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Superconductivity in a unique type of copper oxides

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The mechanism of superconductivity of cuprates remains one of the biggest challenges in condensed matter physics. High-Tc cuprates crystallize into layered perovskite structure featured with copper-oxygen octahedral coordination. Due to the strong Jahn Teller effect plus Coulomb interactions the octahedron in high Tc cuprates is elongated, placing the $3dx^2$-y^2 orbital level at top, almost degenerate with the O2p orbital, wherein the doped holes reside. This situation is considered to be unique of the cuprates that sustains d- wave paring symmetry and high Tc.

Here we present the high pressure synthesis of Ba_2CuO_{4-y} superconductor. Interestingly the cuprate possesses extraordinarily compressed octahedron along the *c*-axis direction. In the compressed octahedron the $3dz^2$ orbital level would be lifted above $3dx^2$-y^2 orbital level. The compound shows bulk superconductivity with critical temperature (Tc) above 70 K confirmed by Meissner effect, □SR measurements. The Tc is more than 30 K higher than that for the isostructural hole doped La_2CuO_4. The present work sheds renewed light on comprehensive understanding of the pairing and Tc determining mechanism of cuprate superconductors.

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