NMR Study on Carrier Distribution and Superconductivity in Multilayered High-T_c Cuprates

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Extensive investigation has recently been made on various multilayered high -T_c cuprates with three or more CuO_2 planes in a unit cell. These multilayered cuprates include crystallographically inequivalent kinds of CuO_2 planes, *i.e.*, the outer CuO_2 planes (denoted as OP) with a pyramidal oxygen coordination and the inner one (IP) with a square oxygen coordination. Recent NMR studies revealed that the local carrier concentrations (N_h) are different between in the OP and in the IP from the microscopic point of view.

We present systematic changes of carrier distribution among CuO_2 planes in Hg- and Cu-based multilayered high-T_c cuprates with varying the number of CuO_2 planes in a unit cell (n) from 3 to 5 and total-carrier content (δ) from under- to over-doped region. The local carrier content at each plane, $N_h(OP)$ and $N_h(IP)$, have been evaluated separately from the value of Knight shift at room temperature. (Fig.1) We found that $N_h(OP) > N_h(IP)$ in all the systems. It was also revealed that the difference of the doping level $\Delta N_h = N_h(OP) - N_h(IP)$ increases as δ and n increase. (Fig.2) In Cu1234 (n=4) with large ΔN_h, the superconducting gap fully develops in the IP below T_c=117K, but that in the OP increases linearly down to T_{c2}=60K below T_c, suggesting that the large inhomogeneity of the carrier distribution between the IP and the OP causes a decoupling among them.[1] The inhomogeneity of carrier distribution among the CuO_2 planes is one of the key factors to characterize multilayered systems. Furthermore, We discuss the origin of T_c in multilayered high-T_c cuprates and the relation between ΔN_h and magnetic excitations in each plane.

[1] Y.Tokunaga, K.Ishida, Y.Kitaoka, K.Asayama, K.Tokiwa, A.Iyo and H.Ihara, Phys. Rev. B **61** (2000) 9707.