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Design, construction and test in SULTAN of high-current ReBCO racetrack coil

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Various quench detection methods are under development at EPFL Swiss Plasma Center, aiming at the detection response determined solely by temperature and not affected by EM noise or mechanical strain. This can be especially useful when applied to HTS coils. Currently, the promising options are twisted-pair SQDs (essentially, co-wound insulated superconducting wire), thermocouple chains and FBGs (Fiber Bragg Grating) inserted in Teflon tubing. The performance of the proposed methods is being investigated in SULTAN on a high-current ReBCO racetrack coil. The coil design is based on laminated stacked-tape soldered (LASSO) conductor using 12 tapes of 4 mm width arranged in 6 parallel 2-tape stacks. The coil is wound using an 18 m-long LASSO conductor and fiberglass cloth for turn insulation. It is impregnated with aqueous DMSO providing superior thermal conductivity (up to ~ 2 W/m/K at 10 K) compared to common solutions such as epoxy or wax, and cooled indirectly by forced-flow helium in steel pipes placed near the coil. In addition to the quench detection instrumentation, the sample is also equipped with CERNOX temperature sensors, hall probes, strain gauges and foil heaters. It is characterized in SULTAN using a 15 kA/10 V direct drive test insert, which allows investigating fully developed quench situations in a controlled manner. This paper gives the details of the sample design and construction, focusing on its intensive instrumentation, and summarizes the main test results in terms of DC, AC and quench performance.

Topic

Applications in large instruments such as high-field magnets, medical magnets and accelerator magnets

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