

## Summary on neutron irradiation campaign for RR and other retention-related experimental studies at SCK CEN

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According to what has been agreed at the 2nd and 3rd RCM meeting, SCK CEN has prepared and start the execution of the neutron irradiation campaign to enable: (i) generation of the sample set for future RR campaigns; (ii) assess retention in tungsten (and other materials comprising the campaign) in different labs using deuterium and tritium experiments; (iii) make assessment of the retention in Eurofer97 steel and innovative W-Cr-Y alloys.

The launched campaign included three irradiation temperatures 50 and 300 °C and the target irradiation dose is 0.2 dpa in W (or 0.5 dpa in Fe) which corresponds to the twice the end-of-life dose of the first ITER divertor. Besides mentioned above W and Eurofer97 steel, the experiments involve Molybdenum, Iron and CuCrZr. This set of samples will comprise the research material for future CRPs dedicated to the reduction of the uncertainty on neutron irradiation damage, correspondingly induced defect structure, annealing of defects and interaction of hydrogen isotopes with those defects.

The irradiation experiment is completed. The irradiation capsules are opened and all samples are extracted and after inspection defined to have “intact” condition i.e. ready for the post irradiation studies. The first batch of sample transportation has been executed to UKAEA, UK in 2024.

In addition, several tungsten samples irradiated in the previous campaigns (as discussed at the 1st and 2nd CRP) are still available for the advanced post irradiation characterization and can be shipped with A-type container. The samples are irradiated up to 0.05 - 0.2 dpa exhibit the activity of less than 2 mSv/hour on contact and can be handled in fume hood under ALARA procedure. These samples could be used for this CRPs to perform dedicated experiments to investigate permeation and retention of hydrogen isotopes. The freshly irradiated samples could be shipped together with “old” samples to reduce the cost.

In 2025, SCK CEN plans to perform a series of microstructural examination of ITER specification tungsten irradiated in this campaign using in-situ TEM. The experiments will be dedicated to understanding of the microstructural evolution under heating from irradiation temperature up to 1000 °C. This information will be indispensable for the interpretation of the retention studies which will be performed with these samples. Example of such study performed on ITER-specification W irradiated at 600 °C and then in-situ annealed up to 1000 °C will be presented.

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