

Measurements of Accumulated Metallic Impurities During LiTER Operation in NSTX*

S. F. Paul, H. W. Kugel, C. H. Skinner, J. A. Robinson

Princeton Plasma Physics Laboratory
Princeton, NJ 08543-0451

Lithium was injected into the NSTX vacuum vessel to coat plasma facing components as part of a long term program to explore the potential for lithium to improve plasma and PFC performance. During the 2007 experimental campaign, lithium was evaporated using a stainless steel oven (LiTER) and allowed to condense on the plasma facing components. Time-resolved radiated power profiles of the total plasma radiation in the mid-plane were measured using a 16-channel tangential bolometer. The plasma emission was also recorded by vacuum ultra-violet and air wavelength spectrometers. Results showed that confinement was improved on an appreciable number of shots during the runs with lithium deposition. Generally, ELM's were either reduced or eliminated for hundreds of milliseconds, and the density profiles showed less of a pedestal compared to discharges prior to lithium deposition. With lithium evaporation, the radiated power profiles were often, but not universally, highly peaked as well. This was an indication of metallic impurity accumulation in the center of the plasma, the narrowness of the radiated power profile is used as a metric for the degree of metals accumulation. In the more severe cases of accumulation, the volume-integrated radiated power would exceed 50% of the total input power and the estimated concentration of metals on axis (modeled using iron as the representative impurity) reached 0.2% of the electron density. Surprisingly, accumulation was not well-correlated with ELM-suppression. The time rate of contraction of the radiated power profile correlated with accumulation better than either the ELM amplitude or frequency. Shots with narrowed, more peaked radiation profiles contracted more slowly and over a greater period of time. Plasmas with moderate accumulation tended to peak very rapidly, followed by an impurity profile collapse shortly thereafter. A second lithium evaporation campaign has been installed to cover regions of the walls that were previously shadowed by the center stack in NSTX.

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