Topic: EX-D

Achievement of Reduced Recycling and Improved Particle Control from Lithium Coatings Following Wall Conditioning Experiments in NSTX *

Kugel, H.W.

Princeton Plasma Physics Laboratory, Princeton, NJ 08543, USA

hkugel@pppl.gov

Abstract Text
Lithium pellets have been recently used to create lithium coatings that significantly lowered recycling in NBI-heated NSTX plasmas. Lithium coatings on edge PFC's are being investigated as a tool for recycling control in NSTX and ITER. TFTR obtained reduced recycling and significantly enhanced performance by starting with a thoroughly degassed limiter and applying lithium deposition techniques directly into low density plasmas. Recent NSTX Lithium Pellet Injection (LPI) experiments have reproduced this recycling effect and improved density control. Repeated LPI into ohmic helium discharges was used to deposit lithium on the Center Stack Limiter (CSL) immediately after pre-conditioning this surface with a series of helium discharges. A following deuterium reference CSL discharge with NBI, then exhibited a reduction in the volume-average density by a factor of about four and a peaked density profile. The density reverted to the pre-LPI level after two further reference plasmas as the lithium was passivated. In a subsequent experiment, diverted, Lower Single Null (LSN), helium discharges were then used to condition the Lower Divertor target in NSTX. This was followed by LPI into a sequence of helium discharges used to deposit Li on the Lower Divertor. Finally, an LSN, deuterium reference plasma with NBI was applied. The density exhibited a factor of about five reduction from a similar reference discharge at the beginning of the experiment, and the density profile was again peaked. Particle control in NSTX has, heretofore, involved primarily controlling impurity influxes and recycling. In the past year, several HeGDC and boronization techniques were compared, and used to develop procedures successful at controlling impurities and density rises during short-duration discharges. However, to control spontaneous density rises and profiles during long-duration H-modes, and to achieve efficient current-drive for non-inductive current sustainment, stronger control of edge recycling was found to be required. These lithium results demonstrated the required edge pumping of diverted plasmas. Furthermore they motivated preparations for installation of a lithium evaporator for performing routine thick lithium coating depositions over a significant fraction of the plasma facing surfaces in 2006.
*Work supported by US DOE Contract DE-AC02-76CH03073.