EC WAVE PLASMA BREAKDOWN ON GAMMA 10 DEVICE

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It has been demonstrated that an Electron Cyclotron (EC) wave utilized plasma breakdown on a medium-sized plasma device, GAMMA 10. The linear magnetic confinement device, GAMMA 10 tandem mirror studies fusion oriented plasma physics with its feature. The targeted main plasma is confined in its central cell with the help of the established potential barrier at both end regions.

In the experiments, its plasma BreakDown (BD) and building up the temperature and the density are carried out by two plasma guns and following 10.3/9.9/6.4 [MHz] Ion Cyclotron Range of Frequency (ICRF) heating systems. In these years, 28 [GHz] Electron Cyclotron Resonant Heating (ECRH) has been employed as an auxiliary heating scheme for raising up the electron temperature for relaxing the temperature difference of ions and electrons (Ti~ 3 [keV] >> Te ~ 50 [eV]) in the central cell. In addition, a steering ECRH antenna has been introduced for the experimental optimization.

On this study, we explored a new plasma breakdown scheme by the central cell ECRH injection as a non plasma gun employed sequence like as tokamak's breakdown assisted sequence, or stellarator's starting up sequence. For some stellarator devices, a plasma is produced by ECRH utilized BD, then successively ramped up and sustained as the designed plasma. On the GAMMA 10 device, we tried the ECRH plasma BD with a sole closest port gas feeding, then heated the plasma successively by the identical ECRH and relayed to the ICRF plasma building-up. We studied the parameter scans for gas feeding level, ECRH wave polarization and ECRH antenna position with 200 [kW] / 10 [ms] ECRH pulse injection. As a result of this preliminary experiment, we could achieve the same level parameters of electron density and diamagnetism etc., as the usual operational plasma. Figure 1 shows the plasma breakdown delay time and the H-alpha intensity at the time of BD depending on the gas feeding volume expressed as the gas reservoir pressure of gas puff #1b. At 160 [Torr] feeding condition, a plasma couldn't be relayed successfully to the following ICRF sequence. Except for the small gas feeding, a plasma could be ramped up and sustained to the end. It can be seen that the gas feeding increased, the delay time becomes short and H-alpha intensity becomes strong. Following the result, it is possible to optimize this BD sequence by detailed parameter study and that can be a reasonable operation sequence.

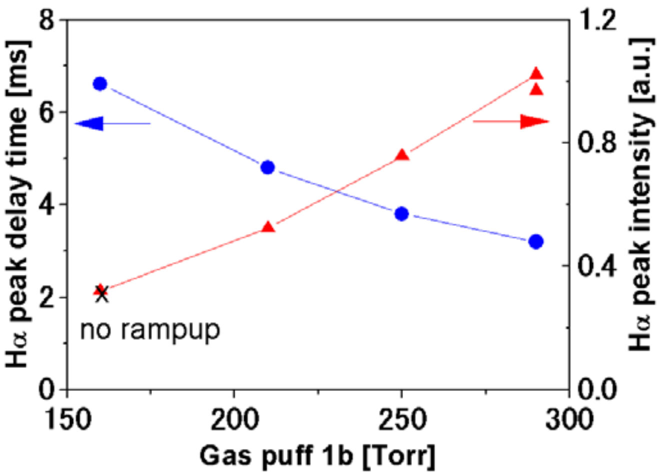

Figure 1: Breakdown delay time and H-alpha intensity

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