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Neutronics Analysis of Helium Cooled Ceramic Breeder Blanket with S-shaped Lithium zone and Cooling Pipes for CFETR

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China Fusion Engineering Test Reactor (CFETR) is a tokmak fusion experimental device under design to bridge the R&D gaps between ITER and DEMO. Helium Cooled Ceramic Breeder (HCCB) blanket is one of the candidate blanket concepts for CFETR. Blanket with S-shaped lithium zone and cooling pipes reduces the space of helium manifold and is conducive to tritium breeding. The neutronics analyses of HCCB blanket with S-shaped cooling pipes for CFETR have been performed with the Monte Carlo code MCNP and nuclear cross-section data from the FENDL-3.1b data library. The aim of the analysis is to provide the reference for the design and optimization of CFETR blanket system.

The 3D neutronic analysis for CFETR was done, in which the 11.25 degree sector model (consist of blanket modules, manifold, support plate, shield, divertor, vacuum vessel, thermal shield, TF coils, PF coils, CS and cryostat) was generated with the McCad automated conversion tool from the reference CAD model for analysis, the 2-D (radial and poloidal) neutron source map was plugged via general source definition card to stimulate the D-T fusion neutrons. The concerned neutronics parameters of CFETR, mainly including the tritium breeding ratio to characterize tritium self-sufficiency, the energy multiplication factor to characterize power generation, as well as, the inboard and outboard mid-plane radial profiles of neutron flux densities, helium production rate, displacement damage rate and the energy deposition to characterize the shielding performance, were produced. The detail results will be presented in this conference.

Eligible for student paper award?

Yes

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