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Enhancement of trapped magnetic field using a large-size REBCO bulk in a desktop type superconducting bulk magnet

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We have developed a desktop-type superconducting bulk magnet using a Stirling cryocooler with the aim of miniaturizing the magnet system. As a result of cooling and magnetizing tests using a GdBCO bulk material 45 mm in diameter and 15 mm thick, the lowest achieved temperature was 51.3 K, and the maximum trapped field was approximately 2.8 T at the center of the bulk surface in the applied field of 7.0 T. For this paper, we remodeled the bulk magnet system in order to attach a large bulk 60 mm in diameter and 20 mm thick for the purpose of enhancing the total magnetic flux. This was based on the idea that a total magnetic flux was increased if the volume of the bulk was expanded, while we were anxious about the reduction of the trapped field due to the low cooling capacity of the refrigerator and a high ultimate temperature. When cooling and magnetizing tests were carried out using 966;60-mm GdBCO bulk, the sample was cooled from room temperature to the ultimate temperature of 55.6 K for approximately 6.5 hours, and the total magnetic flux was 2.0 mWb, which was about twice that of 966;45-mm bulk, indicating that the aim of this study was achieved. Moreover, the maximum trapped field was 3.0 T in the applied field of 6.2 T, which was the maximum value in the pulsed-field magnetization using a large bulk at temperatures beyond 50 K.

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