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P4.166 Tritium breeding capability of water cooled ceramic breeder blanket with different container designs

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Water cooled ceramic breeder (WCCB) blanket has been considered as the primary design in Japan. There are many thin cooling pipes in the blanket and internal pressure would be applied to the blanket by the pipe rupture. A number of efforts have been made for keeping pressure resistance of the blanket with box structure. Pressure resistance of the box structure could be reinforced with internal ribs or fillets but tritium breeding ratio (TBR) would decrease due to an increase of structure material inside the blanket. Cylindrical structure is well known for more effective than the box structure from the viewpoint of pressure resistance. This study aimed to clarify tritium capability of the blanket different container designs. Box structure, two cylindrical structures with poloidal or radial axis were considered in this study. The dimensions of the blanket were referred to WCCB test blanket module (TBM) in ITER project. TBR of different blanket designs were evaluated by using Monte-Carlo code MCNP5.14 and nuclear data library for fusion neutronics applications, FENDL-2.1. A ratio of breeder and multiplier, gap size around the blanket were regarded as parameters. The tritium breeding capabilities of the blanket designs were analyzed from the perspective of the neutron economy considering neutron escape, captures in iron, and neutron multiplication. Based on the results, the relation between TBR and the neutron economy in different TBM designs was clarified. Finally, blanket designs that could improve tritium breeding capability were proposed.

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