§8. Analysis of Neutral Particle Transport and Recycling Behavior in Open Magnetic Field Configuration Plasmas

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Investigation of edge plasma behavior and neutral particle transport is important subject for open magnetic field configuration plasmas as well as toroidal configuration plasmas. Particularly in tandem mirror plasmas, penetration of neutrals into the core plasma region plays an important role in formation of the neutral density profile, since the plasma density is lower than that of tokamaks. In order to investigate precise behavior of edge plasmas, a high-speed camera is applied to the GAMMA 10 central-cell. Recently gas puff imaging (GPI) experiments and light-emission measurements due to plasma-material interaction have been performed in the central-cell and the detailed investigation of edge plasma behavior has been started.

Figure 1 shows the cross-section view of the GAMMA 10 central-cell and the location of high-speed camera. The camera is located in front of the south viewport of the GAMMA 10 central cell midplane. This camera is capable of capturing 2-D images of 192x144 pixels in 40000 frames per second, which is suitable in the experimental condition of GAMMA 10. As shown in the lower photograph of Fig.1, the camera observes the central limiter located near the midplane. In this experiment light emission from the plasma is due to the plasma-limiter interactions.

Figure 2(a) shows the time evolution of visible emission from the plasma near the limiter at the central-cell. As shown in the figure, rotation of the light emission area on the limiter is observed in clockwise direction around the axis parallel to the line of magnetic force from the right to the left. This rotative direction corresponds with that of diamagnetic drift of electrons. This strong light emission is observed to be associated with the ECH pulse applied in the central-cell (c-ECH) and it confirmed that this event always coincides with an abrupt increase of the Hα line intensity and a decrease of the diamagnetism in the central-cell, which strongly indicates the enhancement of hydrogen recycling near the central-cell limiter during c-ECH. However this phenomenon decreases in its extent gradually with the progress of the experiment, which implies that the wall conditioning suppresses the enhancement of hydrogen recycling during c-ECH. On the other hand, Fig. 2(b) shows the behavior just before the plasma collapse, which reveals an opposite direction. This agrees with the rotative

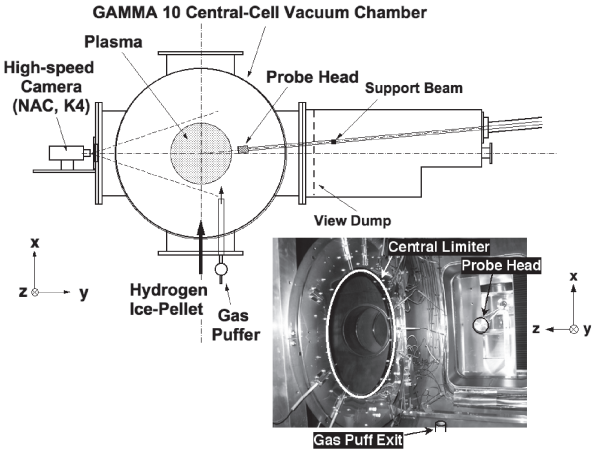

Fig. 1. Schematic view of the cross-section of GAMMA 10 central cell vacuum chamber and the photograph of the interior of the chamber.

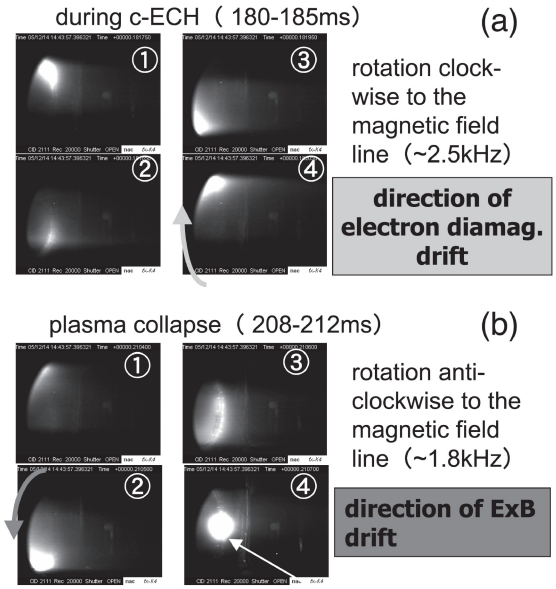

Fig. 2. Time evolution o 2-D image measured with a high-speed camera in C-ECH experiment. (a) during ECH injection, (b) at the plasma collapse.

direction of ExB drift and indicates the one of the MHD activities [7].

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