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Neutron irradiation effects on PFC materials: an overview of EUROfusion programme

Dmitry Terentyev[1], Michael Rieth[2], Ermile Gaganidze[2], Gerald Pintsuk[3], Giacomo Aiello[4], Michael Klimenkov[2], Aleksandr Zinovev[5], Shuhei Nogami[6], Steffen Antusch[2], Jan Coenen[3], Petra Jenuš[7], Koray Iroc[5], Chao Yin[8], Carmen Garcia Rosales[9]

[1]Belgian Nuclear Research Center, Belgium
[2]KIT, Germany
[3]FZJ, Germany
[4]EUROfusion, Germany
[5]SCK CEN, Belgium
[6]ALMT, Japan
[7]JSI, Slovenia
[8]USTC, China
[9]CIET, Spain

The EUROfusion Consortium is an association of Laboratories across 28 European countries in charge of implementing the European Roadmap to Fusion Electricity. Development and qualification of neutron tolerant materials is one of the missions on the Roadmap, with neutron irradiation and subsequent post irradiation examination representing a key challenge as it requires substantial time and financial resources, expertise in dealing with nuclear materials and long-term vision for the codification of the results into reactor design codes. In this talk we provide an overview of the EUROfusion contribution to the investigation of the neutron irradiation effects in plasma-facing materials (PFC). The presentation summarizes the main results and lessons learned over the 2018-2024 period, and it is sub-divided into four sections covering: (i) commercial ITER-specification tungsten; (ii) advanced tungsten grades achieved by alloying or innovative production methods; (iii) advanced copper-based heat sink materials; (iv) W-Cu joints. The effects of neutron irradiation are assessed in terms of the modification of mechanical properties, and supported by microstructural investigations to explain and interpret the obtained results. The corresponding irradiation matrix for the development of the Material Property Handbook (MPH) is presented and discussed. Currently existing gaps in the MPH and outlook for the actions to cover these gaps are discussed as well.