Topic C	Requested: ☐ Oral ☒ Poster	Panel suggestion: ☐ Oral ☐ Poster

Fueling Efficiency and ELM Interaction with Pellet Injection on DIII–D H–mode Plasmas*

L.R. Baylor,† T.C. Jernigan,† R. Maingi,† M. Ali Mahdavi

General Atomics, P.O. Box 85608, San Diego, CA 92186-5608

Pellet injection has been used on DIII–D to study density limits and particle transport in H–mode plasmas. These experiments have given us a variety of conditions in which to examine the fueling efficiency and edge localized mode (ELM) interaction of pellets injected into H–mode plasmas. The fueling efficiency defined as the total increase in number of plasma electrons divided by the pellet number of fuel atoms, is determined by Thomson scattering measurements of density profiles before and just after pellet injection. These measurements have been made as close as 20 μs after completion of the pellet ablation, but are more typically made 1 to 2 ms after injection of the pellet. We have found that there is a decrease in the pellet fueling efficiency with increased neutral beam injection power from 100% to less than 50%. The pellet penetration depth also decreases with increased neutral beam injection power so that, in general, fueling efficiency increases with penetration depth. Penetration beyond the ELMing region significantly enhances the fueling efficiency. A comparison with fueling efficiency results from other tokamaks shows similar behavior.

Injection of pellets into H–mode plasmas induces an ELM like event that has a similar duration and magnitude of divertor H_α light perturbation and similar power incident on the divertor to a normal non-pellet induced ELM. This suggests that pellet fueling of reactor plasmas may be no more detrimental to divertor operation than inherent ELM activity. The ELM-like event is found to expel a significant fraction of the pellet deposited mass. A short transition to L–mode following the pellet injection is believed to be responsible for this rapid expulsion of edge pedestal density. Triggering of ELMs with pellet injection may be a method to limit density buildup in otherwise ELM-free plasmas.

The recent addition of a vertical injection port at the top of the DIII–D machine has been made using curved guide tubes from the horizontal pellet injector location. Initial results from pellets that are injected 10 cm inside the magnetic axis through the vertical port show a deeper density perturbation depth than expected and as good or higher fueling efficiency from normal horizontally injected pellets into the same plasma discharges, despite a factor of 3 lower velocity. The measured H_α light perturbation on both the lower and upper divertor locations is smaller for the vertically injected pellets, possibly indicating a reduced expulsion of pellet mass.

---

*Work supported by U.S. Department of Energy under Contract Nos. DE-AC03-89ER51114 and DE-AC05-96OR22464.

†Oak Ridge National Laboratory.