§9. LID Biasing Experiments

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In the LID experiments, the outward heat and particle fluxes crossing the island separatrix flow along the field lines to the back side of the island, where target plates are placed on a divertor head. The particles recycled there are pumped out by a cryogenic pump. Thus the high efficient pumping, which is the key function in the LID, can be achieved if a large number of particles is guided to the target plates. It was numerically shown that this occurs, especially, when the large number of toroidal circulation of the particles is realized before they strike the wall due to the large radial diffusion [1]. Biasing creates flow by $E \times B$ drift, which helps the particles to circulate the torus quickly without diffusing to the wall.

The experiment was performed when the divertor head was well inside an m/n = 1/1 island, generated by adding the perturbation field to the standard CHS configuration with R_{AX} = 99.5 cm and B_0 = 0.9 T. The bias voltage of about -150 V was applied to the divertor head for 0.08 sec $\leq$ t $\leq$ 0.1 sec. The neutral particle pressure p_d in the pumping duct was measured with a fast-ion gauge located directly behind the divertor head. Figure 1 shows that when the bias voltage is applied, p_d becomes a factor of 1.5 higher than in the case without biasing. Figure 2(a) shows the Hα intensity measured toroidally at the divertor head position. It is clear that the Hα intensity is a factor of 1.5 higher with biasing than without biasing, which is consistent with the fast-ion gauge result. The Hα intensity, measured toroidally at the opposite position of the divertor head, is depicted in Fig. 2(b). With biasing, the Hα intensity decreases, compared with that without biasing. These results suggest that a much larger number of particles is guided to the bias divertor head, due to the $E \times B$ drift, as expected.

The plasma parameters such as averaged electron density and stored energy are found not to change even if the bias voltage is applied. This reason is not clear, but is expected that since the plasma changes seriously with the LID itself, it does not change further by biasing. These results are, however, encouraging in terms of effectiveness of the bias divertor head for the control of outward heat and particle fluxes in the edge region.

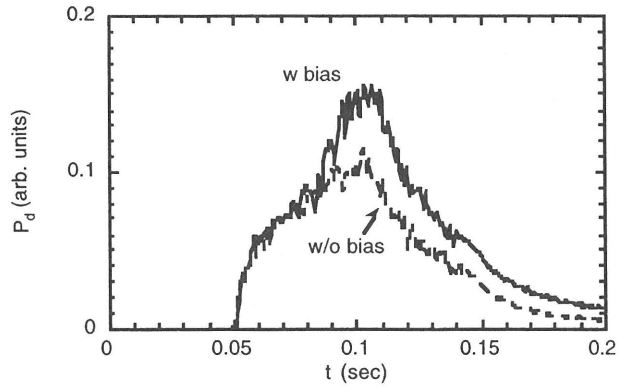

Fig. 1. Comparison of p_d's with and without biasing

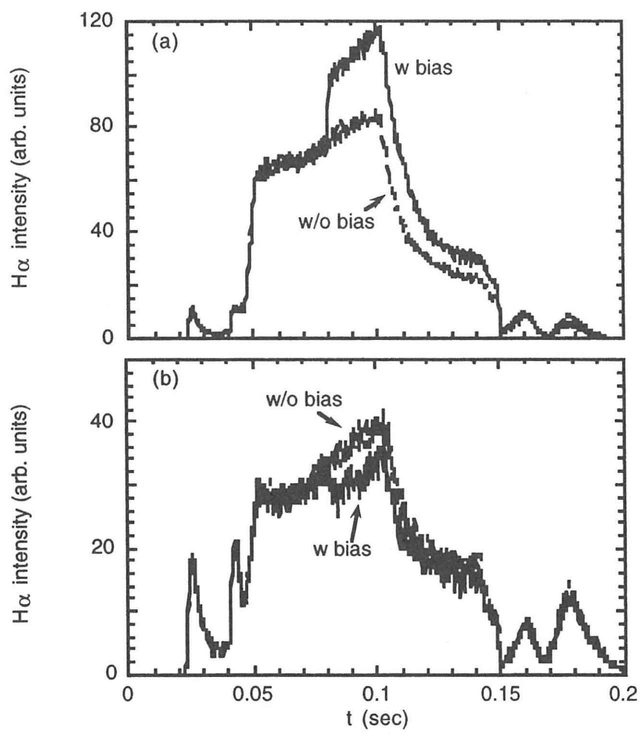

Fig. 1. Hα intensity with and without biasing, measured at different toroidal positions.

Reference

1) Komori, A., *et al.*, in *Plasma Physics and Controlled Nuclear Fusion Research 1994*, Seville (IAEA, Vienna, 1996), Vol. 2, p. 773.