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Generation of Detached Plasmas by using Simple Closed Divertor Module
簡易閉ダイバータモジュールを用いた非接触プラズマ生成

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To establish detached plasmas as methods to reduce particle and thermal loads, it is necessary to clarify the influence to core plasma confinement properties and stability of detached plasmas. Now a closed divertor module on the axisymmetrized tandem mirror GAMMA10 is planed to introduce to promote systematical research of detached plasmas. In this study, we develop the simple closed divertor module as a prototype. We conduct its performance test in a liner divertor plasma simulator.

1. Introduction

Generation of detached plasmas by plasma-gas interaction is thought to be effective methods to reduce particle and thermal loads on divertor plates in magnetic confinement fusion reactors. Mechanism of generation of detached plasmas has been investigated in terms of atomic molecule processes by using the liner divertor plasma simulator. However, to establish detached plasmas to reduce particle loads and thermal loads, it is necessary to clarify the influence to core plasma confinement properties and stability of detached plasma.

Now a closed divertor module on the axisymmetrized tandem mirror GAMMA10 is planed to be installed to promote systematical research of detached plasmas. In the mirror end of the GAMMA10, a cryopump is equipped. Therefor, if we puff the large amount of gas in the end, neutral particles are evacuated. To suppress the evacuation to increase the neutral pressure, a closed divertor module is essential [1].

In this study, we developed the simple closed divertor module as a prototype. We investigate its performance test in the liner divertor plasma simulator NAGDIS-Ⅱ.

2. Experiments

Figure. 1 shows the design of the simple closed divertor module. This module consists of silica tube and target plate which is made of the boron nitride(BN) and the gas pipe. The inner diameter and length of the silica tube are 48 mm and 400 mm, respectively. The diameter of the plasma is 20 mm [2]. In the silica tube, ten electrostatic probes are mounted. At the BN target, seven electrostatic probes are mounted. The gas pipe is equipped to measure neutrality gas pressure in the silica tube.

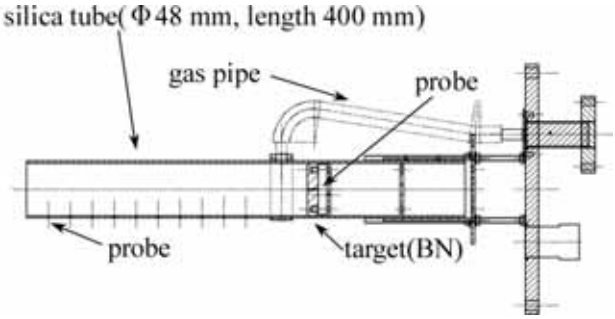

Fig.1 Design of the closed divertor module.

The recycling process increases the neutrality gas pressure in the tube. The increase in the neutral pressure may contribute to enhance the recombination process, which is essential for a detached plasma.

3. Results and discussion

Figure. 2 shows the neutrality gas pressure inside and outside of the tube on increasing the electron density outside the tube. The pressure inside the tube increases with increasing the electron density. The outside pressure decreases with increasing the electron density. The result indicates that the neutrality pressure increases by the recycling process. However, detached plasmas was not formed in this experiment. The plasma in front of

the target is shown in Fig. 3. It might be attributed to the fact that the neutral pressure in front of the target was not sufficiently increased by the module.

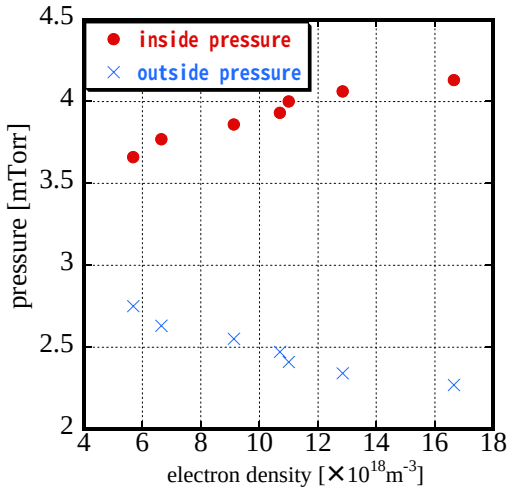

Fig.2 The neutral pressure inside(circle) and outside(cross) the tube.

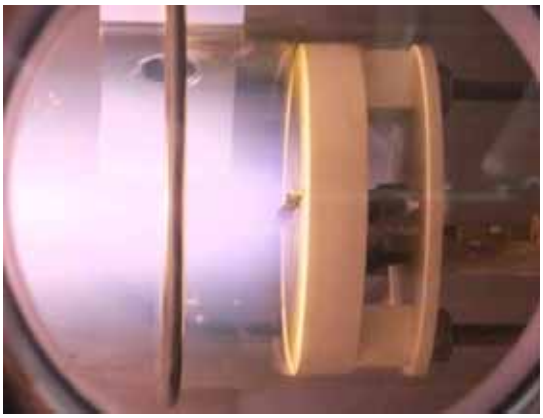

Fig.3 A picture of plasma in front of the target.

To generate detached plasmas, the neutrality pressure inside the tube needs to be increased more. It is planned to improved the module to increase the neutral pressure inside the tube more efficiently.

References

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