MAR06-2005-020168

Abstract for an Invited Paper
for the MAR06 Meeting of
the American Physical Society

New Class of T'-structure Cuprate Superconductors[1]

MICHIO NAITO, Tokyo University of Agriculture and Technology (TUAT)

High-temperature superconductivity has been discovered in $La_{2-x}Ba_xCuO_4$ that derives from the undoped mother compound La_2CuO_4 crystallizing in the K_2NiF_4 (so-called T) structure with oxygen octahedra surrounding the copper ions. It has been common sense that high-temperature superconductivity develops upon doping such an antiferromagnetic Mott-insulator with charge carriers. La_2CuO_4 is also the basis of the electron-doped cuprate superconductors of the form $La_{2-x}Ce_xCuO_{4+y}$, which however crystallize in the Nd_2CuO_4 (T') structure without apical oxygen above or below the copper ions of the CuO_2-plane. Due to the vicinity to the structural phase transition into the T-structure the study of the undoped or low doped mother compound with T'-structure is difficult. However, using the *iso*valent substituents Y, Sm, Eu, Gd, Tb, or Lu for La, nominally undoped La_2CuO_4 can be synthesized by molecular beam epitaxy in the T'-structure. The surprising result is that all these nominally *un*doped T'-compounds are *superconductors* with fairly high critical temperatures over 20 K. This suggests a phase diagram for this new class of electron doped cuprates, in which the Mott-insulating, antiferromagnetic ground state is not obtained.

[1]This work has been performed in collaboration with Akio Tsukada (TUAT), Yoshi Krockenberger (MPI), Masumi Noda (NTT), Hideki Yamamoto (NTT), Dirk Manske (MPI) and Lambert Alff (Darmstadt University of Technology).