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New Methods to Reduce Fast-Ramping AC loss in High Temperature Superconductors Coils at High Currents of 500 A –800 A

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Most of the existing AC loss experiments and simulations of High Temperature Superconductors Coils deal with low currents of less than 100 A, which does not provide sufficient data or analysis for the HTS coils with higher current at 500 A to 800 A. If the AC loss is considerably larger, it will result in high heat dissipation into the HTS coils, and so as to elevate the coil temperature and fail the magnet operation. A 50 turns of solenoids magnets with a diameter of about 30 cm, are being studied. It turns out that the AC loss in a 0.5 T coil is about 1000 –10000 more than that in a single conductor, and may result in ~5000 W heat dissipation. A few new Methods have been experimented in this study to reduce the coil AC loss at frequency of 1 Hz – 10 Hz. (1) Divide the 50 turns into 5 identical coils, each has 10 turns, align them vertically on the same axis, with 2 mm gap between them. May try with or without steel core, and maybe flux diverter. (2) Divide the 50 turns into 5 different ID/OD coils, concentrically aligned with 3 mm gap. (3) Still the same 50 turns coil, but increase turn-to-turn insulation thickness, from 0.1 mm to 1 mm and 2 mm. AC loss calculation will be performed and compared to optimally reduce the AC loss in the fast-ramping HTS coil and the thermal load.

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