Elimination of the Screening Current Induced Fields in High Temperature Superconducting Coils

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Abstract: We report a study for the elimination of the screening current induced field in fully-insulated and no-insulation high temperature superconducting coils exposed to an external AC magnetic field generated by background solenoid coils wound with copper wires. The magnetic center field was obtained numerically and compared to that obtained empirically to quantify the screening current induced field in the fully-insulated and no-insulation coils. The value of the screening current induced field measured for the no-insulation coil (-0.64 mT) was 24% smaller than that in the insulation coil (-0.84 mT) due to the current paths originating from the turn-to-turn and layer-to-layer contacts, suggesting that the screening current dissipated through contact resistance during charging. As both the fully-insulated and no-insulation coils were exposed to an external AC magnetic field, the magnetic center field of the coils increased gradually to eventually saturate at the theoretical values of 31.7 and 31.9 mT, respectively. Moreover, the screening current induced field in the no-insulation coil could be removed completely under lower external AC magnetic fields compared to the fully-insulated coil, due to the lower screening current induced field in the no-insulation coil after charging.

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