DPP07-2007-000619

Abstract for an Invited Paper
for the DPP07 Meeting of
the American Physical Society

Lithium Surface Coatings and Improved Plasma Performance in NSTX[1]

H.W. KUGEL, Princeton Plasma Physics Laboratory, Princeton University, Princeton, NJ 08543

NSTX research on lithium-coated plasma facing components is the latest step in a decade-long, multi-institutional research program to develop lithium as a plasma-facing system that can withstand the high heat and neutron fluxes in a DT reactor. The NSTX research is also aimed towards sustaining the current non- inductively in H-mode plasmas which requires control of both wall recycling and impurity influxes. Employing several techniques to coat the plasma facing components (PFCs) with lithium, NSTX experiments have shown, for the first time, significant benefits in high-power divertor plasmas. Lithium pellet injection (LPI) uses the plasma itself to distribute lithium on the divertor or limiter surfaces. The multi-barrel LPI on NSTX can introduce either lithium pellets with masses 1 - 5 mg or powder during a discharge. This significantly lowered recycling and reduced the density in a subsequent NBI-heated, divertor plasma. Lithium coatings have also been applied with a LIThium EvaporatoR (LITER) that was installed on an upper vacuum vessel port to direct a collimated stream of lithium vapor toward the graphite tiles of the lower center stack and divertor. The lithium was evaporated either before tokamak discharges, or continuously between and during them. By evaporating lithium into the helium glow discharge that typically precedes each tokamak discharge, a coating of the entire PFC area was achieved. Lithium depositions from a few mg to 1 g have been applied between discharges. Among the effects observed in subsequent neutral-beam heated plasmas were decreases in oxygen impurities, plasma density, and the inductive flux consumption, and increases in electron temperature, ion temperature, energy confinement and DD neutron rate. In addition, a reduction in the ELM frequency, including their complete suppression, was achieved in H-mode plasmas. Additional observations, such as, the duration of the lithium coatings, increases in core metal impurity radiation, and diagnostic window depositions will also be discussed.

[1]Work supported by US DOE Contract DE-AC02-76CH03073.