Qualification of EUROFER97 for TBM: contribution of the EUROfusion project within 2021-2025

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In this contribution, we provide an overview of the activities implemented by EUROfusion under the umbrella of a collaboration agreement with the domestic agency Fusion for Energy (F4E), aiming at finalizing the qualification of the EUROFER97 steel for the application in ITER TBM as structural material. Under central coordination of EUROfusion, the workflow is subdivided into four streams to address: (i) closure of the gaps in the mechanical and physical properties; (ii) the execution of dedicated mechanical tests to validate design rules according to RCC-MRx code provisions; (iii) characterization of weldments and (iv) assessment of the effect of neutron irradiation on baseline and welded material. The implementation of these tasks is a major international qualification programme shared across seven European organizations, namely: CCFE UK, CEA France, CIEMAT Spain, ENEA Italy, EK Hungary, KIT Germany and SCK CEN Belgium.
EUROfusion contribution covers a number of scientific and technical issues to be tackled along the way. In this contribution, the experimental facilities including neutron irradiation and nuclearized test facilities involved in the programme are reviewed. Specific attention is drawn to the experimental activities targeting the design rules validation, which includes a combination of computational analysis, neutron irradiation and mechanical testing performed according to international standards and RCC-MRx quality requirements. In this respect, the applicability and challenges of the small specimen test techniques (SSTT) is another important topic of specific interest. The overall planning of the activities and its alignment with ITER and DEMO schedules are also presented as well. The ultimate objective of the currently configured programme is to provide maximum achievable input for the next revision and update of RCC-MRx code (in 2025), covering the characterization of EUROFER97 properties up to the end of life for the ITER TBM.