DPP14-2014-001168

Abstract for an Invited Paper
for the DPP14 Meeting of
the American Physical Society

Impurity transport experiments in Alcator C-Mod to address high priority R and D for ITER*

MATTHEW REINKE, University of York

The decision to start ITER operation in the non-active phase (H/He plasmas) with a W divertor has brought increased attention to physics issues related to high Z impurity transport and control. Lack of impurity control would lead to the radiative collapse of plasmas by W accumulation and increased disruptivity, which is detrimental to ITER operation. Prediction of plasma contamination by high Z impurities in ITER and its control requires understanding of W production and transport in the SOL through the edge transport barrier (in H-mode) and into the core plasma in conditions as similar as possible to those in ITER. Experiments in Alcator C-Mod have been carried out to understand these physics processes and their control in electron heated (ICRH+LHCD) L-mode and H-mode plasmas without significant core particle or momentum sources as in ITER. Core transport of impurities injected by laser blow off in L-modes shows that, in the absence of sawteeth, W develops stationary peaked profiles (for 100s of ms vs. $\tau_E = 14$ ms) while lower Z impurities (e.g. Ar) do not. Sawteeth are observed to be very effective in flushing out W on timescales of the sawtooth period (=10 ms) in these L-mode plasmas. Injection of Ca shows that the impurity diffusivity in the core plasma decreases by a factor of 10 in H-mode with respect to L-mode and that an inwards pinch is necessary at the H-mode edge to match observed increases in impurity confinement time in H-mode, up a factor of 5-50 compared to L-mode. Initial results of impurity transport in He L-mode plasmas show similar results to D plasmas. The results of these and other ongoing C-Mod experiments (including impurity transport and impurity peaking control by heating sources (magnitude, fast particle population, radial location, etc.) in H-mode plasmas with ITER-like peaked density profiles and $T_e = T_i$) will be described and consequences for ITER impurity transport control will be drawn.
Supported by the US DOE under DoE Contract No. DE-FC02-99ER54512