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YBCO-PbS Magnetic Shields for Superconducting Cryogenic Electronic Devices

Anand K. Tyagi* and T. P. Sharma#

* Department of Applied Physics, Guru Nanak Dev University
AMRITSAR - 143005 (India).
Talephone : (0183) 258802-09/215, FAX : (0183) 225756

Department of Physics, Institute of Advanced Studies, Meerut University, MEERUT - 250005 (india).

SUMMARY :

The performance of superconductive electronic devices gets greatly impaired by magnetic interferences and noise from various external sources. It can be alleviated by using the superconductive shield enveloping the devices. The conventional shield materials, like Pb and Nb, have intrinsic noise problem and usually operate at liquid helium temperature. We have investigated the performance of YBCO-PbS superconductors with T_c above liquid nitrogen temperature, as a shield material. Our earlier reports revealed, at least, a three fold increase in mechanical strength of this material over pure YBCO.

To assess the quality of this HTS material as shields, the cylinders of pure YBCO and YBCO-PbS superconductors were fabricated. The extent of shielding of an external dc magnetic field was measured by putting a calibrated Hall probe into the cylinders. The shielding behaviours were determined at 77 K and results are shown in fig.1. It is found that when the external field was below a certain critical field H_s, Hall probe registers no magnetic field (within its limits of detection) inside the cylinder. The value of H_s for pure YBCO was found 275 Oe, with a characteristic shielding curve. The YBCO-PbS shields indicated a drastic enhancement (30-40 %) in Hs values. The magnetic field is also found to enter the shields relatively slowly at a well defined value of magnetic field. This clearly establishes that YBCO-PbS superconductors are the promising candidates to be used as shield materials in most of the cryo-electronic applications.

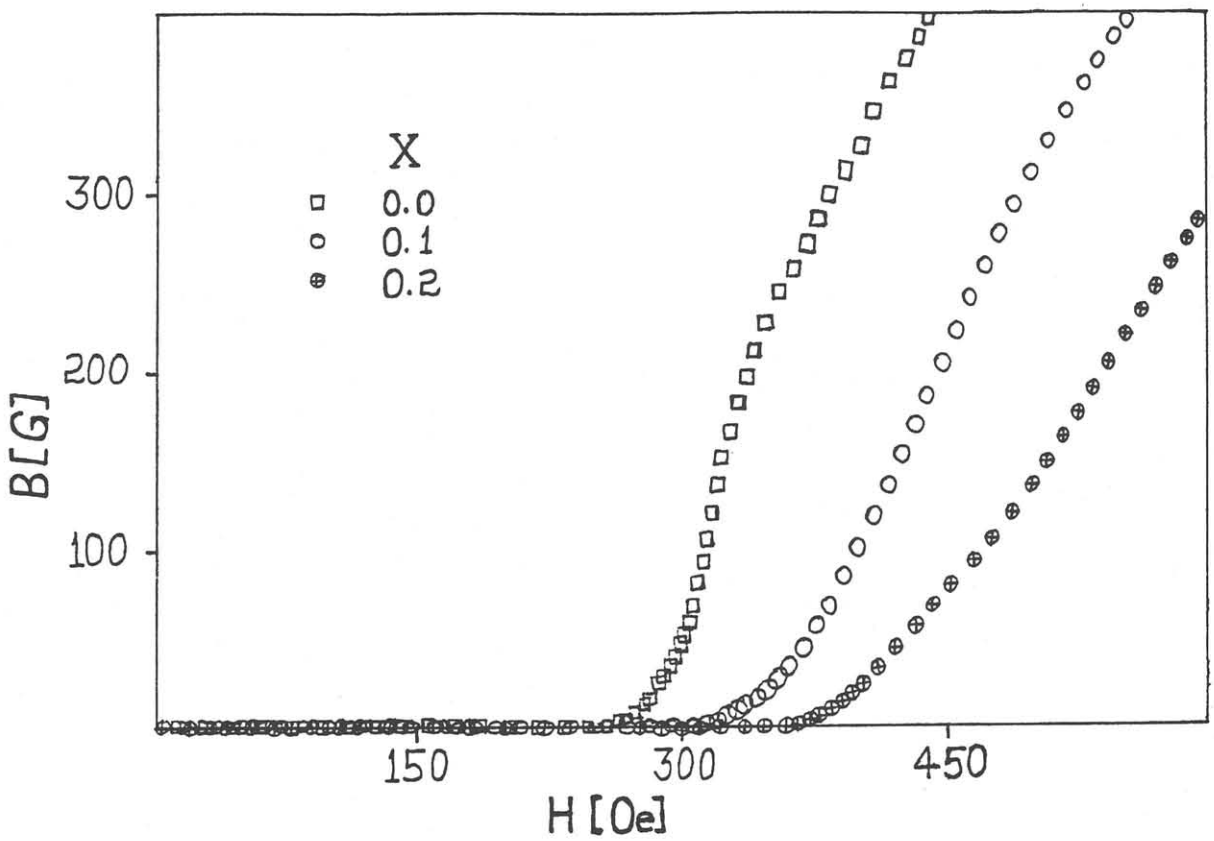

FIG. I: MAGNETIC SHIELDING MEASUREMENTS ON YBCO-PbS CYLINDRICAL SAMPLES WITH NOMINAL COMPOSITION $Y_1Ba_2(Cu_{1-x}Pb_x)_3S_{3x}O_y$.