

§46. Titanium Tracer Impurity Behavior in the LHD Plasma with a Plasma Detachment

Tamura, N., Kalinina, D.V., Veshchev, E., Sudo, S., Matsubara, A., Sato, K., LHD Experimental Group

A plasma detachment in LHD plasma has been achieved in the 8th LHD experimental campaign, although it has been done with a different approach from the conventional one. When the plasma detachment occurs, a core plasma confinement is expected to be improved. In order to investigate impurity transport in the core LHD plasma during the plasma detachment, the tracer-encapsulated solid pellet (TESPEL) injection has been performed. The TESPEL can deposit its tracer particles inside the plasma (typically $\rho = 0.7 \sim 0.8$). Thus, the deposition of those is absolutely free from the influence of the plasma detachment. Figure 1 shows typical waveforms of a TESPEL injected discharge with the plasma detachment. The time during the plasma detachment is indicated by the colored area in the figure. In this case, the plasma detachment has been sustained for around 1.8 s from 0.9 s. As has been indicated by the vertical dashed line in the figure, the TESPEL is injected at $t \sim 0.8$ s just before the onset of the plasma detachment. Just after the TESPEL injection, the intensities of emission line for Ti XVI (N-like) and Ti XII (Na-like), measured by a vacuum ultra violet spectrometer (SOXMOS), are increased and decreased rapidly. At about the same time, the intensity of Ti XX (Li-like) is increased. This temporal behavior is attributed to the rapid ionization of the tracer impurity due to the high electron temperature of the LHD plasma. When the plasma detachment occurs, the electron temperature is decreased drastically (Figure 1(b) shows the temporal behavior of the electron temperature around the center ($R = 3.64 \sim 3.67$ m with $R_{ax} = 3.65$ m) of the LHD plasma.) In accordance with the decrease of the electron temperature, the intensity of Ti XX is decreased quickly and those of Ti XVI and Ti XII are increased appreciably. During the plasma detachment, the intensity of Ti XX remains the almost same level. The intensity of Ti XVI is decreased gradually, conversely, that of Ti XII is increased gradually. This experimental result suggests that, during the plasma detachment, Ti tracer impurity seems to be simply re-distributed according to its ionization balance and not to be pumped out from the core plasma. This might indicate that the particle confinement in the LHD plasma is improved during the plasma detachment. The differences of the impurity transport properties in the core plasma between with and without the

detachment are being investigated.

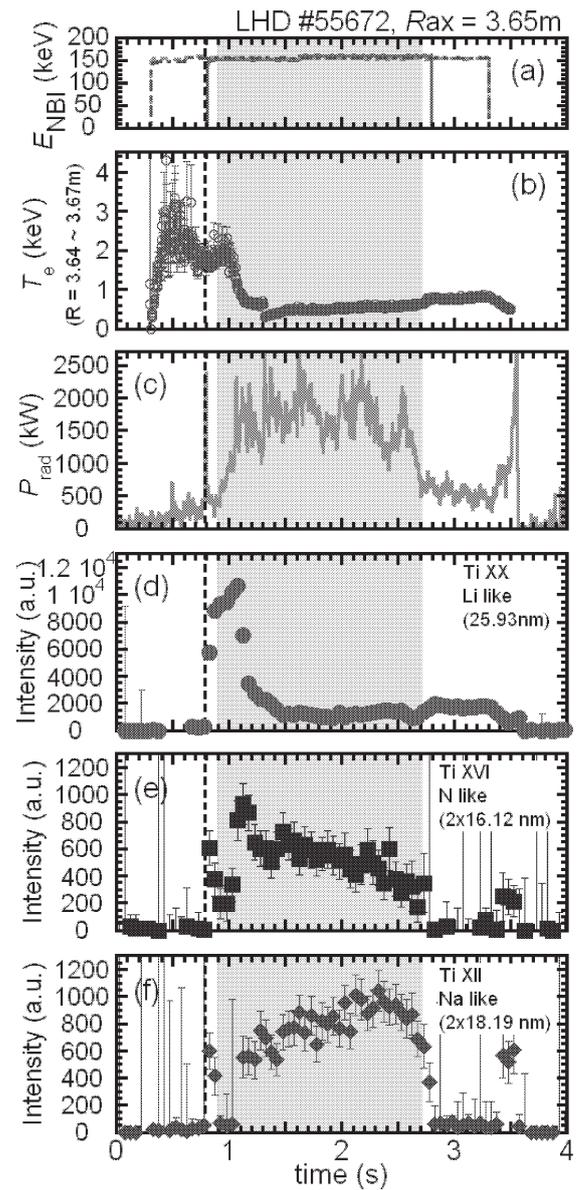


Fig. 1. Typical waveforms of TESPEL injected discharge with the plasma detachment. The TESPEL injection time is at $t \sim 0.8$ s as indicated by the vertical dashed line. The colored area indicates the time during the plasma detachment.