Plasma Edge Conditions During Pellet Induced H–mode Transitions in DIII–D*

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H–mode transitions have been produced as a direct result of pellet injection in DIII–D. Significant changes to the plasma edge conditions occur during these pellet induced H–mode transitions. Analysis of these changes can result in a greater understanding of the key quantities responsible for the formation of the edge transport barrier at the L-H transition. H–mode transitions were produced by injecting frozen deuterium pellets of diameter 2.7 mm from the inner wall into the high toroidal field side (HFS) of the plasma and also by pellets injected from the outer wall into the low field side (LFS) of the plasma. Both the HFS and LFS pellets produced significant increases in the edge electron density, which led to substantial reductions in the edge electron and ion temperatures. However, H–mode transitions were still produced with temperatures at or below the L–mode temperatures, implying that the attainment of a critical edge temperature is not necessary for H–mode transitions. The pellet induced H–mode plasmas exhibited clear pedestals in electron density and electron and ion temperatures at the plasma edge, the H–mode persisted for 500–900 ms depending on the duration of the applied neutral beam power. The values of the edge plasma quantities across the H–mode transition were expressed in the parametric terms described in several theories and models of the H–mode transition. On comparison, the experimentally determined parameters at the H–mode transition were well below those required by the theoretical models. The HFS pellet's penetration and deposition profiles were substantially deeper (up to $\rho \approx 0.2$) than that of the LFS pellet (up to $\rho \approx 0.8$). However, since both HFS and LFS pellets produced H–mode transitions, this implies that pellet penetration depth is not important; the important factor is the large increase in the electron density right at the plasma edge produced by both these types of pellets. Changes in the edge profiles of n_e, T_e, T_i, and E_r across the transition will be presented. Finally, the HFS and LFS pellets were both able to reduce the power required to access the H–mode. For example, HFS pellet injection reduced the H–mode power threshold by about 33%, from 7.3 MW to 4.9 MW in plasmas which had the ∇B ion drift away from the X–point.

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