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Heavy Impurity Transport in the Core of JET Plasmas

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In the context of the investigations on JET of the effects of an ITER-like wall on the plasma performance, this contribution presents a comprehensive picture of the W transport in the core of JET H-mode plasmas with up to 2.5 MA of plasma current, based on a successful agreement between experiment, interpretative simulations and theoretical predictions. The main outcome is that W is particularly sensitive to neoclassical transport, which is affected by any type of poloidal asymmetry and in particular largely enhanced by centrifugal effects. In presence of peaked density profiles and insufficiently peaked ion temperature profiles, the neoclassic inward pinch leads to W accumulation in the core and in extreme cases to a premature discharge termination. Only around mid-radius, turbulent outward convection competes with neoclassical transport. MHD activity may hamper or speed up the accumulation process depending on circumstances. The path towards W accumulation is described in details for a representative 2 MA hybrid discharge in which the W behavior follows closely the evolution of the electron density profile. Neoclassical and linear gyro-kinetic calculations of W transport closely reproduce both a 2D interpretive W density diagnostics based on the tomographic inversions of SXR signals and the interpretive simulations of a 1D impurity transport code (JETTO/SANCO. Ion Cyclotron Resonance Heating in the plasma center flattens the electron density profile and peaks the ion temperature profile and represents a means to reverse the neoclassical convection. Evidence of such flow reversal has been obtained by injecting Mo and analyzing the transient behavior of the impurity, which allows the deconvolution of convective and diffusive transport terms. This confirms analogous results of impurity out-flushing by central ICRH found in other experiments and in JET plasmas with carbon wall.

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