

# Experimental neutronics tests for a neutron activation system for the European ITER TBM

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The tritium breeding blanket is an essential part of future DT fusion power reactors. Test Blanket Modules (TBM) will be installed in the experimental reactor ITER with the aim to investigate the nuclear performance of different breeding blanket designs. A very important parameter for many TBM experiments is the neutron flux density inside the TBM since the neutron flux determines other parameters such as tritium production rate, nuclear heating, material activation including production of mobile radioisotopes. The measurement of the neutron flux inside the TBM is necessary in order to achieve a high accuracy.

Currently there is no fully qualified neutronics instrumentation available for the TBMs which would be able to withstand the harsh environment conditions such as high temperature ( $>400^{\circ}\text{C}$ ) and, depending on the operation scenario, intense radiation.

KIT is developing an neutron activation system for the measurement of neutron flux densities in selected positions in the TBM based on pneumatic activation probe transport. At this moment it is not clear whether cooling for the irradiation ends could be provided, therefore the selection of activation materials requires, among others, the consideration of melting point and chemical compatibility.

We intend to utilize mostly nuclear reactions leading to radioisotopes with half-lives on the order of tens of seconds up to minutes. An important goal is to establish a measurement method which allows to simultaneously obtain the induced activities in the activation probes and calculate the corresponding spectral neutron flux densities with moderate time resolution of tens of seconds so that a coarse time profile of the neutron spectrum can be recorded.

We will present the status of experimental tests of activation foil combinations irradiated with 14 MeV neutrons from the intense DT neutron generator of Technical University of Dresden. A dedicated pneumatic sample changing system has been set up for these tests. The system provides automated transport of the activation foil packages to the irradiation and consecutive measurement of the induced gamma-ray activity. These tests aim to demonstrate experimentally that the selected short-lived activation foil materials are really suitable for quasi on-line spectral neutron flux density measurements. Tests have been performed in a pure DT neutron field, in a DT neutron field with thermal neutrons from a polyethylene moderator and in the neutronics mock-up of the European HCLL TBM.