MT 26
International Conference on Magnet Technology
Vancouver, Canada | 2019

Contribution ID: **647** Type: **Poster Presentation**

Tue-Af-Po2.23-02 [89]: A Hybrid Trapped Field Magnet Lens (HTFML): concept and realisation

Tuesday 24 September 2019 14:00 (2 hours)

In this presentation, the concept of a Hybrid Trapped Field Magnet Lens (HTFML) is described, which exploits two different characteristics of type II superconductors: the "vortex pinning effect"of an outer superconducting bulk cylinder, which acts as a trapped field magnet (TFM) using field-cooled magnetization (FCM), combined with the "diamagnetic shielding effect"of an inner bulk magnetic lens. The HTFML can reliably generate a concentrated magnetic field in the centre of the lens that is higher than the trapped field from the cylindrical bulk TFM and the external magnetizing field, even after the externally applied field decreases to zero. This requires that, during the FCM process, the outer cylinder is in the normal state (T > superconducting transition temperature, Tc) and the inner lens is in the superconducting state (T < Tc) when the external magnetizing field is applied, followed by cooling to an appropriate operating temperature, then removing the external field. The concentrated magnetic field in the HTFML changes depending on the superconducting characteristics of the materials used, their shape and size, as well as the magnetizing conditions. This is explored for two potential cases: 1) exploiting the difference in Tc of two different bulk materials ("case-1"), e.g., MgB2 (Tc = 39 K) and Gd-Ba-Cu-O (Tc = 92 K) or 2) using the same material for the whole HTFML, e.g., Gd-Ba-Cu-O or (RE)-Ba-Cu-O (where RE is rare-earth element), but utilizing individually-controlled cryostats, the same cryostat with different cooling loops or coolants, or heaters that keep the outer bulk cylinder at a temperature above Tc to achieve the same desired effect. We will also report sample fabrication and experimental results towards realising an all-(RE)-Ba-Cu-O HTFML practically.

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Session Classification: Tue-Af-Po2.23 - Novel and Other Applications I