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Status of K-DEMO Design Concept Study

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The conceptual study on the Korean fusion demonstration reactor (K-DEMO) has been carried out since 2012 [1]. K-DEMO is featured by the medium size tokamak (R = 6.8 m, a = 2.1), a high magnetic field (B_{To} = 7.4 T) with steady-state operation. The primary candidate of coolant medium is the pressurized water. One unique aspect of K-DEMO is a two-staged development plan to mitigate the gaps between the present level of technology and the required technology level for the full functions of DEMO. At first, K-DEMO targets not only to demonstrate a net electricity generation (Q_{eng} > 1) and a self-sustained tritium cycle, but also to function as a component test facility. Then, at its second stage, a major upgrade is expected to replace in-vessel components in order to demonstrate a net electric generation on the order of 500 MWe.
A preliminary operating scenario using a combination of various H&CDs (heating and current drives) covering neutral beam, electron cyclotron, lower hybrid, and fast wave H&CDs has been derived. The total H&CD power is estimated approximately 110 MW. The main components of K-DEMO have been conceptualized. The superconducting magnets (toroidal field (TF), poloidal field, and central solenoid magnets) were developed. Key features of the K-DEMO magnet system include the use of two TF coil winding packs, each of a different conductor design, to reduce the construction cost and save the space for the magnet structure material. The CICCs (Cable-In Conduit Conductors) for each type of magnets were fabricated and tested. Divertor is adopting the monoblock-typed tungsten armors with the reference choice of a double-null operation. Solid ceramic pebble typed lithium orthosilicate (Li_4SiO_4) was primarily selected for the tritium breeder. Extensive mechanical and neutronic analyses have been carried out to support the developed design concepts and the results are presented.

[1] K. Kim et al., "Design concept of K-DEMO for near-term implementation", Nuclear Fusion 55 (May 2015) 053027 (9pp).

Eligible for student paper award?

No

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