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Tungsten Transport in the Core of JET H-mode Plasmas, Experiments and Modelling[1]

CLEMENTE ANGIONI[2], JET, Culham Science Centre, Abingdon, OX14 3DB, UK

The physics of heavy impurity transport in tokamak plasmas plays an essential role towards the achievement of practical fusion energy. Reliable predictions of the behavior of these impurities require the development of realistic theoretical models and a complete understanding of present experiments, against which models can be validated. Recent experimental campaigns at JET with the ITER-like wall, with a W divertor, provide an extremely interesting and relevant opportunity to perform this combined experimental and theoretical research. Theoretical models of both neoclassical and turbulent transport must consistently include the impact of any poloidal asymmetry of the W density to enable quantitative predictions of the 2D W density distribution over the poloidal cross section. The agreement between theoretical predictions and experimentally reconstructed 2D W densities allows the identification of the main mechanisms which govern W transport in the core of JET H-mode plasmas. Neoclassical transport is largely enhanced by centrifugal effects and the neoclassical convection dominates, leading to central accumulation in the presence of central peaking of the density profiles and insufficiently peaked ion temperature profiles. The strength of the neoclassical temperature screening is affected by poloidal asymmetries. Only around mid-radius, turbulent diffusion offsets neoclassical transport. Consistently with observations in other devices, ion cyclotron resonance heating in the plasma center can flatten the electron density profile and peak the ion temperature profile and provide a means to reverse the neoclassical convection. MHD activity may hamper or speed up the accumulation process depending on mode number and plasma conditions. Finally, the relationship of JET results to a parallel modelling activity of the W behavior in the core of ASDEX Upgrade plasmas is presented.

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[2]Max-Planck-Institut fuer Plasmaphysik, D-85748 Garching, Germany