§10. Effect of RF Limiter on Plasma Potential

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An RF current on a limiter surface along the magnetic field produces a strong evanescent RF field, E//, near the limiter unless the frequency is chosen to excite propagating waves. The RF electric field forms a ponderomotive potential barrier near the limiter surface. When this potential barrier which is larger for electrons is the order of the electron temperature near the limiter, the electron flux to the limiter is suppressed and resultant ambipolar potential is formed. This concept of controlling edge plasma by the RF on the limiter surface has been demonstrated in the linear device [1]. The effect of the ponderomotive potential on the tokamak edge plasma has been studied by measureing the plasma potential.

The movable graphite RF limiter of 12 cm long along the toroidal direction is installed from the top of the chamber and the DC potential of limiter head is grounded. The RF current flows mostly in the toroidal direction. The frequency (=8 MHz) is in the range, $\omega < \omega_{ci}$ and the maximum RF power is 1.5kW. The plasma potential inside the limiter radius is measured by a heavy ion beam probing, which is located 180 degrees away from the RF limiter in the toroidal direction. The beam coordinate for the potential measurement is shown in fig.1. The plasma potential measured at 5 cm inside the limiter decreases when the RF is turned on (fig. 2). The spacial profile of the plasma potential along the beam coordinate is shown in fig. 3. The potential drop due to the RF is small near the limiter and large inside the plasma, which is about -250V at 5 cm inside the limiter when the RF power is 1.5 kW . The decay length of the RF near field is estimated within a centimeter and the ambipolar potential is expected to be positive near the limiter. Therefore, the potential drop observed here can not be expressed simply by the ponderomotive force on electrons, and it is conjectured due to the change in the surface plasma transport by the extraction of the time averaged electron current on the limiter or another effects.

References
[1] T. Shoji et al., J. Nuclear Materials 176 & 177 (1990) 830

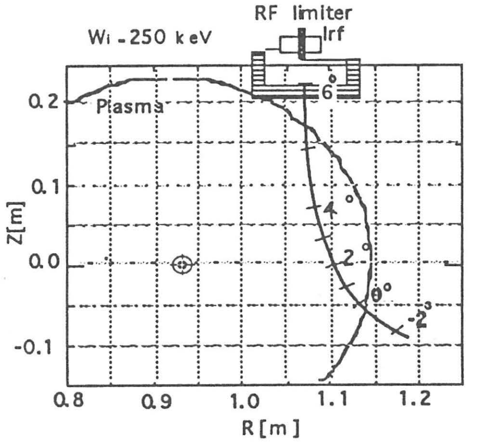

Fig.1 Coordinate of potential measurement for 250 keV Tl beam and the RF limiter position.

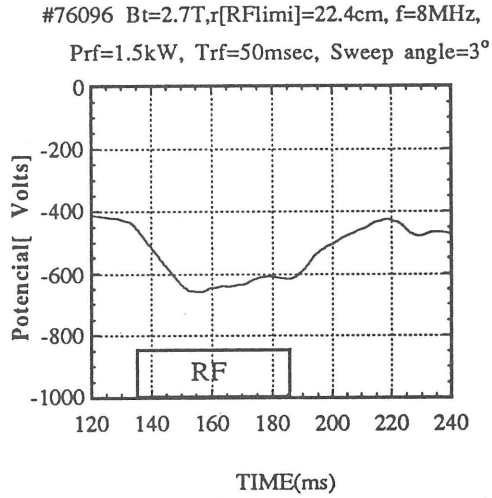

Fig. 2 Time variation of plasma potential at 2° . Prf=1.5 kW, f=8 MHz.

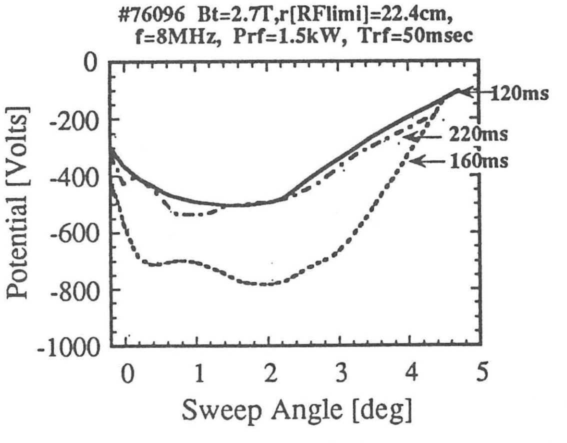

Fig. 3 Spacial profiles of plasma potential before, after the RF and during the RF.