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Spatial distribution measurement of Hα line intensity of divertor simulation plasma in GAMMA 10/PDX

GAMMA 10/PDXにおけるダイバータ模擬プラズマのHα線強度空間分布測定

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In GAMMA 10/PDX, the divertor simulation experimental module (D-module) has been installed in the west-end region to study divertor detachment and plasma-wall interaction. The spatial distribution of the Hα line intensity in front of the V-shaped target has been measured with a high speed camera with an interference filter (656nm ± 10nm). The Hα line intensity at the upstream side becomes higher with increase in the amount of H_2 gas supply. The Hα line intensity distribution becomes steeper with increase in the H_2 gas supply.

1. Introduction

Understanding of divertor plasma phenomena is one of the most important issues for the stable plasma sustainment. A divertor plate is exposed to high heat and particle fluxes [1]. To reduce the heat load on the divertor plate, divertor detachment is effective [2]. Divertor recycling plays an important role on power handling such as the divertor detachment as well as particle handling [3]. In GAMMA 10/PDX, the divertor simulation experimental module (D-module) has been installed in the west-end region to study the divertor detachment and plasma-wall interaction [4,5]. In this study, we have measured spatial distribution of Hα intensity in front of a V-shaped target which is installed in the D-module to study behavior of the divertor simulation plasma.

2. Experimental setup

GAMMA 10/PDX is a tandem mirror plasma confinement device. The total length is 27 m and the vacuum vessel volume is 150 m^3. This device consists of a central cell, anchor cells, plug-barrier cells and end regions. The D-module is installed in the west-end region. Figure 1 is a schematic diagram of the D-module. The end loss plasma is exposed to the V-shaped target in the D-module. Tungsten plates with the thickness of 0.2 mm are attached on the V-shaped target. Langmuir probes are installed on the upper target and around the inlet of D-module. Gas inlet is set at the inlet of the D-module.

In this study, we have measured spatial distribution of the Hα line intensity in front of the V-shaped target with the high speed camera. An interference filter (656nm ± 10nm) is installed in front of the camera. In this experiment, additional hydrogen gas was supplied into the D-module. Plenum pressure for the hydrogen gas supply was up to 1000 mbar.

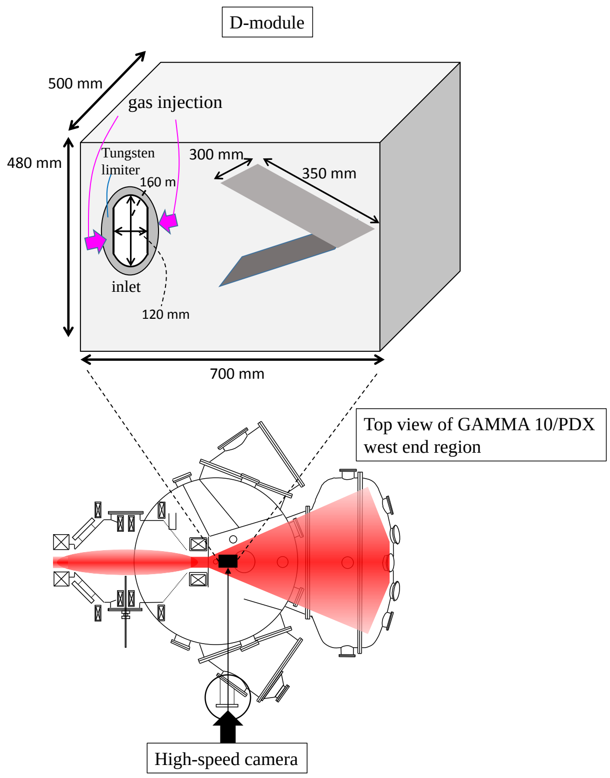

Fig. 1. Schematic view of the D-module and the west-end region.

3. Experimental results

End loss plasma was exposed to the V-shaped target. The central plasma was produced and heated by Ion Cyclotron Resonance Frequency (ICRF) power. Figures 2(a)-2(f) show spatial distributions of Hα line intensity measured with the high speed camera. It should be noted that the maximum value of the color bar of Fig. 2(a) is different from the others. The Hα line intensity increased about 100 times on average when plenum pressure is 1000 mbar. The spatial distribution of the Hα intensity changed with increase in the amount of gas supply. Normalized intensity at the upstream side becomes higher with increase in the plenum pressure as shown in Fig. 2(g)-2(k). The Hα line intensity distribution becomes steeper with increase in the plenum pressure.

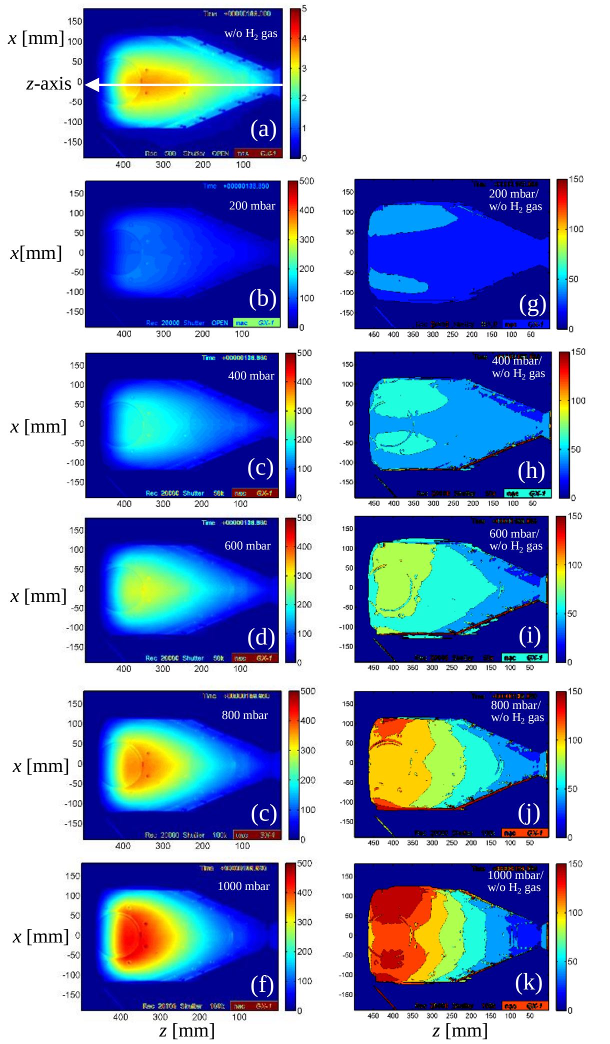

Fig. 2. (a-f)Hα line intensity distributions and (g-k) distributions normalized by that of (a). Noted that maximum value of the color bar is different from (b-f).

Figure 3 shows the Hα line intensity distribution on the *z* axis and distribution normalized by the intensity at *z* = 400 mm. The corner of the V-shaped target is defined as *z* =0. Change in the intensity such as a spike and dip around *z* = 125, 240, 350 mm are caused by reflection at the flange which is installed at the far side of the plasma. The Hα line intensity at the upstream side becomes higher as the plenum pressure becomes higher.

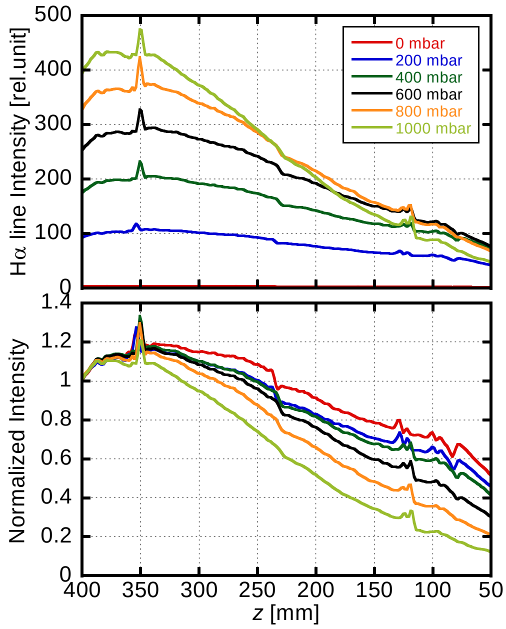

Fig. 3. (a)Intensity distribution on the *z*-axis and (b)distribution normalized by intensity at *z* = 400 mm as a function of the distance of the corner of the V-shaped target.

Acknowledgments

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