Characteristics of ELM Activity and Fueling Efficiency with Pellet Injection from Different Locations on DIII–D*

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Pellet injection from several different locations has been used on the DIII–D tokamak to study core fueling and transport in H-mode and L-mode plasmas. These experiments have provided a variety of conditions in which to examine the fueling efficiency and edge localized mode (ELM) interaction with pellets injected into DIII-D plasmas. The fueling efficiency, defined as the total increase in number of plasma electrons divided by the number of pellet fuel atoms, is determined by measurements of density profiles before and just after pellet injection. We have found that there is a decrease in the pellet fueling efficiency with increased neutral beam injection power with low field side (LFS) injected pellets. The pellet penetration depth also decreases with increased neutral beam injection power so that, in general, fueling efficiency increases with penetration depth. The fueling efficiency is generally lower in ELMing H-mode discharges than in L-mode due to an expulsion of particles with a pellet triggered ELM. A comparison with fueling efficiency data from other tokamaks shows similar behavior.

New injection ports on the DIII-D inner wall enable high field side (HFS) pellet injection from both the midplane and 30 cm above the midplane. These ports, in addition to the previously existing top vertical port and outside midplane port, enable a comparison of the effect of pellets injected from the different locations on fueling efficiency and ELM activity. We find that the ELMs triggered from HFS injected pellets and vertical injected pellets are similar to the nominal background ELMs in ELMing H-mode plasmas. ELMs are triggered when the edge pressure gradient reaches the stability threshold, approximately 50 ms after pellet injection. In contrast, the LFS injected pellets trigger large magnitude long duration ELMs that lead to a significant reduction in fueling efficiency. The fueling efficiency of the HFS injected pellets is found to be significantly higher than with the LFS injected pellets and remains high even with significant heating power.

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