Fuel removal : complementary research at the TOMAS experimental facility

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The upgraded TOMAS device, jointly operated at IEK-4 Forschungzentrum Jülich, enables the development of various fuel removal techniques, including methods based on ion- and electron-cyclotron (IC / EC) range of frequency plasmas, and to complement plasma-wall interaction research in tokamaks and stellarators [1]. The toroidal magnetic field generated by 16 coils can reach its maximum of 125 mT on axis. The IC system can couple up to 6 kW in the frequency range of 10 - 50 MHz. The EC system is operated at 2.45 GHz with up to 6 kW forward power. The direct current glow discharge (GDC) system is based on a graphite anode with the maximum voltage of 1.5 kV and current of 6 A. A load-lock system with a vertical manipulator allows exposure of material samples. A number of diagnostics have been installed: single- and triple-pin Langmuir probes for radial plasma profiles, a Time-of-Flight Neutral Particle Analyzer capable of detecting neutrals in the energy range of 10 - 1000 eV and a Quadrupole Mass Spectrometer.

With the present system upgrades, TOMAS is uniquely positioned to address a number of critical open issues with high impact on operating parameters and efficiency of fuel removal methods in ITER and other devices. These are (i) characterising the particle fluxes to the PFC's and confirming the role of neutral particles, especially in ICWC, (ii) study isotopic exchange in pre-characterised samples using the sample load-lock system and provide input data for modelling and (iii) studying the erosion of tokamak co-deposited layers using the sample load-lock system.

This contribution presents the TOMAS device capabilities with recent results on the characterisation of the plasma parameters and particle flux, and presents an overview of the ongoing plasma wall interaction studies relevant to the hydrogen workshop.

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