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Wed-Mo-Po.09-05: Electromechanical Behavior of Double Casing Conductors under Torsion and Bending for High-Current Fusion Devices

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In fusion applications, cables made from high-temperature superconducting tapes are required to transport high currents in strong magnetic fields. Cable-in-conduit conductors (CICC) using multiple high-temperature superconducting (HTS) strands, such as the HTS conductor, meet these demanding requirements. This study presents experiments on a double casing conductor (DCC), a round HTS strand developed with the HTS twisted stacked-tape cable (TSTC) approach. The soldering quality was enhanced through vacuum pressure impregnation. The inner casing offers extra support for the tapes, minimizing mechanical issues caused by weak solder, while the outer casing ensures proper solder flow and prevents the inner casing from cracking under direct stress. To achieve the required high currents, multiple DCC strands must be assembled into cables. The triplet-CICC structure is considered a crucial step toward full-size fusion conductors. Initial tests include a twisted triplet sample, where the relationship between current-carrying performance and twisting pitch will be evaluated. Subsequently, tests on the winding radius will determine the minimum radius that the conductor can tolerate when wound into large coils. In the experimental tests, samples were bent to specified radii at room temperature, followed by critical current measurements at 77 K under self-field conditions. Each sample was characterized at various bending radii in decreasing order, and cross-sectional images were taken to assess any macroscopic damage.

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