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Wed-Mo-Or1-05: [Invited] Engineering Design and Status of the LTS Magnets for Next Generation Compact Fusion Reactor in China

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In the past few years, with the continuous improvement of the performance requirements for superconducting magnets in future compact fusion devices, China has been committed to the design and manufacture of superconducting magnets. At present, the comprehensive design of low temperature superconducting (LTS) magnets for next generation fusion reactors in China has been finalized, encompassing toroidal field (TF) and poloidal field (PF) components. And the coil winding and insulation VPI technology have been developed. In terms of overall design, the TF magnet system has a total of 16 coils, the high-field and low-field coils are wound with CICC conductor prepared with high-Jc-Nb3Sn and ITER Nb3Sn, respectively. Its operating current is 55 kA/turn and inductance is 7.5 H. The PF coils are wound with CICC conductor prepared with ITER Nb3Sn/NbTi, with a maximum operating current of 52.86 kA/turn and a maximum inductance of 1.2 H. According to electromagnetic analysis, the magnetic field at the center of the plasma (@R=3.6 m) is 6.15 T, the maximum magnetic field in TF coil region is about 13.5T. The overturning moment and maximum stress of the TF are 62 MN·m and 850 MPa. Under the condition of 7 MA plasma current, the highest magnetic field of PF magnets is 11.1 T and the maximum stress of PF coil jacket is 498 MPa. The thermal-hydraulic analyses based on the influence of nuclear heat, AC loss, and conduction heat under various working conditions have also been completed. The temperature margin is higher than 1.64 K under all plasma scenarios, which meets the design requirements. At present, the winding, heat treatment, jacket, insulation VPI, and internal joints of TF dummy coil have all been completed, which also met the design requirements. The PF5-7 coils are being wound and are projected to be completed in the first half of 2025. Regarding the overall assembly of superconducting magnet system, the installation scheme design of TF magnets and PF magnets has been completed. The above works will contribute to the construction of Burning Plasma Experimental Superconducting Tokamak (BEST) in China.

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