24P031-P

# Effect of V-shaped target on recombining plasma

# V 字ターゲットが再結合プラズマへ与える影響

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Eexperimental simulation of the divertor target configuration via detached plasma formation of hydrogen sheet plasma have presented in a linear divertor plasma simulator TPD-SheetIV. Two types of target geometry (V-shaped and oblique targets) have been investigated. At the V-shaped target, detached condition with high radiation loss is produced easily. The V-shaped target enhances the recycling and detachment plasma is attained there effectively. It can also be demonstrated preliminary by reducing heat flux at small amount of gas puff flux and argon fraction.
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## 1. Introduction

The divertor design for stable detached plasma formation should be optimized to handle such high heat and particle fluxes In the high performance plasma for high power and long pulse operation. In JT-60SA or ITER, the bottom part of the divertor chamber forms a distinct corner (V-shaped) with the target was proposed for high gas conductance between the divertor legs[1,2]. Recently, the closed Helical Divertor (HD) in LHD is planned to accomplish an active neutral particles control to improve plasma confinement and to sustain high performance long pulse discharges[3]. Therefore, the divertor target geometry to be compatible with the high performance plasma is one of key significant issues on detached plasma.

Although there are a number of papers on the numerical simulation of the target configuration, very little is known about the experimental simulation of the V-shaped target on detached plasma formation. The experimental simulation of both effects of the V-shaped target geometry and impurity transport seeding with a noble gas Ar on detached plasma formation of hydrogen sheet plasma in a linear divertor plasma simulator, TPD-SheetIV will be presented in this report. In order to investigate the effect of the target geometry, there are two possible candidates for the target configuration. The first one is a conventional oblique target due to reduction of the peak power load on the target. The second one is V-shaped target with opposite

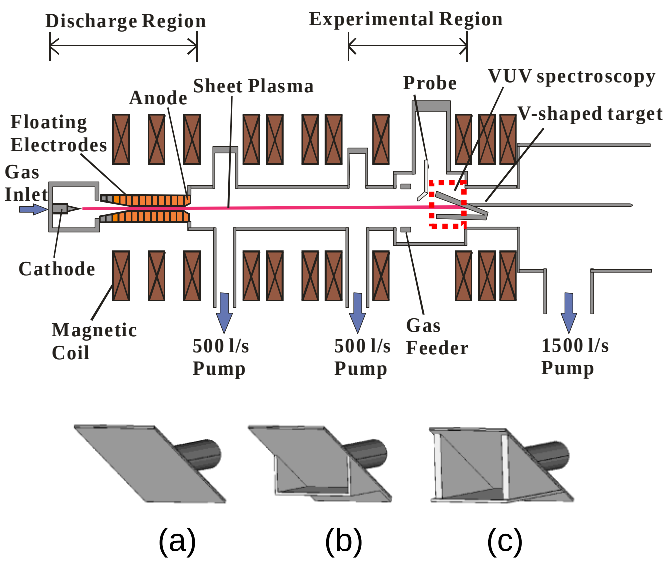


Fig.1 Schematic configuration of the linear plasma simulator TPD-SheetIV and target geometry (a)oblique, (b,c) V-shaped target.

plate for accumulation of neutrals particles near the target plate.

**2. Experimental apparatus**

A liner divertor simulator facility: TPD-SheetIV has been built in the previous work[4]. Figure 1 shows a schematic configuration of TPD-SheetIV and the target configuration: (a) oblique target without the opposite plate (θ = 30 degree), (b)V-shaped target with the opposite plate (L = 45 mm,), and (c) V-shaped target with the opposite plate (L = 90 mm) for accumulation of neutrals particles near the target plate. Ten rectangular magnetic coils formed a uniform magnetic field of 0.1 T in the experimental region. The hydrogen plasma was generated at a hydrogen/deuterium gas flow of 70 sccm with a discharge current of 30-100 A. The electron temperature and electron density are measured with the plane Langmuir probe located 3 cm in front of the target.

**3. Experimental Results**

Figure 2 shows the dependence of hydrogen gas pressure P on the electron density ne and the electron temperature Te 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. The Lyman Rydberg series lines of neutral hydrogen were measured at an axial distance, 3 cm in front of the target plate. The brightness of the high-n Lyman series lines, such as $L_\gamma$ and $L_\delta$, are directly related to the recombination rate of EIR. These high-n Lyman series lines intensities can be used as an indicator of EIR.

**4. Conclusions**

We present the experimental simulation of the divertor target configuration via detached plasma formation of hydrogen sheet plasma in a linear divertor plasma simulator TPD-SheetIV. Two types of target geometry (V-shaped and oblique targets) have been investigated. The V-shaped target enhances the recycling and detachment plasma is attained there effectively. It can also be demonstrated preliminary by reducing Q at small amount of gas puff flux and argon fraction.

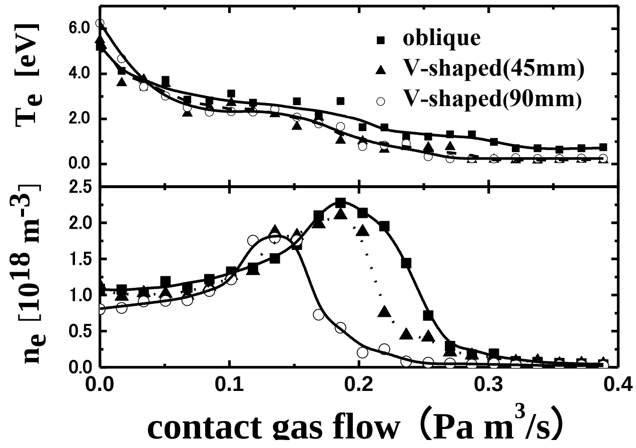


Fig. 1 Dependence of hydrogen contact gas pressure P on the electron density $n_e$ at a discharge current of 50A. The geometry of the target plates are oblique target (■), V-shaped target( ▲ :45mm), and V-shapedtarget(○:90mm).

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