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大型タンデムミラーを用いた非接触プラズ生成とその特性評価の進展

Progress of detached plasma formation and its characteristics using a large tandem mirror device

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In future fusion devices, formation of detached plasma is a key issue in their operation. The aim of the E-divertor project is to study divertor simulation under the condition closely resembles to actual fusion devices and to solve important research subjects toward the stable control of the detached-plasma. Divertor simulation experiments were started in the GAMMA 10/PDX tandem mirror using a divertor simulation experimental module (D-module) at the exit of west end-cell.

In Fig. 1(a) the schematic view of the vacuum vessel and the shape of the plasma in the west end-mirror region of GAMMA 10/PDX is shown together with the location of the diagnostic equipment. At the exit of end-mirror coil, a movable calorimeter is installed to measure the heat flux and end-loss plasma flow. Recently we achieved the highest heat flux of 15 MW/m^2 by applying short pulse of ECH in the plug/barrier cells. In divertor simulation experiments, D-module is moved up on axis close to the end-mirror exit. As shown in Fig. 1(b), D-module is equipped with gas injection system for investigating radiation cooling mechanism for the generation of plasma detachment in D-module. Arrays of Langmuir probes (Lp's) and calorimeters are installed on the each upper and lower tungsten plates, respectively. A pair of calorimeter and Lp is also located behind a small gap of the V-shaped corner for measuring the degree of plasma detachment.

In Fig. 2(a), the dependence of plenum pressure of injected noble gases on the heat and ion fluxes measured at the V-shaped corner is shown. According to the increase of gas throughput, both heat and ion fluxes are decreased. Figure 2(b) shows the 2-D image of Hα emission captured with a high-speed camera near the V-shaped target plates. Simultaneous injection of Hydrogen and Xeon gases caused a strong reduction of heat and ion fluxes and a dark region appeared near the corner of V-shaped target, which clearly shows the generation of the detached plasma.

More detailed results and further discussion will be presented in the meeting.

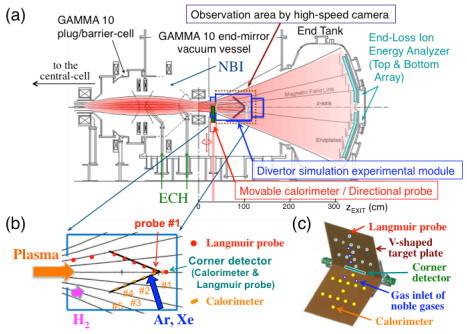

Fig.1 Schematic view of the experimental setup

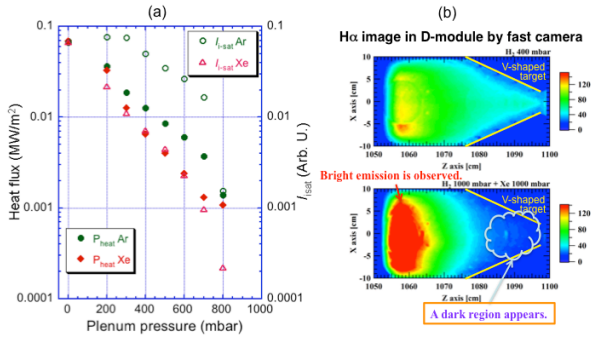

Fig.2 (a) Heat flux and ion flux vs. plenum pressure of radiator gases (Ar, Xe). (b) 2-D image of Hα emission in the V-shaped target. (Up: attached, Down: detached)

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