APP3-6

Numerical Simulation of a Hybrid Trapped Field Magnet Lens (HTFML) Magnetized by Pulsed Fields

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Our group has proposed a concept of the hybrid trapped field magnetic lens (HTFML) consisting of a trapped field magnet (TFM) cylinder and a bulk magnetic lens [1, 2]. A magnetic field, trapped by a TFM cylinder, is concentrated by a bulk magnetic lens inside the TFM cylinder under the magnetizing process, in which the zero-field cooled magnetization (ZFCM) and field-cooled magnetization (FCM) are combined. As a result, the HTFML can continuously generate a magnetic field higher than the external field, B_{bg}. Using numerical simulations, a concentrated magnetic field, B_c, of 4.73 T was expected for B_{bg} = 3 T at 20 K using MgB_2 cylinder and GdBaCuO lens, and B_c = 13.49 T for B_{bg} = 10 T at 20 K using GdBaCuO cylinder and GdBaCuO lens [1]. Recently, we have experimentally confirmed the HTFML effect using an MgB_2 cylinder and GdBaCuO lens, for which B_c = 3.65 T was achieved for B_{bg} = 2 T at 20 K. To magnetize superconducting bulks, a pulsed field magnetization (PFM) is attractive for practical applications because of an inexpensive and mobile experimental setup with no need for a superconducting magnet [3]. In the present study, the HTFML effect is numerically investigated using GdBaCuO cylinder and GdBaCuO lens during PFM for the first time. A three dimensional numerical model is constructed, in which the TFM cylinder (40 mm in inner diameter ID, 60 mm in outer diameter OD, 20 mm in height H) and magnetic lens with thin slits (10 mm in ID, 30 mm in OD, 10 mm in H) are set on the cold stage of a refrigerator. The concentrated magnetic field at the center of the lens bore and the temperature rise of the bulks are investigated. The possibility of the HTFML device magnetized by PFM is discussed.

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