MAGNETIC BEHAVIOUR OF HIGH T_C SUPERCONDUCTORS

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A status report on the measurement and current understanding of magnetic behaviour of high T_C superconductors will be presented. Magnetization studies provide important information about such physical characteristics of superconductors, like, lower and upper critical fields, critical current densities, dissipation mechanism in mixed state etc., whose knowledge is crucial for basic understanding of superconducting phenomenon in them, as well as, for devising ways to harness them for potential application. The results of a variety of experiments point towards the fact that, in high T_C compounds, the values of lower critical field are considerably low (< 1mT), whereas those of upper critical field are extremely high ($\sim 10^7$ T). The observed values of critical current densities in zero magnetic field in single crystal specimens of these compounds are in the range of 10^{10} A/m^2 at 77K. However, in their polycristalline ceramic form, the measured transport current densities are three to four orders of magnitude lower, as the intergrain boundaries act as weak links due to very short coherence lengths in these materials. A successful prescription to understand the isothermal magnetization hysteresis curves in terms of macroscopic critical currents flowing inside a type II superconductor was proposed by C.P. Bean in early sixties /1/. Taking an example of $RBa_2Cu_3O_7$ family of superconductors, it has recently been shown /2/ that the magnetic behaviour of high T_c superconductors can also be qualitatively explained in the framework of celebrated Bean's model taking into account the experimentally observed field and temperature variations of intragrain (single crystal) and intergrain (polycrystalline) current densities in them.

Contd..../2

/1/ C.P. Bean, Phys. Rev. Lett. 8, 250 (1962); Rev.Mod. Phys 36, 31 (1964).

/2/ A.K. Grover et. al., Pramana-J. Phys. 30, 569 (1988); P. P. Chaddah et. al., Cryogenics (to appear)