§62. Fluctuations in Detached Recombining Plasmas

Uesugi, Y., Tanaka, N., Ohno, N. (Nagoya Univ.)

It is necessary to evaluate plasma parameters in detached plasmas, especially, electron temperature Te, which is a key to determine the recombination process. Electrical probes are often used to measure the electron temperature Te because of convenient method and a good spatial resolution, but it has been reported that the electrical probes give the much higher Te than that measured with the spectroscopic method [1]. The reason is mainly considered as the plasma resistivity and fluctuations in the detached recombining plasmas [2].In this paper, we report a detail investigation on the fluctuation in the detached recombining plasmas.

The experiment was performed in a linear divertor simulator, NAGDIS-II. The schematic of the experimental setup is shown in Fig. 1. Figure 2 shows the averaged floating potential and its fluctuating components as a function of the neutral pressure. The fluctuating components are monotonically increasing with the neutral pressure. In detached recombining plasmas the electron temperature is estimated to be about 0.2 eV by spectroscopic method. The fluctuation level is found to be very large in comparison with the electron temperature. Figure 3 shows frequency spectra as a parameter of the neutral pressure P. The frequency spectrum shows the strong peaks at frequencies less than 10 kHz and around 120 kHz. As increasing the neutral pressure, each peak intensity grows and the peak at higher frequency ~120 kHz shifts to a lower frequency. We also measured the fluctuation of ion saturation currents. The same tendency as frequency spectrum of the floating potential was obtained in that of ion saturation currents. Spatial measurements of the plasma parameters show that the fluctuation level of the ion saturation current exists uniformly in the radial direction.

In summary, we have investigated the fluctuation in the detached recombining plasmas in detail. The potential fluctuation is so large compared with the electron temperature that the I-V curve of the electrical single probe should be distorted by this potential fluctuation. Moreover the observed fluctuation has characteristic peaks in the spectrum.

We have not understood the mechanism of generation of the fluctuations yet. We need further investigation to do more detail measurements about spatial correlation of fluctuations.

References

[1] N. Ezumi et al., Contrib. Plasma Phys., 38S(1997)31.

[2] N. Ohno et al., to be appeared in Contrib. Plasma Phys.

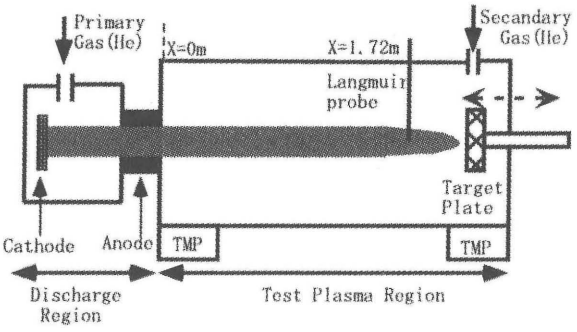

Fig.1. Schematic of experimental apparatus NAGDIS-II.

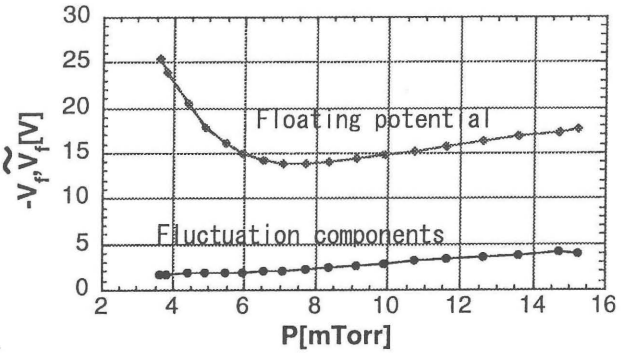

Fig.2. The averaged floating potential and its fluctuating components as a function of the neutral pressure.

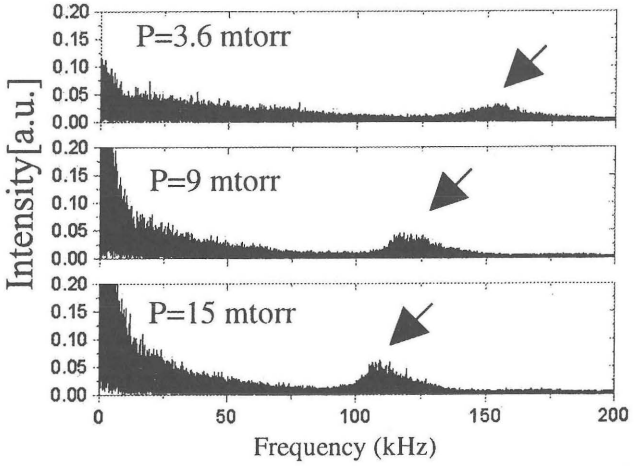

Fig.3 Frequency spectra of the electrostatic fluctuation as a parameter of the neutral pressure P