§ 9. Impurity Transport in High Density Plasma Produced by TPD-II (II)

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i) Introduction

A reduction of reversed gas flow toward main plasma in a gas divertor is required to achieve both a low thermal load on a divertor plate and high magnetic confinement in the main plasma. In the divertor system proposed by us, a high vacuum region is set between the divertor region and the monitoring region.1,2) In this paper, impurity transport of the divertor materials in the plasma is investigated using TPD-II (Test Plasma generated by Direct Current).

ii) Experimental apparatus

Experimental setup was shown in Fig.1. The helium plasma produced in a plasma source traveled through a monitoring chamber, contact with a metal divertor or gas divertor, and finally relaxed to neutral gasses.

The hollow type electrodes made of SUS304 was placed in front of the metal divertor for the impurity measurement experiment. The electrode equipped with a slit was size of 150mm in diameter, 50mm in width, 1mm in thickness.

Carbon sheets or carbon particles fit up to inner surface of the electrodes. Only one electrode was set up in the vacuum chamber in the operation. The used discharge gases were helium and hydrogen. Chemical species in the hollow discharge was measured by using emission spectroscopy for the plasma.

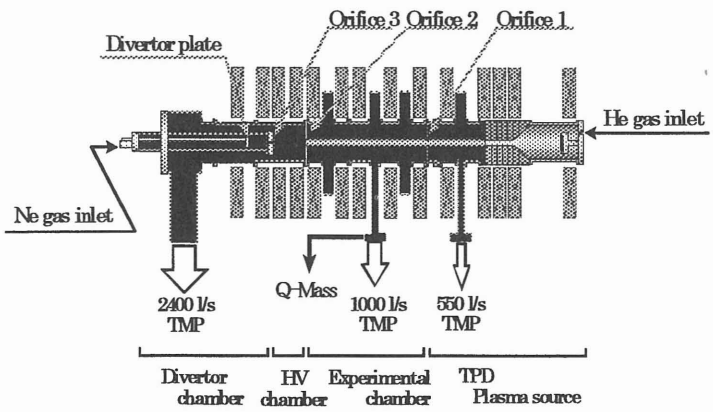

Fig. 1. Experimental apparatus of TPD-II (NIFS).

iii) Experimental results

Emission spectroscopy in hollow cathode discharge are shown in Figs. 2,3 respectively. Discharge voltage are from 600V to 1kV corresponding to discharge current of from 20mA to 60mA.

The intensity of helium spectral line (281.28nm) increases with the increase of discharge current for hollow cathode electrode made of SUS304.

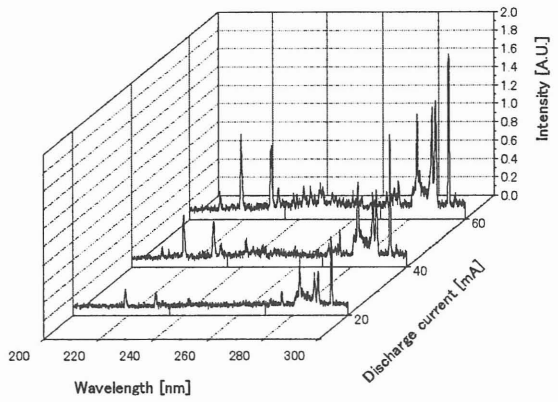

Fig. 2. Emission spectra as a function of the discharge current using a hollow cathode electrode made of SUS304.

For the electrode fit up of carbon sheets, the intensity of C emission spectral lines (283.67, 283.76nm) increase with the increase the discharge current. In both electrodes, high discharge current of 60mA fails to heat up the electrode for long time.

Electrode surface on which carbon particles deposited is cleaned up under the flow of hydrogen as working gas. The experimental fact that the intensity of carbon spectra decreases with the elapsed time supports the cleaning of deposited carbon mentioned above.

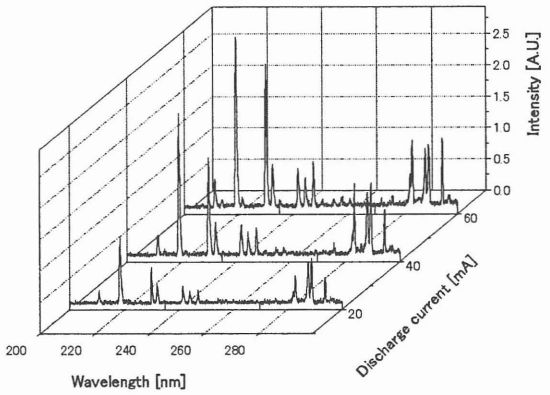

Fig. 3. Emission spectra as a function of the discharge current using a hollow cathode electrode with carbon sheets.

References

1) Matsubara, A., et. al, J. Nucl. Sci. Technol., 37 (2000) 555.

2) Matsubara, A., et. al, J. Plasma Fusion Res., 78, (2002) 196.

3) Ono, M., et. al. J. Society of Advanced Science ,13, (2001) 533.