

TECHNICAL PREPARATION FOR IN SITU TRITIUM RELEASE STUDIES OF EU REFERENCE CERAMIC BREEDER PEBBLES

Advanced Ceramic Breeders (ACB) applied as pebbles serve as the European reference material for the ITER-TBM and the DEMO Helium Cooled Pebble Bed (HCPB) blanket concept. Although ACB pebbles (Li_4SiO_4 with additions of Li_2TiO_3) have been extensively characterised and evaluated in the past, its performance under neutron irradiation still needs to be qualified. Hence, a neutron irradiation campaign was launched to help closing this gap of knowledge.

The irradiation campaign will be performed at the WWR-K reactor in Almaty, Kazakhstan. ACB pebbles produced using the melt-based KALOS process with a high enrichment in lithium-6 will be implemented in the experiment. Two pebble beds will be irradiated at temperature ranges of 400–600 °C and 600–900 °C, respectively. Different purge gas compositions ($\text{He} + x \% \text{H}_2$) will be used for transporting the tritium out of the samples. The tritium release will be measured in situ. Here, the species HT and HTO will be distinguished. Afterwards, the tritium residence time depending on the selected irradiation parameters will be determined. For the experiment, the neutron spectrum of the fission research reactor will be adapted to simulate more fusion-, and in particular more ITER-like conditions.

The technical preparation for this neutron irradiation campaign will be presented. This comprises the development of the irradiation rig design including neutron-physical and thermophysical calculations that are necessary to meet the requested irradiation criterions. A cadmium shielding was selected to cut off thermal neutrons in the spectrum and to adapt the lithium burn-up to displacement per atom ratio. A mock-up test was performed to validate the selected design option.

Section

Energy and materials science (Section 2)

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