§7. Measurement of Helically Trapped Particles

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We report behaviors of high energy ions with large pitch angle produced by ICRF heating. These helically trapped particles escape from the confinement region with their sloshing motions in the helical ripple mirror. We detected the flux of loss ions during ICRF heating pulse.

The particle detector[1] was located just outside of the last closed magnetic flux surface at G6 port. Ions with energy of 0.9±0.7keV and 4.8±1.8keV in parallel and perpendicular to the magnetic line were detected in the ICRF heating discharge operated at the magnetic axis, R_{ax}=92.1cm and the magnetic field strength, B_t=1.7T.

Figure 1 shows temporal evolutions of ion loss flux and plasma parameters in a typical unsuccessful ICRF heating discharge. The RF heating power was applied to decaying ECH plasma from 50 to 115msec. The stored plasma energy reached its peak, 700J at 60mse, however, the plasma collapse occurred before terminating RF heating pulse due to the increase of radiated power loss. The loss ion flux increased before the radiation loss increases. These results suggest that the high energy loss causes impurity release from the vacuum wall, thus accumulated impurities cause the increase in radiated power loss. In contrast to this discharge, when the loss ion flux remained in lower level, the stored energy was sustained during whole RF heating pulse and the radiated power loss was suppressed.

Figure 2 shows the dependencies of the time integrated loss ion flux over the RF heating pulse on the combined RF heating power of P+U antennas for high and low electron densities. The RF pulse length was 60msec. The charge amount for low density case (solid circle) was larger than that for high density case (open circle). The measurement of NPA indicates that the ion temperature of low density case was higher than that of high density case, while the electron temperature by Thomson scattering measurement shows the opposite tendency to the ion temperature[2]. The absorbed power fraction to ions seems to decrease as the plasma density increases in the mode conversion heating scheme.

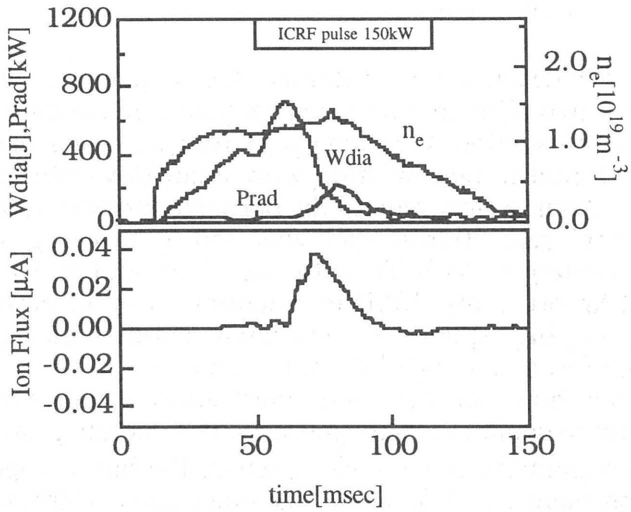

Fig. 1 Temporal evolution of stored energy, radiation loss, line averaged electron density and loss ion flux when rf power of U antenna is 150kW.

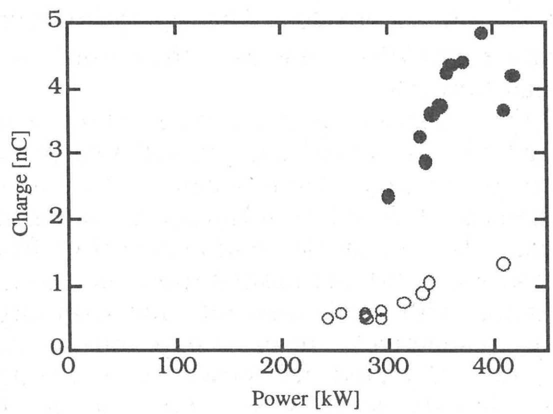

Fig. 2 Charge amount of detected loss ion flux during rf pulse as a function of rf power. Solid and open circles show the line averaged electron density of $2x10^{13}cm^{-3}$ and $4x10^{13}cm^{-3}$ respectively.

References

1) Masuda S., Mutoh T., Kumazawa R., et. at., Ann. Rep. NIFS (1993-1994) 193.

2) Kumazawa R., Nishimura K., et. al., in proc. of 21st EPS conference on controlled fusion and plasma physics. (1994) 18B II 1000