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Summary of the Test Results of ITER Conductors in SULTAN

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After completing the qualification tests of the ITER cable-in-conduit conductors (CICC), the series manufacture tests are running in the SULTAN test facility in Villigen, Switzerland, with target completion date in 2015. The key test for the conductor samples is the current sharing temperature, Tcs, at the nominal operating field and current, i.e. the maximum temperature at which the conductors operate before developing an electric field of 10 μV/m. All the TF samples fulfilled the ITER requirement of Tcs ≥ 5.8 K after 1000 load cycles. The Tcs results have a broad scattering among the suppliers, from 5.8 K up to 6.6 K.
The assembly of the Nb3Sn based CICC samples (for TF and CS coils) is carried out at CRPP. The NbTi CICC samples (for PF, CC and bus bars) are assembled at the suppliers, with a U-bend replacing the bottom joint. The poor performance of some Main Busbar (MB) conductor samples, caused by poor sample assembly, triggered the effort to assemble a MB sample at CRPP with solder filled terminations and a bottom joint. The superior test results of the MB-CRPP sample, closely matching the performance assessment carried out using 3-D field distribution and n-index behaviour was a successful achievement of the last year of operation.
According to the Procurement Arrangement for the ITER coils, the winding companies must qualify the joint and termination manufacture by SULTAN samples. The first joint sample tested in SULTAN was a TF joint from EU, followed by a Correction Coil (CC) joint sample from China. Other joint samples are being assembled in USA (Central Solenoid), in Russia (PF1) and in China (PF6).
All the ITER coils use the "twin box"design for joints, except the Central Solenoid. At the first test in SULTAN of a twin-box TF joint sample in 2013, an unexpected resistance increase was observed after an accidental dump of the SULTAN field, causing a large field transient parallel to the joint contact surface, with large eddy currents and electromagnetic loads at the pressure-contact between strand bundle and copper plate of the twin box. The resistance requirement for the TF joint was still fulfilled after the dump. The impact of transient field on resistance and stability was investigated at an additional test campaign of the TF joint sample, with intentional dumps of the SULTAN field.

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