

Superconducting Y-Ba-Cu-O thin films by RF sputtering*

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Abstract. Thin films of Y-Ba-Cu-O have been prepared by conventional methods of RF sputtering. The films exhibit superconducting onset temperatures as high as 91 K, midpoint at 80 K and a zero resistance state at 35 K. Critical current measurements implied critical current densities of the order of 31 A/cm². An attempt has been made to establish the role of substrate and various deposition parameters.

Keywords. High T_c superconductivity; Y-Ba-Cu-O system; RF sputtering; thin films; critical currents.

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Since Bednorz and Muller's (1986) discovery of the high temperature superconductivity in La-Ba-Cu-Oxides, significant contributions have been made in understanding the structure and structure-related phenomena in various oxide systems exhibiting superconducting transition temperatures in the range 90-95 K (Rao *et al* 1987; Sreedhar *et al* 1987). It is now generally agreed that both from the view points of fundamental understanding and technological applications, high T_c superconductors offer a tremendous potential. However, for micro-electronic devices like cryotrons, Josephson tunnel junctions and their derivatives such as SQUIDS (superconducting quantum interference devices) and quantum detectors of microwave and sub-millimeter wave radiation, it is imperative that these materials are prepared in the form of thin films. It has been established that the superconducting properties have a subtle dependence both on structure and composition of the material. To prepare these materials in the form of thin films, their structure and composition therefore have to be controlled delicately through deposition parameters. Very few reports exist in literature on such films (Somekh *et al* 1987; Chaudhari *et al* 1987; Dijkkamp *et al* 1987). In the present communication, we demonstrate fabrication of high T_c superconducting thin films of Y-Ba-Cu-O system with superconducting onset temperatures as high as 91 K and attempt to establish the conditions for reproducible results.

Thin films of Y-Ba-Cu-Oxide were prepared by conventional methods of RF sputtering using a 13.56 MHz system (Materials Research Corporation). Table 1 summarizes the optimum deposition conditions which yielded best results upto now.

Before sputtering, the chamber was pumped down to pressures of the order of 10^{-6} torr. The films were deposited in a plasma of argon and oxygen in the ratio 1:1.

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