EX/D1-2 · Exhaust, ELM and Halo Physics using the MAST Tokamak

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Abstract: Scalings for the SOL width on MAST extend the parameter range of conventional devices but confirm a negative dependence on power flow across the separatrix. In L-mode and at ELM peaks, >95% of power to the targets arrives to the outboard side. Peak heat flux densities rise by a factor 2~6 during ELMs and are accompanied by a shift in the strike-point location but by little change in the target heat flux width. Energy loss per ELM as a percentage of pedestal energy and pedestal collisionality appear uncorrelated, possibly because ELMs on MAST are dominated by convective transport. Modelling shows that parallel gradients in the magnitude of the magnetic field in MAST may drive strong upstream flows. Broadening of the target heat flux width by divertor biasing is being explored as a means of reducing target power loading in next-step devices and has facilitated halo current measurements using series resistors. Halo currents are always less than 30% of plasma current and the product of toroidal peaking factor and halo current fraction is ~50% of the ITER design limit. Varying the series resistance demonstrates that the VDE behaves more as a voltage source than a current source.

EX/D1-3 · Driving Mechanism of SOL Plasma Flow and Effects on the Divertor Performance in JT-60U

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Abstract: SOL plasma flow plays an important role in the plasma transport along the field lines, and influences control of the divertor plasma and impurity ions. Recently, mechanisms producing the SOL flow such as drifts produced by electric field and pressure gradient are pointed out. In JT-60U, three reciprocating Mach probes were installed at the high-field-side (HFS) baffle, low-field-side (LFS) midplane and just below the X-point. The measurements of the SOL flow and plasma profiles both at the HFS and LFS, for the first time, found out the SOL flow pattern and its driving mechanism. "Flow reversal" was found near the separatrix of the HFS and LFS. Radial profiles of the SOL flow were similar to those calculated numerically using the UEDGE code with the plasma drifts included. SOL particle fluxes towards the HFS and LFS divertors were, for the first time, evaluated. Important physics issues for the divertor design and operation, such as in-out asymmetries of the heat and particle fluxes, and control of impurity ions with intense gas puff and divertor pump (puff and pump), were investigated.

EX/D1-4 · Operation of ASDEX Upgrade with Tungsten Coated Walls

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Abstract: An alternative for low-Z materials in the main chamber of a future fusion device are high-Z materials, but the maximal tolerable concentration in the plasma core is restricted. A step by step approach to employ tungsten at the central column of ASDEX Upgrade was started in 1999. Meanwhile almost the whole central column is covered with tiles, which were coated by PVD with tungsten. Up to now 9000 s of plasma discharge covering all relevant scenarios were performed. Routine operation of ASDEX Upgrade was not affected by the tungsten. Typical concentrations below 10^{-5} were found. The tungsten concentration is mostly connected to the transport into the core plasma, not to the tungsten erosion. It can be demonstrated, that additional central heating can eliminate the tungsten accumulation. These experiments demonstrate the compatibility of fusion plasmas with W plasma facing components under reactor relevant conditions. The erosion pattern found by post mortem analysis indicates that the main effect is ion sputtering. The main erosion of tungsten seems to occur during plasma ramp-up and ramp-down.