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Tcs Measurement Result of ITER Toroidal Field Insert Coil Tested in 2016

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Performance of the ITER toroidal field (TF) coil conductor has been measured in the SULTAN facility with 3.6 m straight configuration and joints at the sample top and bottom. However, this test condition includes large gradients of magnetic field along the conductor length caused by its only 0.45 m high field length. This condition, which is not present inside the ITER TF coils, could lead to an increased drop of Tcs: current sharing temperature. In order to study the TF conductor performance without such large field gradient, a TF Insert Coil (TFIC) was tested in the CSMC facility in Naka Fusion Institute, Japan. The TFIC is a single layer 8.875-turn solenoid coil wound from ITER TF conductor. The coil diameter is 1.44 m and the conductor length is around 40 m. The TFIC has been tested from October 2016 to March 2017 and its Tcs was measured through 1,000 electromagnetic cycles and then several times of warm-up and cool-downs from room temperature to cryogenic temperature. In parallel with the TFIC test, Tcs measurement with similar procedure was also carried out in the SULTAN with a TF conductor sample, which was cut from the one for the TFIC during its fabrication, and both Tcs results were compared. The result showed that the Tcs of the TFIC was around 0.7 K higher than that in SULTAN mainly caused by hoop stress in the coil, and the change in Tcs through the electromagnetic cycles was almost identical in both cases. However, the Tcs results after the warm-up and cool-downs were different for each case and the TFIC showed smaller Tcs degradation than the SULTAN sample. The result of the Tcs measurements and following analysis are reported in this presentation.

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