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ICRF Discharge Production for Ion Cyclotron Wall Conditioning on JET

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Discharge wall conditioning is an effective tool to improve plasma performance by (i) reducing the generation of plasma impurities liberated from the wall and (ii) controlling the recycling of hydrogenic fluxes. On ITER discharge wall conditioning will be employed as well for (iii) mitigating the tritium inventory build-up, for which one relies mostly on the removal of tritium-rich co-deposited layers. Ion cyclotron wall conditioning (ICWC) is a well-studied discharge wall conditioning technique having the advantage over Glow Discharge Conditioning (GDC) that it is applicable in the presence of magnetic fields. The ICWC mode of operation is included in the functional requirements of the ITER ion cyclotron resonance heating and current drive system, and is envisaged for use between ITER plasma pulses, in the presence of the toroidal magnetic field.
Ion Cyclotron Range of Frequencies (ICRF) plasma production employing ICRH&CD antennas designed for Fast Waves excitation is studied extensively on JET in the frame of fuel removal experiments by isotopic exchange aiming at the development of ICWC scenarios for ITER. This contribution presents an overview of these ICWC experiments with focus on (i) establishing safe and reliable operation of the ICRF antennas in plasma production mode at ITER full field (JET 3.3T, 25MHz) and half field scenario (JET 1.65T, 25MHz) and (ii) achieving high conditioning efficacy in isotopic exchange scenarios. The experimental results are complemented by modeling results using the recently upgraded 1D (along major radius) transport code Tomator1D for ICRF plasma production in a torus in presence of a toroidal magnetic field, the Monte Carlo code RFdinity1D simulating ICRF discharge initiation at omega_{pe} < omega, and a 1-D full wave RF code, together providing insight on ICRF plasma production physics as well as on ICRF plasma parameters which are outside measurement limits of JET density and temperature diagnostics.

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