IAEA FEC 201

Contribution ID: **191** Type: **Poster**

Analysis of the impact of nitrogen- & neon-seeding on ASDEX-Upgrade H-Modes with SOLPS simulations

Thursday, 20 October 2016 14:00 (4h 45m)

Future fusion devices like ITER and DEMO will have to be operated with a detached divertor to meet material limits. Stable H-mode operation at high heating power $P_{Heat}/R = [5-12]MWm^{-1}$ with both targets completely detached, confinement of $H_{98} = 0.8-0.95$ and Greenwald fraction of $f_{GW} = 0.7-0.9$ has been demonstrated with nitrogen seeding in the all-tungsten ASDEX Upgrade tokamak. In ITER gas handling would be simpler if neon could be used instead of nitrogen. Hence, neon seeding has been attempted in ASDEX Upgrade for comparison. So far, detachment could not be achieved without provoking a radiative collapse due to tungsten accumulation. In order to still compare both radiative species, a series of H-modes with increasing seeding rates - high-recycling to detached outer divertor target - have been simulated. The simulations are based on input parameters and transport coefficients that are taken from closely validated SOLPS modeling of nitrogen seeded, medium heating power ($P_{Heat}/R = [5-7]MWm^{-1}$) discharges. The characteristic evolution of the radiation distribution and the impact on the upstream plasma parameters differ significantly for both seeding species. With nitrogen the divertor radiation increases and moves from the targets to the X-point and into the confined plasma - strongly localized in the direct proximity of the X-point. Similar to experiment, the upstream separatrix pressure varies only within 10% during this evolution. In contrast, neon mainly leads to an increase of main chamber radiation that strongly degrades the temperature pedestal. When the neon radiation finally condenses to the X-point, the separatrix pressure is reduced by about a factor of two. The differences for both seeding species seem to be due to at least two reasons. First, the radiation potential L_Z favors main chamber radiation for neon and divertor radiation for nitrogen. Second, divertor enrichment is strong for nitrogen and absent for neon in the simulations. The coherence with contrasting ITER simulations in which nitrogen and neon seeding to partial detachment show a similar impact on plasma performance will be discussed based on our findings.

Paper Number

EX/P6-22

Country or International Organization

Germany

Primary author: Dr REIMOLD, Felix (Forschungszentrum Jülich)

Co-authors: Dr KUKUSHKIN, Andrei S. (ITER Organization); Prof. REITER, Detlev (Forschungszentrum Jülich); Dr WISCHMEIER, Marco (IPP Garching); Dr BERNERT, Matthias (Max-Planck Insitut für Plasmaphysik)

Presenter: Dr REIMOLD, Felix (Forschungszentrum Jülich)

Session Classification: Poster 6

Track Classification: EXS - Magnetic Confinement Experiments: Stability