Detailed OEDGE Modeling of Core-Pedestal Fueling in DIII-D*

J.D. Elder[1], S. Lisgo[2], A.W. Leonard[3], P.C. Stangeby[1,3], J.A. Boedo[4], B.D. Bray[3], N.H. Brooks[3], M.E. Fenstermacher[5], D. Reiter[6], D.L. Rudakov[4], E.A. Unterberg[7], J.G. Watkins[8]

[1]*University of Toronto Institute for Aerospace Studies, Toronto, M3H 5T6, Canada.*
[2]*ITER, Route de Vinon-sur-Verdon 13115, St. Paul-lez-Durance, France.*
[3]*General Atomics, PO Box 85608, San Diego, California 92186-5608, USA.*
[4]*University of California-San Diego, 9500 Gilman Drive, La Jolla, California 92093, USA.*
[5]*Lawrence Livermore National Laboratory, PO Box 808, Livermore, California 94550, USA.*
[6]*Forschungszentrum Jülich, IEF-Plasmaphysik, Association FZJ-EURATOM, TEC, Jülich.*
[7]*Oak Ridge Natianal Laboratories, P.O. Box 2008, Oak Ridge, Tennessee 37831, USA.*
[8]*Sandia National Laboratories, PO Box 5800, Albuquerque, New Mexico 87185, USA.*

The OEDGE code, using measurements to constrain plasma reconstruction, finds divertor recycling accounts for the majority of pedestal and core fueling in attached inter-Edge Localized Mode (ELM) H-mode and attached L-mode plasmas in DIII-D. It is important to develop a detailed characterization of core ionization in order to assess its impact on pedestal parameters and resulting core plasma performance. Plasma conditions for attached L-mode and inter-ELM H-mode lower single null discharges on DIII-D have been determined by the process of empirical plasma reconstruction [1,2]. Empirical plasma reconstruction offers the advantage of more closely matching the measured SOL profiles and surface ion fluxes compared to plasma fluid modeling for assessing pedestal ionization sources. EIRENE is used to model the hydrogen recycling. Divertor sources are determined from target Langmuir probes while volume sources are calculated from the reconstructed plasma conditions. Wall sources are estimated based on window frame models and are partially constrained by spectroscopic and reciprocating probe measurements. Extended modeling grids have been developed to allow plasma wall interactions to be modeled over most main chamber surfaces.

In the cases examined, divertor recycling accounts for more than 50% of the core fueling though the exact proportion depends on the strength of wall sources. The fraction of the total divertor target flux ionized inside the separatrix is in the range of 5% to 20% depending on plasma conditions and geometry. The fraction of total wall fluxes ionized inside the separatrix ranges from 30% to 50%. The probability of wall recycling deuterium ionizing in the confined plasma varies poloidally around the vessel wall and is typically larger when the wall-separatrix distance is small. Ionization in the confined plasma is concentrated below the midplane with peaks in the poloidal profiles just above the X-point due to the dominance of the divertor recycling sources for these attached discharges. Radial core ionization in high density H-mode peaks strongly near the separatrix. Extended grids are used to model the contributions to core fueling from main chamber recycling and an assessment is made of the likely importance of main chamber sources to core fueling.

[1] J.D. Elder, *et al*., J. Nucl. Mater. **337-339** (2005) 79
[2] S. Lisgo, *et al*., J. Nucl. Mater. **337-339** (2005) 256

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