Edge Plasma Effects in DIII–D Impurity Seeded Discharges*

G.L. Jackson,† J.A. Boedo,‡ C.J. Lasnier,Δ A.W. Leonard,† G.R. McKee,◊ M. Murakami,# MR. Wade,# J.G. Wakins,£ and W.P. West†

†General Atomics, P.O. Box 85608, San Diego, California 92186-5608
‡University of California, San Diego, La Jolla, California 92093-0417
ΔLawrence Livermore National Laboratory, Livermore, California 94551
◊University of Wisconsin, Madison, Wisconsin 53706-1687
#Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831
£Sandia National Laboratories, Albuquerque, New Mexico 87185

Impurity seeded discharges with confinement enhancements comparable to H-mode and reduced peak heat flux to plasma facing components have been observed in many devices, and these types of discharges may make an attractive fusion reactor scenario. In DIII-D, radiating mantle discharges with both an L-mode and ELMing H-mode edge have been obtained with a significant fraction of the input power, up to 80% in ELMing discharges, radiated inside the last closed flux surface, significantly reducing peak divertor heat fluxes.

After impurity injection into DIII-D ELMing H-mode discharges the ELM amplitude and frequency decrease. In addition, power and particle flows to the divertor, measured by Langmuir probes and an IRTV camera are also reduced. However, H-mode pedestal pressure is comparable to unseeded discharges, indicating that a good H-mode transport barrier is maintained.

DIII-D L-mode discharges have also been achieved with H-mode confinement factors, H_{97Y}, of appoximately unity, both in diverted and limited configurations. In this case the onset of neon impurity puffing has led to a reduction in carbon influx and deuterium recycling, consistent with an increase in particle confinement time.

We will present conditions under which DIII-D impurity seeded discharges have been obtained and the limitations in sustaining these discharges. MIST modeling of impurity line radiation and edge impurity profiles will also be discussed.

*Work Supported by U.S. Department of Energy under Contracts DE-AC03-99ER54463, W-7405-ENG-48, DE-AC05-00OR22725, DE-AC04-94AL85000, and Grants DE-FG03-95ER54294, and DE-FG03-96ER54373.