

§7. Study of Optimum Conditions and Atomic and Molecular Reactions on LHD Closed Divertor

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The closed Helical Divertor (HD) in LHD is planned to accomplish an active detached plasma and neutral control to improve plasma confinement and to sustain high performance long pulse operation. The critical issue for realizing long pulse operation is reduction of heat load on the divertor plates with efficient particle control in the divertor plasma. The neutral pressure in the closed HD has to be enhanced by more than one order of magnitude compared to that under the present open divertor condition. Also, the closed HD configuration can contribute to sustaining the super dense core plasma by active pumping of neutral particles in the plasma periphery.

In this study, we have been demonstrated the observation in the detached plasma by changing the geometry of the target plate, that is, oblique target and V-shaped target, on the linear plasma divertor simulator TPD-Sheet IV. Also, we measured ion flux to first-wall in LHD by using bias voltage applied electric probe in the V-shaped target.

The experiment was performed in the linear plasma device TPD-SheetIV. Electron density and electron temperature were measured using a planar Langmuir probe in front of the endplate.

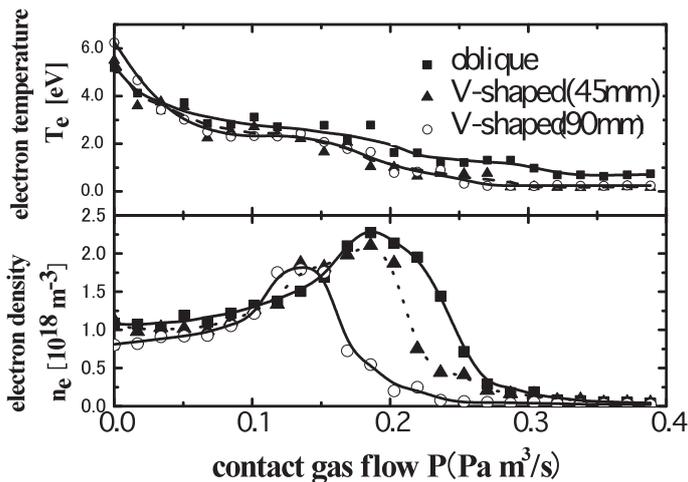


Fig. 1 Dependence of hydrogen contact gas pressure P on the electron density n_e at a discharge current of 50A. The geometry of the target plates are oblique target (■), V-shaped target(▲:45mm), and V-shaped target(○:90mm).

Figure 1 shows the dependence of hydrogen gas pressure P on the electron density n_e and the electron temperature T_e at discharge current of 50 A in TPD-SheetIV. The geometry of the target plates are oblique target (■) and V-shaped target (▲:45mm), and V-shaped target(○:90mm). With increasing in P , the value of T_e decreases gradually from 6 to 0.5 eV. On the other hand, n_e has the maximum value and the maximum gas flow decreases with increasing P . At V-shaped target, both n_e and T_e decrease at the lower pressure comparing with oblique target.

In LHD experiment, time evolutions of ion saturation current measured by five Langmuir probes in the V-shaped target on divertor plate. The V-shaped target is set up in the movable target device as shown in Fig.2. Fig.3 shows typical time evolutions of ion saturation current measured at V-shaped target in LHD. The ion saturation current was observed frequent large spikes during discharge.

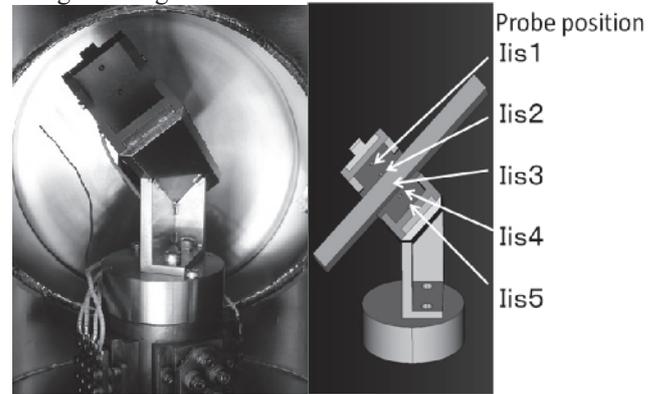


Fig.2 Photograph of V-shaped target on LHD experiment and the position of probe in V-shaped target.

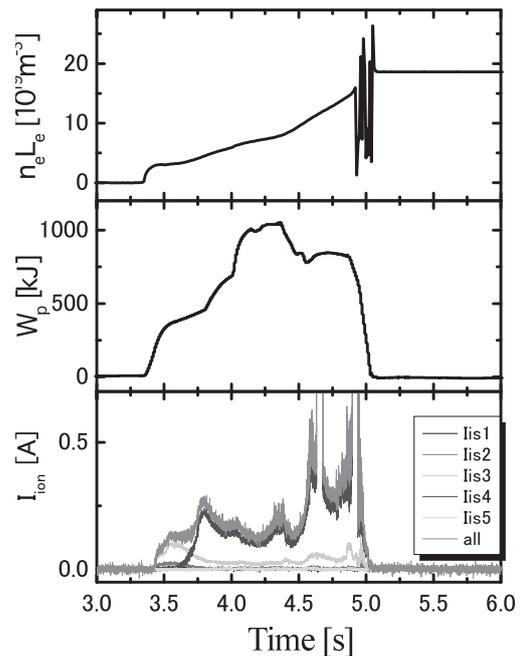


Fig. 3 Typical time evolutions of ion saturation current to V-shaped target on divertor plate in LHD(102099).