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Characterization of Electron Cyclotron Wall Conditioning Plasma in ASDEX Upgrade

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ITER envisages Electron Cyclotron Wall Condition (ECWC) after DMS events, to assist fueling changes and for tritium inventory control in its operational campaigns during which the toroidal magnetic field is continuously present. In PFPO-1, ECWC will operate mostly at the second harmonic X2 ECH wave polarization from upper and equatorial launchers. The here presented experiments in ASDEX Upgrade with full tungsten plasma facing components characterize ECWC discharges with X2 waves launched horizontally from the equatorial ports. The characterization of the deuterium plasmas is based on experimental inputs such as interferometry, in-vessel pressure measurements and poloidal field maps obtained from the measured coil currents, as well as advanced tomographic methods using filtered cameras at the hydrogen Balmer lines. TOMATOR-1D simulations and CTS radiometer spectra complement the findings.
Analysis shows that densities below the R cut-off are be obtained with significant levels of stray radiation. This radiation includes waves at half of the gyrotron frequency due to PDI effects occuring at 2nd harmonic UHR at the LFS of the resonance. Wave refraction at higher densities may be avoided by using optimal poloidal field pattern. Such pattern, along with the location of the ECH resonance, determines as well the strongest surface interaction areas for the charged particles. Directing plasma flux to inner wall surfaces by the field maps, and same for the inner divertor apron, is less effective due to magnetic mirror effects and outward convective flows. This may make ECWC less attractive for fuel recovery from deposits at the inner divertor. The uniform conditioning by an intense flux of low energy atoms produced at the ECH absorption layer may however be effective for main chamber conditioning after DMS events.

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