§20. Study of 3D Structure of Detached Recombining Plasmas

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Plasma detachment is one of the most effective methods for reduction of particle and heat loads onto divertor plates in magnetically confined fusion devices. One-dimensional structure of detached recombining plasma along magnetic field has been investigated in linear diverter plasma simulators (LDPS). On the other hand, it has been found that cross-field blobby plasma transport is enhanced in the detached plasmas. Therefore, for understanding of detached plasma formation, three dimensional structure of detached plasma should be investigated[1].

Figure 1 shows a schematic of the experimental setup in the linear divertor simulator NAGDIS-II device[2]. Magnetic connection length can be varied with a movable target plate. We have conducted Langmuir probe measurement at different positions. One is located around 18 cm from anode (UP), and the other is about 100 cm from anode (MID). At UP, the electron temperature, the electron density, and the ion saturation current were measured. At MID, the ion saturation current and the emission intensities from He neutrals were measured. Effective magnetic connection length (z [cm]), which is defined as a distance from anode to target plate, can be varied from 110 to 200 cm. Working gas is He.

Figure 2 shows photos of detached recombining plasmas depending on a magnetic connection length z. Plasma condition strongly depends on z. As decreasing z, plasma changes from detached to attached condition. On the other hand, at UP, the electron temperature, the electron density and the ion saturation current were constant with respect to variation of magnetic connection length z.

Figure 3 shows the He I emission intensity of 7^3D $\rightarrow$ 2^3P) observed at MID. When magnetic connection length was long (z>130cm), the emission intensity increased, and became broader in the radial direction, even though plasma parameters at UP were constant.

The experimental results indicate that variation of magnetic connection length has a strong influence on plasma detachment, which is associated with broadening of plasma column.

1) T. Yashiro, N. Ohno, S. Kajita, H. Kamaya, A. Tamakoshi, T. Onda, ISPlasma2014/ICPLANTS2014 March 2-6, 2014 Nagoya, Japan, 03pP09

2) N. Ohno *et.al.*, Nucl. Fusion **41** (2001) 1055.

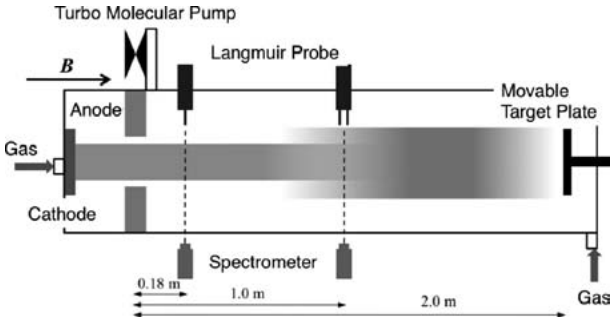

Fig. 1: Schematic of experimental setup in NAGDIS-II.

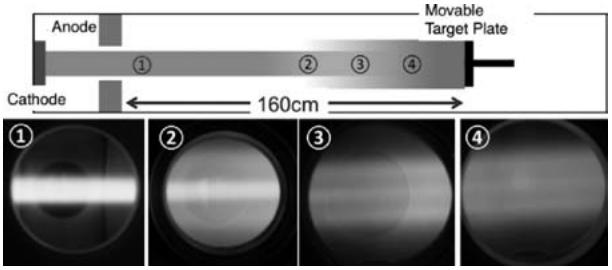

Fig. 2: Photos of detached recombining plasma with a variation of magnetic connection length.

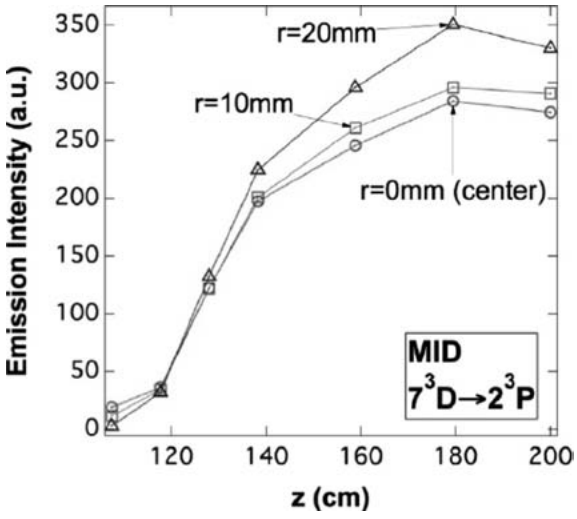

Fig. 3: Dependence of He I emission intensity of 7^3D $\rightarrow$ 2^3P) on magnetic connection length z as a parameter of radial position r.