HELIUM COOLED HIGH- AND MEDIUM-FLUX-TEST-MODULES FOR THE INTERNATIONAL-FUSION-MATERIAL-IRRADIATION-FACILITY

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The International-Fusion-Material-Irradiation-Facility (IFMIF) is an accelerator driven neutron source to create a displacement rate per full power year of more than 20 dpa/fpy in materials e. g. like steel within the High-Flux-Test-Module (HFTM) with a volume of 0.5 litres. It also provides a helium and hydrogen production rate related to the dpa rate comparable to values to be expected in a DEMO Fusion reactor. In addition a Medium-Flux-Test-Module (MFTM) is dedicated to in situ creep-fatigue tests.

In the HFTM material specimens are installed in capsules. The capsules which wear electric heaters are housed in rigs. They are cooled at the outer side by helium. The interactions of helium cooling and electric heaters allow to keep the specimen at temperatures between 300 °C and 650 °C with small tolerances at accelerator on and off situations. Recent design amendments of the HFTM lead to an increase of the specimens packing density of about 30%. Major design changes were the flat plate rig cross section, triple heaters for each rig and narrow rectangular helium channels with $D_{hydr.}$ = 2mm. The neutronic calculations with the extended Monte Carlo code McDeLicious revealed the influence of the specimen packing density on the neutron field and the dpa/fpy. Pressure loos and heat transfer from the rig walls to the helium were calculated with CFD code STAR-CD, the second pivotal design tool. For validating the code dedicated experiments with a new helium loop are carried on. First results confirm that the transition laminar to turbulent will not occur below $Re < 4000$.

In the Medium-Flux-Test-Module (MFTM) creep/fatigue specimens have to be kept at different temperature levels. The specimens are heated with ohmic heating and cooled with helium flowing through the specimens. A helium jet cooling is investigated in order to keep the specimens temperature within acceptable tolerances. Appropriate CFD codes and turbulence models are scrutinized.