O-9

**Sticking Coefficients of Boron Radicals**

*Matej Mayer*, Torsten Bräuer, Dario Cipciar, Chandra Prakash Dhard, Carsten Killer, Dirk Naujoks, Ralf Steinwehr, Udo von Toussaint, Lilla Vano, Holger Viebke

Max-Planck-Institut für Plasmaphysik, Germany

The recent decision of ITER to start plasma operation with a full tungsten wall necessitates implementing a wall conditioning method for gettering impurities, especially oxygen and water molecules, for obtaining efficient plasma start-up [1]. Regular boronizations using a glow discharge in B2H6 gas diluted in He are foreseen in order to coat the wall with a thin layer of boron [1], which acts as getter. B2H6 molecules are dissociated in the glow-discharge plasma into atoms and radicals, which finally stick to the walls. Simulation calculations predict a non-uniform distribution of boron over the whole inner wall, with thicker layers close to the discharge electrodes and thinner layers further away [1]. However, these predictions depend crucially on the assumptions about the sticking coefficients of the boron radicals. Unfortunately, these sticking coefficients are not known, thus rendering these predictions quite uncertain. Therefore a proper design of the ITER boronization system urgently requires experimental data on the sticking coefficients of boron radicals.
We used the cavity technique [2] in order to determine the effective sticking coefficient of boron radicals during an individual boronization in the stellarator Wendelstein 7-X (W7-X). A cavity is a small box made from silicon wafers with an entrance slit facing the glow-discharge plasma. The analysis of the lateral distribution of boron on the bottom and top inner surfaces allows determining the effective sticking coefficient of boron radicals.
Two cavities were exposed during an individual boronization in W7-X using the multi-purpose manipulator. The cavities were exposed at about the position of the inner wall. The boron distributions on the inner surfaces of the cavities were measured using Nuclear Reaction Analysis (NRA) with 3 MeV incident 3He ions. Multiple peaks from the 10B(3He,px)12C and 11B(3He,px)13C reactions were used for quantifying the amount of boron. Two detectors with a combined solid angle of about 110 msr were used simultaneously – this very large solid angle provides the necessary sensitivity for the very thin deposited boron layers. The distribution of boron inside the cavities was simulated using a Monte-Carlo program [2] and compared to the experimental distributions. The mean effective sticking coefficient of boron radicals created by the applied boronization plasma was in the range 0.4 – 0.5.

[1] A. Loarte et al., Initial evaluations in support of the new ITER baseline and Research Plan, ITER Technical Report ITR-24-004 (2024).
[2] S. Krat et al., Hydrocarbon film deposition inside cavity samples in remote areas of the JET divertor during the 1999-2001 and 2005-2009 campaigns, J. Nucl. Mater. 463 (2015) 822.