§3. High Ion Temperature Mode on ICRF Heating

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Successful ICRF heating discharges were obtained by reducing radiated power after boronization($B_{10}H_{14}$), where the stored plasma energy lasted to the end of the heating pulse. The plasma stored energy reached 2.2kJ with 590kW of combined RF power, referred to high stored energy mode[1]. This experiment is reported in the previous section.

We describe another ICRF heating discharge with high ion temperature in minority heating method. In low gas puffing operation(at 3-4torr l/sec, whereas 20torrl/sec in high stored energy mode) relatively low density plasma with the high ion temperature was obtained(referred to high ion temperature mode); the maximum plasma stored energy was 2kJ with RF power of 500-600kW as shown in Fig.1. In this experiment, the ion-ion hybrid resonance was located at the magnetic axis(same in the high density mode). The average electron density was n_e=2-3x10^{13}cm^{-3}, which was almost half that in the high stored energy mode. The stored energy gradually decreased with time due to increase in radiated power. At the end of RF heating pulse, the radiated power increased up to 400kW. The ion temperature, T_{iFNA} of 600eV was measured at 62ms by fast neutral particle analyzer(FNA) and was higher than electron temperature on the magnetic axis, T_{e0}=400eV. The ion temperature decreased with increase in the electron density. The temperature difference between ions and electrons was observed in lower average electron density than n_e=2.5x10^{13}cm^{-3}. These phenomena were also observed in the high stored energy mode, where the electron temperature exceeded the ion temperature in the high average electron density, n_e=3.8 x10^{13}cm^{-3}. Figure 2 shows radial profiles of the electron temperature and electron density measured at 60ms by Thomson scattering. The electron temperature had a peaked profile and the electron density had a hollow profile same as observed in the high stored energy mode. The electron temperature on axis was 400eV, which is lower than the ion temperature as described above. The radial profile of the electron density was hollow, but the hollowness is smaller than that in the high stored energy mode.

Reference

[1] R.Kumazawa et al., in Proc. of 21st European Physical Conference on Controlled and Plasma Physics, 18B II(1994)1000.

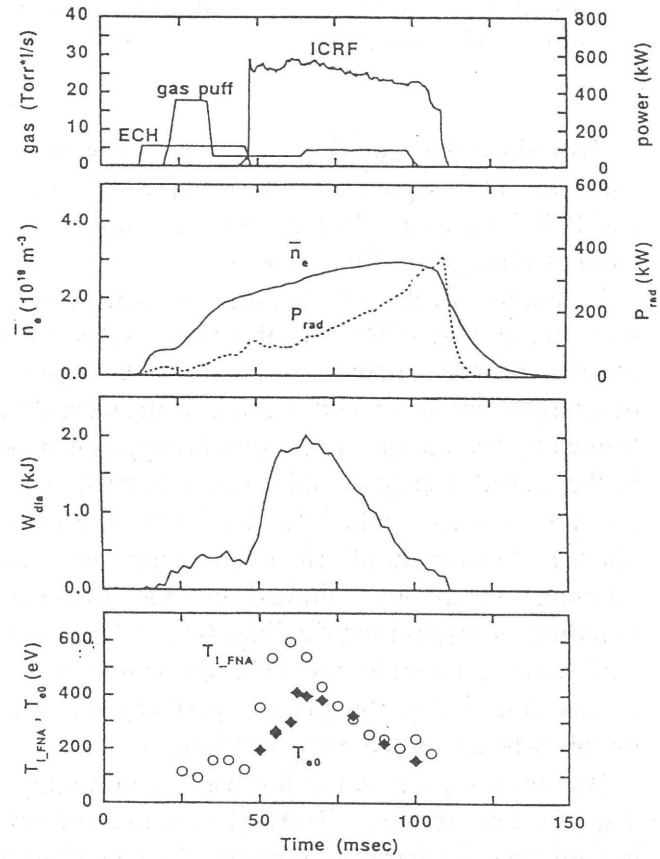

Fig.1 Time evolutions of gas puffing rate, injected ICRF heating power, electron density, radiated power, plasma stored energy, ion temperature and electron temperature.

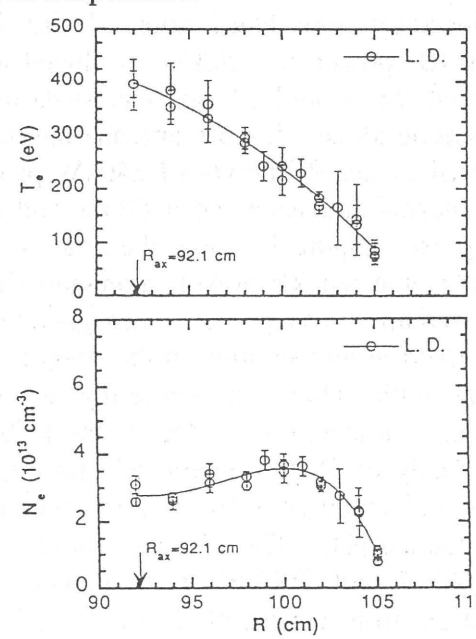

Fig.2 Radial profiles of electron temperature and density at 60 ms in high ion temperature mode.