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Reduction of screening current-induced magnetic field for REBCO coils by the use of multi-filamentary conductors

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A screening current induced in REBCO superconducting layers during coil charging and causes several problems such as hysteresis effect of the central magnetic field and reduction in the central magnetic field intensity. These are critical problems for superconducting coil systems such as NMR. The present work systematically investigated reduction effect of the screening current-induced field by the use of multi-filamentary conductors based on coil experiments and numerical simulation.
4 mm-width REBCO conductors were divided into three filaments along the longitudinal direction using a cutter. A coil which comprises three double pancake coils was wound with the conductors. The inner diameter, outer diameter, and length of the coil are 30 mm, 37 mm, and 28 mm, respectively. The number of total turns and the total length of the conductors are 162, and 16.8 m, respectively. The coil was charged to the coil critical current for both positive and negative polarities in liquid nitrogen and the central magnetic field was measured by a Hall sensor. The same measurement was made for another coil wound with mono-filamentary REBCO conductors, which had the same configuration as the multi-filamentary coil.
The screening current-induced field, Bs, for the multi-filamentary coil at a loading factor of 80%, was 38% of that for the mono-filamentary coil. Simulation showed a similar result. Thus, Bs was reduced to ˜1/3 by dividing the REBCO layers into three filaments. And we found the reduction effect of the multi-filamentary conductors on the screening field is notably effective for high-loading factor operations.

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