HIGH TEMPERATURE SUPERCONDUCTIVITY IN THE La-Ba-Cu-O AND Y-Ba-Cu-O SYSTEMS

M A K L Dissanayake
Department of Physics, University of Peradeniya
and
Institute of Fundamental Studies, Kandy

Since the discovery of superconductivity in mercury in 1911 by Kamerlingh Onnes (Tc=4.3 K), many different materials, mainly metals and alloys, were found to exhibit this exotic phenomenon. A successful theoretical explanation was put forward in 1957 by Bardeen, Cooper and Schriefer (BSC) according to which, superconductivity arises when electrons in these solids form bound pairs and attractive interaction that binds these electron pairs arises due to their interaction with the lattice vibrations. However, until 1986, the highest recorded transition temperature was $\sim$ 23 K for Nb3Ge alloy, and the practical applications of superconductors were, therefore, severely limited due to the high cost of liquid helium which is necessary to cool the materials down to such low temperatures.

This scenario has now completely changed with the discovery of superconductivity in ceramic type oxide material La-Ba-Cu-O (Tc=30 K) by Bednorz and Muller in September, 1986. This led to the discovery of superconductivity in Y-Ba-Cu-O with a Tc of 95K, which is well above the boiling point of liquid nitrogen, by Chu et al in February, 1987. Scientists

have now identified the phases that are responsible for superconductivity in these oxide materials. However, the mechanism of superconductivity in these materials seems to be different from that in conventional superconductors. The experimental findings are both for and against the applicability of BCS theory to these materials. A new universal theory, incorperating many unconventional ideas may be necessary in order to understand the occurrence of superconductivity in these new systems.

There are reports of Y-based materials with Tc $\sim$ 300 K, but the results seems to be not repoducible. Considerable efforts are going on at present to understand the mechanism of superconductivity in these materials and also to search for stable superconducting phases with Tc above room temperature.