P 18: Plasma Wall Interaction I - Poster

Time: Wednesday 16:15–18:15 Location: Zelt Ost

P 18.1 Wed 16:15 Zelt Ost

Investigation of ground state excitation of sputtered tungsten in the linear plasma device PSI-2 — •Stephan Ertmer, Oleksandr Marchuk, Albrecht Pospieszczyk, Arkadi Kreter, and Sebastijan Brezinsek — Forschungszentrum Jülich GmbH - Institut für Energie- und Klimaforschung - Plasmaphysik, Partner of the Trilateral Euregio Cluster (TEC), 52425 Jülich, Germany

Tungsten (W) is foreseen as plasma-facing material in future fusion reactors. Spectroscopy is an important tool for particle flux measurements into the plasma. For the interpretation of the measured W line intensities the population distribution of J levels within the fivefold ground term ^{5}D and the $^7S_3$ level of sputtered tungsten released and entering the plasma remains an open question. A local thermal equilibrium (LTE) for these levels with an effective temperature in the order of 0.1-0.3 eV is usually assumed [1]. To investigate this assumption of LTE, we exposed a W target (T_{surf}=300 K) to an argon plasma in PSI-2 and measured the intensity of several W I lines over the first few mm in front of the target with high spatial resolution of 50 μm/px. The position of the intensity maximum provides information about the temporal evolution of the level population. Thus, the assumption on LTE condition within the ^{5}D ground term of the sputtered particles entering the plasma can be studied independently. The data suggest that at a biased, monoenergetic ion energy of 100-200 eV all atoms are sputtered primarily in the lowest ground level $^5D_0$ and the other levels are populated subsequently in the plasma.

[1] I. Beigman et al. Plasma Phys. Control. Fusion 49 1833 (2007)

P 18.2 Wed 16:15 Zelt Ost

Current results of the ITER relevant large RF driven negative ion beam test facility ELISE — •Dirk Wünderlich, Ursel Fantz, Bernd Heinemann, Werner Kraus, Rudi Riedl, and the NNBI team — Max- Planck- Institut für Plasmaphysik, 85748 Garching, Germany

The negative ion beam test facility ELISE is an important intermediate step in the European R&D roadmap for the neutral beam injection (NBI) systems of ITER. The ELISE ion source has half the size of the ITER source and its aim is to demonstrate the ITER requirements regarding the extracted current density (329 A/m^2 in hydrogen, 286 A/m^2 in deuterium), the electron-ion-ratio ($<$ 1) at the required filling pressure ($\leq$ 0.3 Pa) and the pulse length (1000 s in hydrogen, one hour in deuterium).

Typically the source performance is limited by the amount and temporal stability of the co-extracted electrons, in particular in deuterium operation. In the last years several valuable tools for counteracting this increase of the electrons have been identified, mainly modifying the magnetic and electric field topologies close to the extraction system and improving the caesium management.

The presentation summarizes and discusses the latest results obtained at ELISE: using the above-mentioned measures, in short pulses (10 s beam) the ITER values have almost been reached. Additionally, the current densities obtained during long pulses were drastically increased, reaching around 66 % of the ITER requirement both in hydrogen and deuterium.

P 18.3 Wed 16:15 Zelt Ost

Powder mtallurgically produced tungsten fiber-reinforced tungsten composites — •Yiran Mao[1], Jan.W Coenen[1], Johann Riesch[2], Sree Sistla[3], Leonard Raumann[1], Martin Bram[4], Jesus Gonzalez[4], Till Höschen[2], Alexis Terra[1], Christian Linsmeier[1], and Christroph Broeckmann[3] — [1]Forschungszentrum Jülich GmbH, IEK-4, 52425 Jülich, Germany — [2]Max-Planck-Institut für Plasmaphysik, 85748 Garching b. München, Germany — [3]RWTH Aachen University, IWM, 52062 Aachen, Germany — [4]Forschungszentrum Jülich GmbH, IEK-1, 52425 Jülich, Germany

In future fusion reactors, tungsten (W) is the main candidate material for plasma facing component. The intrinsic brittleness is a concern with respect to the fusion environment - high transient heat loads, neutron irradiation. To overcome this drawback, tungsten fiber reinforced tungsten (Wf/W) composites are being developed relying on an extrinsic toughing principle. In this work, recent development progress on powder metallurgy produced Wf/W will be discussed, showing a promising avenue to produce a dense bulk Wf/W composite. The work focuses on recent progress in Wf/W manufacturing and characterization. A main difficulty during sintering is the fiber embrittlement due to carbon contamination. These issues can be solved by separating the powders and graphite tool with a tungsten foil. Preliminary mechanical testing are performed in the as-fabricated condition. It shows that the existing of the weak interface reduces the strength of the composite, but, in return, allow to realize the pseudo ductility mechanism. This discrepancy and the resulting constraints for the manufacturing will be discussed.