Type: Invited Oral

Neutronics and tritium fuel cycle R&D activities for fusion development in China

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For future D-T fusion devices including DEMO reactors and plants, it is essential to achieve the high neutronics performance and to build an efficient tritium fuel cycle. There have been a few future fusion devices developed or under development in China, such as the CFETR (China Fusion Engineering Test Reactor), the burning plasma superconduting experimental tokamak device and the CFEDR (China Fusion Engineering DEMO Reactor). The neutronics calculation and analyses have been carried out to assess the tritium production capability in the corresponding breeding blankets, and the shielding adequacy to minimize the radiation impact on the superconducting magnets. Furthermore, the shutdown dose rate (SDDR) has been evaluated to address the personnel safety from the radiological dose exposure; the radioactive waste has been estimated to assess the radwaste classification. To perform the abovementioned neutornics analysis for all fusion facilities, a workflow of a series softwares and toolkits is developed and used in the Institute of Plasma Physics, Chinese Academy of Sciences (ASIPP). The benchmark between the calcualtion and experimental results is also underway.

To build the D-T fuel cycle for future D-T fusion reactors, tritium inventory requirement is one of the most challenging issues for both tritium self-sufficiency and initial start-up inventory. The development of an integrated tool is underway in ASIPP. This tool is designed to simulate the process of the fuel cycle for different fusion devices, including fueling, burning, retention, purification, isotopes separation and recycling. It has been preliminarily tested and applied to design the fuel cycle for the CFEDR. In addition, a small-scale experimental facility is recently built to test the performance of the closed fuel cycle by using H/D to simulate the T fuel in order to simplify the radiation safety requirements. These tools will be used to support the design of the fuel cycle for the fuel cycle for the fuel inventory need and the efficiency.

Country or International Organisation

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