Topic: EX-C

L-H Threshold Studies in NSTX

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Recent experiments in the the low aspect ratio National Spherical Torus Experiment (NSTX) have been run in support of the high priority ITER and ITPA issue of access to the H-mode. Specifically, a series of L-H threshold experiments have addressed the effect of plasma ion species, applied 3D fields, wall conditioning, plasma current and plasma shape/X-point position on the L-H power threshold and local parameters leading up to the transition. Experiments on the species effect revealed that the L-H threshold power for deuterium and helium were comparable, but that the conclusion depended on how the threshold power was defined. There was a ~35% reduction in the threshold power normalized by line-averaged density for discharges using lithium evaporation to coat the plasma facing components than for those that did not. Application of largely non-resonant n=3 fields at the plasma edge, potentially critical for suppression of ELMs in ITER, resulted in about a 65% increase in density-normalized threshold power. The plasma current in NSTX also has a controlling factor in the L-H transition, with normalized threshold powers almost a factor of two greater at 1 MA than at 0.7 kA. Experiments based on XGC0 predictions indicated that low triangularity discharges required the lowest auxiliary heating power to transition into the H-mode, although these results also depend on the definition of P_{LH}. To within the constraints of temporal and spatial resolutions, no systematic difference in T_e, n_e, p_e, T_i, v_ϕ or their derivatives was found in any of these experiments. Finally, it was found that RF-heated discharges could attain values of $H_{98y,2}$~1 in ELM-free conditions for powers just above the power threshold. NBI heated, ELM-free H-modes could also achieve $H_{98y,2}$~1, but only after ~50 ms after the L-H transition.

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