Flux Jump Assisted Pulsed Field Magnetization

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Introduction

Pulsed Field Magnetization (PFM) is a key technique to bridge the extraordinary flux trapping capability of **bulk superconductors**



Experimental details

Sample: Top-seeded, melt-textured grown Gd-Ba-Cu-Obulks, 30 mm in diameter.
Cooling: Conductive cooling using cryo-cooler, 17 K to room temperature.
Pulsed field: Generated in a solenoid coil, rise time: 35 ms, fall time: about 500 ms.
Maximum peak field: 7.2 T.
Measurement: An array of hall probes placed on the top or in between two stacked samples.



(17.2 T for YBCO and 17.6 T for GdBCO) and engineering applications (magnet, motor etc.). We report here a promising peak trapped field of 4.1 T at the sample surface and 5.3 T in between two stacked samples achieved from PFM. The flux jumps observed during the PFM process is critical for achieving such a high magnetic flux density.

Results and discussion

Trapped field (T)

(a)



Figure (a) shows trapped field measured 15 minutes after PFM at 60 K. A critical B_a , 4.4 T, can be observed leading to the maximum trapped field. Below this critical value, the external field was shielded by the screening current; exceeding this value, excessive heat diminished the peak trapped field.

This critical B_a can be observed in a broad temperature range, from 30 K to 77 K, even in the LN₂ bath. However, a multi-pulse technique was required to achieve the maximum trapped field with a coneshaped distribution at temperature lower than 50 K, as shown in figure (b). Figure (c) plots the maximum trapped field we obtained at different temperatures by single or multi-pulse PFM.

The maximum trapped field measured in between two stacked samples is 5.3 T. We plotted the measured field vs applied field, as shown in figure (b). Initially, the external field was perfectly shielded. When B_a approached the peak value, the screening current disappeared suddenly, indicating a flux jump phenomenon. Evidence can also be found in the time dependent magnetic field as shown in figure (c).



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