

Evaluation of Carrier Concentration and Superconducting Properties under Normal and High Pressure in Cu-, Tl-System superconductors.

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In all the Cu-1234, the T-linear dependence of the in-plane resistivity ρ_{ab} , the variation of the Hall resistivity ρ_H as $1/T$ and the T^2 -dependence of $\cot\theta$ (θ :Hall angle), which are important aspects in hole-type cuprates, were observed. On the other hand, determination of the actual carrier concentration is in general a difficult task. It is controversial to discuss it using the Hall coefficient with a conventional band theory even for a high degree of overdoping samples because of the effect of strong correlation on the normal state transport. From the relation between the Cu valence derived from iodometric titration analysis and the Hall number in CuC-1234 samples, however, we show that the Hall number is a potential measure of carrier concentration. As the result, a unique feature in CuC-1234, that high- T_c (117K) is maintained over a wide range of carrier concentration, was observed, (Fig.1) implying a unique feature of selective-over-doping among different CuO_2 layers. Thus, the coexistence of the electronic state both the highly doped CuO_2 and the nearly optimally doped CuO_2 layers possibly bring about the peculiar low anisotropy in this multilayer Cu-1234.

The enhancement of 8~10K(T_c) at 8 GPa pressure in Cu -1234 samples with different carrier concentrations is found to be comparable to those in Hg- and BC-system. (Fig.2) In CuTl-1223 with T_c of 134.6K, T_c increased up to 147.0 K at 8 GPa. Furthermore, a positive T_c enhancement is observed in highly over-doped CuTl-1223. These results indicate that main origin of T_c enhancement is the change not only of the carrier concentration in the CuO_2 layers but also of the electrical structure related to the change of crystal structure with pressure.

Results of the superconducting anisotropy and thermal conductivity also will be presented in poster.

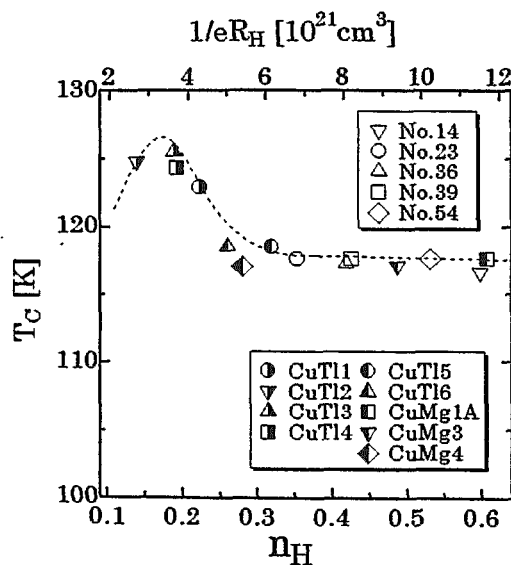


Fig.1 T_c versus the Hall number for various Cu-1234 samples

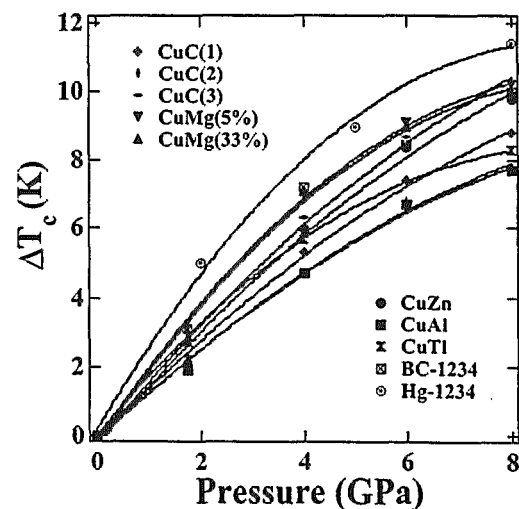


Fig.2 Pressure dependence of ΔT_c for various Cu-1234 samples