NEUTRONIC ASSESSMENT OF AN HELIUM-COOLED $^{6}LI_{8}PBO_{6}$ BREEDING BLANKET DESIGN FOR DEMO

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Large Be mass requirements is a major prospective drawback for future deployment of fusion power reactor based on solid breeder blanket ceramic concept.

The ^{6}Li-enriched octalithium plumbate ($^{6}Li_{8}PbO_{8}$) (OLP) has characteristics of ideal neutron multiplier/tritium breeding ceramic. In breeding blanket consideration of OLP as a breeding ceramic would potentially minimize the amount of Be required for neutron multiplication or even avoid its need.

In this work, an OLP breeding blanket model considering helium as primary coolant and OLP as breeding material and a ferritic-martensitic steel structure is studied under a real fusion reactor volume distributed neutron source. A modified version of the MCNPX code has been used to model the plasma neutron emission in a 3D toroidally-simmetric geometry.

The neutronic reliability and performances of a helium-cooled OLP pebbled-bed blanket is investigated in terms of neutronic responses as: (1) shielding factors of BB/VV structures for superconducting magnets shielding, (2) energy deposition within the structures distributions ensuring overall power amplification, (3) tritium breeding ration performances for of the component, (4) structural and functional material response in terms of damage, ionizing doses and gas production: dpa, dpa rates, H/dpa and He/dpa, and ionizing doses in the ceramic in order to estimate the operational life-time and to progress in the analysis of breeding blanket functionality, (5) material activation for waste management assessment in breeding blanket component and surrounding media.

Tritium breeding ratio (TBR) and needed extra amounts of beryllium are investigated, depending on porosity and OLP (^{6}Li) enrichment.

The accomplishments show promising results to potentially support a possible breeding blanket design concept.

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