, Department of Applied Physics, Tokyo University of Agriculture and Technology, AKIO TSUKADA, Stanford University, HIDEKI YAMAMOTO, NTT Corporation, TAKAAKI MANABE, National Institute of Advanced Industrial Science and Technology — We report the superconductivity in T'-RE_2CuO_4 (RE = Pr, Nd, Sm, Eu, and Gd), which have been for a long time believed as a Mott insulator. The highest T_c of undoped T'-RE_2CuO_4 is over 30 K, substantially higher than that of 'electron-doped' analogs. Remarkably, Gd_2CuO_4, even the derivatives of which have not shown superconductivity so far, gets superconducting with T_c^{onset} as high as 20 K. Our discovery was achieved by using metal-organic decomposition (MOD), an inexpensive and easy-to-implement thin-film process. The keys to prepare the superconducting films are rather simple, namely low-P_{O2} firing and subsequent low-temperature reduction. One point to be emphasized is that low-P_{O2} phase field has been almost unexplored in the search for new superconductors because of the belief that high P_{O2} *should* be required in the synthesis of Cu^{2+} compounds. Our discovery contradicts with the past results supporting undoped mother compounds, T'-RE_2CuO_4, to be insulating. The clue to understanding the sharp contrast between the past and our results is impurity oxygen (O_{ap}) at the apical site, which has to be cleaned up in order to reach the 'generic' electronic phase diagram.

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