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Demagnetization rate of no-insulation HTS coil for persistent-current operation in alternating fields

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No-insulation (NI) high-Tc superconducting (HTS) coils process much higher thermal and electrical stability than the conventional insulated coils. In some rotating machines and Maglev trains, HTS coils carry persistent current and serve as the permanent magnets. For these applications, the main issue is that the demagnetization of HTS coils caused by the local external alternating fields. This paper established an effective simulation that coupling the circuit and T-A formulation models to study the demagnetization behavior of a NI coil in alternating fields that transverse to its axis. The simulation results indicate that after the application of AC fields, screening current is induced in the outermost turns. The persistent current in the outermost turns of the coil is transferred to the inner turns via the turn-to-turn paths. Compared to its insulated counterpart, the NI coil exhibits a better magnetization stability, since the persistent currents are to flow in the shielded inner turns of the coil.

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