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Wed-Mo-Po.09-07: Development of a 6-slot twisted stacked-tape cable in conduit conductor for D-shaped coil

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Twisted stacked-tape cable in conduit conductor (TSTC-CICC) structure constitute a very promising technology due to their easy fabrication process, flexibility, and high current density. This paper introduces a 6-slot TSTC-CICC structure and a 20-meter-long cable is fabricated. To verify its performance, the cable was wound into a D-shaped coil and successfully tested at liquid nitrogen environment. The cable has six twisted slots, and 50 superconducting tapes are embedded in one slot, while copper tapes are used instead to achieve specific electrical and mechanical properties for other slots. After manufacturing the 20-meter-long cable, a pipe bending device was used to form the D-shaped coil, which is crucial for validating the manufacturing process for future tokamak (TF) magnets. To ensure the stable operation of the coil under high magnetic fields and large currents, solder is filled in the cable through vacuum pressure impregnation (VPI) technology to eliminate internal voids in the cable. This study also measured the critical current of the coil, and analyzed the critical current and n -value at the large radius and small radius of different turns of the D-shaped coil. By comparing with the test results of the straight cable, it was shown that the 20-meter-long 6-slot TSTC-CICC exhibits excellent uniformity in critical performance.

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