

Influence of powder processing procedure on the superconducting behaviour of $\text{YBa}_2\text{Cu}_3\text{O}_{7-y}$ ceramics

DHANANJAI PANDEY, V S TIWARI, A K SINGH and
SANGEETA CHAUDHRY

School of Materials Science and Technology, Institute of Technology, Banaras Hindu University, Varanasi 221 005, India

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Abstract. In order to synthesize $\text{YBa}_2\text{Cu}_3\text{O}_{7-y}$ powder, we first coprecipitate yttrium and barium by adding ammonium carbonate to a solution of barium and yttrium chlorides mixed in the 2:1 ratio at the molar level. Ceramics, prepared from powders obtained by calcining the coprecipitated powder with copper oxide, exhibits a very sharp drop in resistivity near 110 K with T_c^{midpoint} of 107 K and a resistivity anomaly at 260 K.

Keywords. Co-precipitation; superconductivity; yttrium; barium; powder processing.

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The recent discovery of superconductivity in rare-earth cuprate perovskites has led to an unprecedented spurt in the field of oxide superconductors. Soon after the first report of superconductivity in multiphase $(\text{Y}_{0.6}\text{Ba}_{0.4})_2\text{CuO}_4$ near 90 K by Wu *et al* (1987), several groups independently identified the superconducting phase (Cava *et al* 1987; Grant *et al* 1987; Rao *et al* 1987; Siegrist *et al* 1987). Since then several possible models for the crystal structure of this phase have also been proposed (Beno *et al* 1987; David *et al* 1987; Gallagher *et al* 1987; Hazen *et al* 1987). In all the structural models proposed, there is near unanimity on the role played by one-dimensional Cu-O chains along the *b* axis of the orthorhombic cell. It is now generally believed that the removal of oxygen atoms from these chains either leads to a lowering of T_c or to the destruction of superconducting behaviour (Tarascon *et al* 1987). In view of this, most of the efforts to improve the onset temperature T_c^{onset} , the 10–90% transition width and the temperature at which the specimens become resistanceless, have been directed towards the optimization of oxygen content in the structure through a control of processing variables (see for example Gopalkrishnan *et al* 1987).

The specimens in these investigations have generally been prepared by the conventional ceramic method involving calcination of a mixture of Y_2O_3 , BaCO_3 and CuO followed by sintering of these powders at suitable temperatures around 900°C for an optimum duration. In view of the severe limitations of the solid state diffusion during calcination of Y_2O_3 , BaCO_3 and CuO powders mixed at a particulate level, uniform distribution of Y^{+3} and Ba^{+2} ions in the 1:2 ratio at the submicroscopic level cannot be achieved in the conventional method of preparation. In order to see the effect of uniform distribution of Ba^{+2} and Y^{+3} ions on the superconducting behaviour of $\text{YBa}_2\text{Cu}_3\text{O}_{7-y}$, we have prepared these materials by a