P 25: Plasma Wall Interaction IV

Time: Friday 11:30–12:00 Location: KH 01.012

P 25.1 Fri 11:30 KH 01.012

Improving The Sinterability Of WfW By Alloying — •Chongyang Liu[1,4], Jan Willem Coenen[1], Yiran Mao[1], Mehrdad Mousapour[1], Tomislav Damjanovic[1], Christian Linsmeier[1,2], and Martin Bram[3,4] — [1]Forschungszentrum Jülich GmbH, Institute of Fusion Energy and Nuclear Waste Management, 52425 Jülich, Germany — [2]Ruhr-Universität Bochum, Faculty of Physics and Astronomy, Bochum 44801, Germany — [3]Forschungszentrum Jülich GmbH, Institute of Energy Materials and Devices, 52425 Jülich, Germany — [4]Ruhr-Universität Bochum, Faculty of Mechanical Engineering, Bochum 44801, Germany

In this work, tungsten fiber*reinforced tungsten (Wf/W) composites were modified by adding vanadium (V) to enhance densification while maintaining fiber ductility. W-V powders were produced by mechanical alloying and consolidated by FAST/SPS under varied V contents, temperatures, and holding times. Density was measured by the Archimedes method, and SEM/EDX analyzed microstructure and V diffusion. Three-point bending and fracture observations evaluated fiber behavior. The results show that small V additions, together with reduced sintering temperature and holding time, significantly improve matrix densification while keeping the fibers predominantly ductile. In contrast, higher temperatures or longer holding promote excessive V diffusion and fiber embrittlement. Overall, V alloying with optimized FAST/SPS parameters offers an effective route to improve Wf/W densification without sacrificing fiber integrity.

P 25.2 Fri 11:45 KH 01.012

Design-by-Analysis of Tungsten Fibre-Reinforced Tungsten for Divertor Plasma-Facing Components — •Tomislav Damjanović[1,2], Jan Willem Coenen[1], Yiran Mao[1], Mehrdad Mousapour[1], Christian Linsmeier[1,2], and Ute Wilkinson[3] — [1]Forschungszentrum Jülich GmbH, Institut of Fusion Energy and Nuclear Waste Managment - Plasmaphysics (IFN-1), Jülich 52425, Germany — [2]Ruhr-Universität Bochum, Faculty of Physics and Astronomy, Bochum 44801, Germany — [3]Dr. Fritsch Sondermaschinen GmbH, Fellbach 70736, Germany

Tungsten remains the leading material for plasma-facing components in fusion devices, yet its brittleness, limited thermal shock resistance, and irradiation-induced degradation raise concerns for long-term divertor operation. Embedding ductile tungsten fibres into a tungsten matrix (Wf/W) offers a route toward enhanced toughness and improved damage tolerance.

This contribution presents a design-by-analysis approach to optimize Wf/W composites for divertor-relevant thermo-mechanical loads. The microscale behavior is represented through homogenized material models using rule-of-mixtures and Mori-Tanaka schemes. These effective properties feed into a mesoscale description based on classical laminate theory to explore fiber volume fractions, orientations, and stacking configurations. Optimized composite layouts are then assessed in component-level finite-element simulations with realistic boundary conditions representative of divertor operation.