

Strand-Jacket Thermal Contact Resistance of REBCO Conductor Measured on Dummy Conductors

Large amount of steel will be used in the cable-in-conduit conductor (CICC) made of high temperature superconducting (HTS) REBCO tapes for European DEMO central solenoid (CS), to withstand the huge Lorenz force during operation. The maximum cross section of steel in the REBCO conductor is 2588 mm², which is about 3 times of the total cross section of cable and helium. Consequently, heat capacity of steel will become dominant in the conductor at temperature above 20 K. This means the steel conduit can play an important role for quench protection, which is usually regarded as a critical problem for HTS, by taking the Joule heat from the quenched superconductors, but only if the thermal contact resistance (TCR) between steel conduit and superconducting cable is sufficiently low. Thus, TCR becomes important for a reliable quench simulation and conductor design.

The strand-jacket TCR is measured on dummy conductors with three copper strands, which is made of pure copper instead of the copper profile encasing a soldered stack of REBCO tapes. In the experiment, current is applied to the copper strands and temperature of strands and jacket (steel conduit) is measured. TCR is then calculated by the temperature difference between them or the increasing rate of temperature. Measurement will be done at room temperature and liquid nitrogen temperature. TCR of different kinds of conductor layouts, e.g. keep the void empty or fill with solder or thin copper wires, are measured. Influence of transverse pressure, as in the case of operation in high field, is also studied.

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