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Overview of the Present Progress on the Superconducting Magnet System of CFETR-PhaseII

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CFETR (China Fusion Engineering Test Reactor) concept design work was started in 2012. It is developed in two stage. CFETR-Phase I is designed with major radius R=5.7m, minor radius a=1.6m and magnetic field at plasma region BT=4-5T. 16 toroidal field coils and 6 central solenoid coils were designed by Nb3Sn CICC with maximum operation current of 64 kA and 50 kA, respectively. Three types of plasma equilibrium shape was designed as ITER-like single null, super-X and snowflake. The maximum flux provided by central solenoid is designed as 180 volt second. However, in order to get much high operation parameters such as steady-state operation, particle and heat exhaust, disruption mitigation and avoidance, ELM control, and material damage by high heat flux and neutron, the superconducting magnet system of CFETR-phase II has been updated based on the larger machine with R = 6.7m, a=2.0m, BT= 6-7T. With this new design, over 1GW fusion power can be achieved and advanced plasma performance can be obtained. In consideration of the maximum magnetic field of TF coils of CFETR-phase II, high performance of Nb3Sn CICC magnet was designed which can withstand 14-15 T. Besides, in order to save the space for blanket system and get much high flux, high temperature superconducting Bi-2212 magnet with better current carrying performance under high field is supposed to be employed for CS coils of CFETR-phase II. The HTS CS coils can provide a high voltage second of about 480V•s and the maximum magnetic field is about 17.5T. In addition, Bi-2212 CICC conductor sample was tested at 4.2 K with critical current of 26.6 kA under its self-field.

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