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Fabrication and characterization of BSCCO-2223 tape based compact coils

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High Temperature Superconductor (HTS) based magnets are potential candidate for the future fusion reactors and electrical industries due to its compact size and operational economy. A SS laminated BSCCO-2223 HTS tape based and double pancake wound compact solenoid coil with an inter-double pancake joint of bore diameter 50 mm with 24 nos. of turns has been fabricated and tested at LN2 temperature. This coil has been charged up to 2.1 kA with maximum current ramp rate per turn of about 8.5 MA/s and generated axial magnetic field of 1.1 T at 77 K, self-field. The estimated axial magnetic field ramp rate of this coil is greater than 4 kT/s. This has inter-turn Kapton insulation. In order to study the effect of inter-turn electrical insulation on the current ramp rate, double pancake based solenoid coils with and without inter-turn Kapton insulation of similar dimensions have also been fabricated and tested up to 10 K using Cryo-cooler. The differences in the current and voltage profiles during current ramp up and ramp down observed for coil with and without electrical insulation. These coils were charged up to 440 A at 10 K and produced magnetic field up to 2 kG. The inter-double pancake joint resistance with overlap length of 100 mm is measured around 48 nΩ at 10 K, self-field. The first coil was operated in pulsed mode for about one millisecond up to the current 20 times higher than the critical current without any thermal damage at 77 K. I-V characteristics for all three coils, joint resistance, and axial magnetic field measurement results and analysis will be reported in this presentation.

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