§26. Whistler Wave Plasma Production in CHS

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Introduction

Whistler wave discharges in MHz range of frequency studied in CHS[1-2] have the notable feature of producing plasmas in a low magnetic field strengths of kG range, which is important in the high beta and some Alfven wave related studies of helical systems. We report here the results of the plasma heating and production by the Whistler wave discharge combined with 2.45GHz microwave additional heating.

Effects of microwave heating on Whistler wave discharge

The maximum RF power of 500kW, pulse width of 10msec and the frequency of 9MHz is used for Whistler wave discharge experiment. The antenna for the wave exciter is Nagoya type III. The plasma density is measured by Langmuire probe near the antenna port and the microwave interferometer located 180 degrees away from the antenna in toroidal direction. In Fig. 1, the time evolution of density n_e (He plasma) measured at the radial position of 80% of the outmost magnetic flux surface (ρ=0.8) is shown for the microwave power of 32kW (200msec) and the rf power of 80 kW at the toroidal magnetic field strength Bt=0.875kG. The hollow shape radial density profile is observed for the initial microwave discharge, however the central density increases and the profile changes to the flat one which is measured till ρ=0.4 when the rf power is superimposed on the microwave plasma. This is due to the fact that there is no density limit for the Whistler wavepropagation and the wave can penetrate at the center of the plasma. The electron temperature for both rf and microwave plasmas is ~8eV. The density at ρ=0.8 versus B_t for microwave and rf+microwave plasmas are shown in Fig. 2. The plasma is produced initially by the rf then the microwave power is introduced in this case because the microwave can not ignite plasmas when Bt < 500 G. When Bt < 500 G, only central density is conjectured to is increased by the rf power, while Bt > 500 G the increase in the density by the superimposed rf power take places in the whole region of plasma.

Reference
1)Shoji, T., Nishimura, K, et al., Nagoya Univ. Ann.Report 6(1989)1
2)Nishimura, K., Shoji, T., et al., Fusion Tech. 17(1990)86

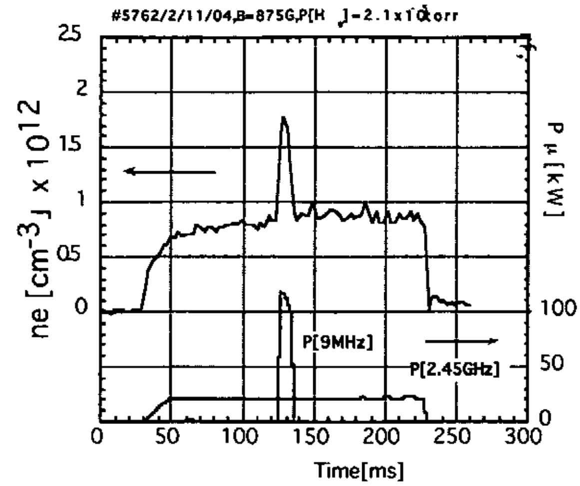

Fig. 1 Behabior of electron density for combined Whistler wave (9MHz) amd microwave(2.45GHz)discharges. Density is measured at ρ=0.8.

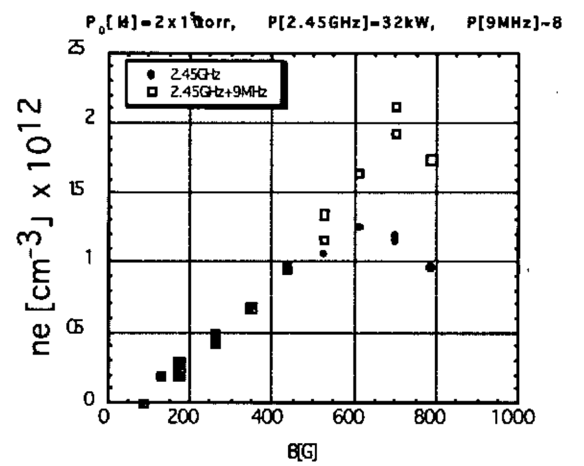

Fig. 2 Dependence of electron density at ρ=0.8 on toroidal magnetic field strength for both microwave and rf+microwave plasmas.