§17. ICRF Heating in CHS

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New five antennas were designed and installed in CHS. Four antennas were installed in slant ports (P-ports) and the other one with a wide width (~24 cm) was installed in a vertically elongated position (U-port). Total radiated RF power is about 1.1 MW now. Suppression of impurities and wall recycling keeping a good loading efficiency are key issues for ICRF heating. To achieve these, Faraday Screen (FS) and the current conductor were carefully designed to keep a certain distance[1]. For wall conditioning, titanium gettering is being done. As the second step of the wall conditioning, boronization with decaborane is scheduled to cover surfaces of the antennas with boron.

Experimental gas is mixed gas of hydrogen as minority species in deuterium gas with various mixture ratios. Its ratio is monitored by the spectroscopy because it is greatly influenced by the wall conditioning. The magnetic field strength is changed to adjust the location of the resonance layer. The RF power is applied to the afterglow plasma of ECH or to the NBI heated plasma. In the case of ECH afterglow target, plasma of 2×10^{13} cm^{-3} / 700 J was sustained for 20 msec by the U-port antenna with 200 kW radiated power at around 1.7 T. Figure 1 shows the dependence of the plasma stored energy and the line averaged electron density on the magnetic field strength B_t for the U-port antenna. Two-component ion energy spectrum was obtained with the Neutral Particle energy Analyzer. Ion temperatures of the bulk and the tail component were about 190 eV and 770 eV, respectively. The electron temperature on the magnetic axis measured by the Thomson scattering was about 200 eV.

Figure 2 shows the time behavior of plasma parameters. Target plasma for NBI was produced by the Type-III antenna (ICRF1). The increase in the stored energy of 300 J was achieved by the combined heating with NBI (~0.6 MW) when the total radiated RF power P_{net} ~ 300 kW. The stored energy without the ICRH was about 1.25 kJ. Additional heating power (ICRF2) could not sustain high stored energy, because the radiation loss increased continuously after ICRF2 pulse turned on. Boronization is expected to reduce the radiation loss.

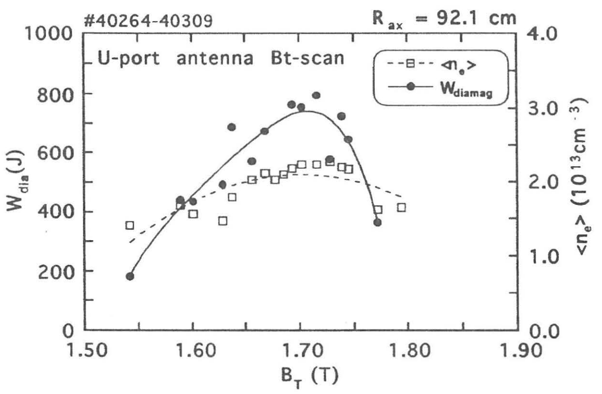

Fig. 1. Dependence of the plasma stored energy and the averaged electron density on the magnetic field strength B_t.

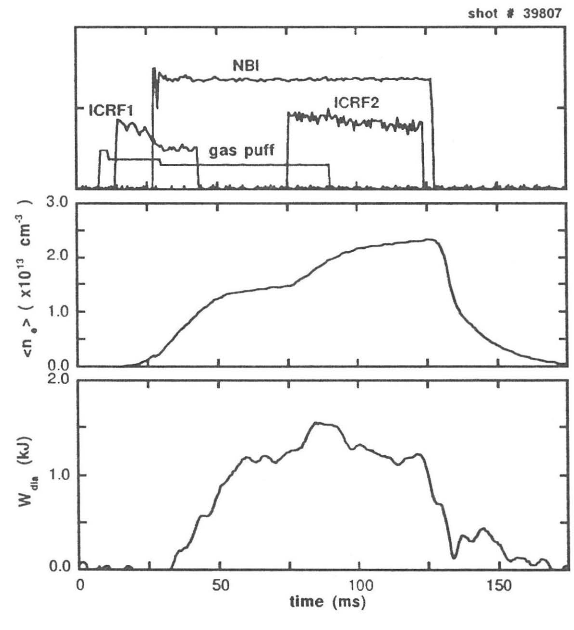

Fig. 2 Time behavior of plasma parameters.

Reference
1) Nishimura, K., et al., Annual Report of NIFS Apr.1992-Mar.1993 (1994) 166.