§4. Measurement of Plasma Transmitted EC-wave Power in CHS

Yoshimura, Y., Sueoka, N., Idei, H., Kubo, S., Ohkubo, K., Isobe, M., Minami, T., Nishimura, S., Osakabe, M., Tanaka, K., Takahashi, C., Okamura, S., Matsuoka, K., CHS Group

Results from transmitted power measurement as a function of magnetic field magnitude are analyzed by using numerical calculations. The data were obtained with horizontal injection of 53.2 GHz EC-wave power and plasma axis *Rax* of 0.92 m. The wave path is supposed to be a straight line and the direction is fixed so that the waves propagate through the plasma axis. Transmitted power components in vertical and toroidal directions corresponding to respective oscillating directions of electric field are measured simultaneously at an opposite port to the injection port.

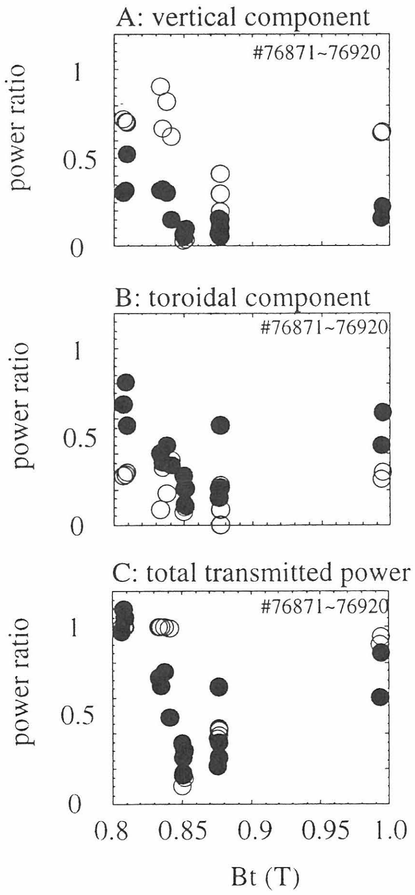
An IBW power is applied for plasma breakdown at various magnetic fields. NBI with 500 kW is superposed on the IBW and during the NBI, plasmas are sustained. The polarizer rotation angle is chosen so that the injected vertical power component becomes maximum. Then the injected wave is approximated to be linearly polarized, and its electric field to be oscillating in the vertical direction. Two ECH pulses are injected. There is no plasma when the first one is injected so that it represents the injected EC-wave power. The second one is injected into NBI-sustained plasmas. The transmitted powers of the two pulses are compared to investigate the absorption and modification of EC-waves in plasmas.

The experimental results are summarized in figures A, B and C. The abscissa is *Bt* in tesla. The value of *Bt* was set to be 0.80 T, 0.835 T, 0.85 T, 0.875 T and 1.0 T. The closed circles depict the transmitted vertical components (A), transmitted toroidal components (B) and the sum of these two components (C). These values are normalized by the respective total injected powers. Due to fluctuations on the raw data, averages during the pulse duration are plotted.

Each of the transmitted vertical component, toroidal component and the sum of them has its minimum around *Bt* = 0.85 T or *Bt* = 0.875 T. With *Bt* = 0.85 T, the *B*-distribution near the resonant magnetic field of 0.95 T for the 53.2 GHz wave has very small gradient so that the wave is under the resonant condition longer along its path. With *Bt* of 0.875 T, the resonant point coincides with the plasma axis. A peaked *Te* profile and higher *Te(0)* result in a better absorption. Here, transmitted toroidal components are detected for all *Bt* settings though the initial injection is done with vertical component of ~1 and toroidal component of ~0. This comes from rotation of polarization direction due to magnetic shear.

The results are compared with numerical calculations. The calculations are carried out for each plasma shot by using respective measured parameters such as *Bt*, *ne* and *Te*. The results are plotted on the figures with open circles. In general, the dependence of the measured values on *Bt* is explained by the calculation, especially for the total transmitted power. With *Bt* = 0.835T just below the critical value 0.85T, more careful treatment would be needed by taking the effects of beam width and refraction of beam path into account.

Concerning with the vertical and toroidal components, discrepancies between the calculation and the measurement can not be neglected. Explanation for the discrepancy is now under investigation.



Figures A, B and C Measured (closed circles) and calculated (open circles) power ratio against magnetic field Bt.