

§11. Analysis of the Ablation Cloud Velocity in the "Tail-Mode" of Pellet Injection in the JIPP T-IIU Tokamak

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Analysis of the ablation cloud velocity in the "Tail-mode" of pellet injection in the JIPP T-IIU tokamak [1] has been carried out.

In the case where the injection angle is anti-parallel to the electron diamagnetic direction in poloidal plane (i.e., in the case of so-called upward injection in this situation of the tokamak), the potential change is negative (~ -500 V) by the heavy ion beam probe (HIBP) measurement. Consequently the radial electric field after the injection should be negative, because it has been measured to be negative (~ -20 V/cm) in usual ohmic plasmas without pellet injection. Therefore, in this case the radial electric field is roughly estimated to be around $E_r \sim -20$ V/cm + $(-500$ V)/(23 cm) ~ -40 V/cm. Substituting these values into the equation in Ref.[1], the cloud velocities for toroidal and poloidal directions will be obtained, respectively, as

$$V_\phi \sim -1/(10^{19}) \cdot (40/0.2) \cdot (0.2 \times 10^{18} + 1 \times 0.25 \times 10^{19}) \sim -5.4 \text{ [km/sec]}$$

for toroidal direction, and

$$V_\theta \sim -1/(10^{19}) \cdot (40/3) \cdot (0.2 \times 10^{18} + 1 \times 0.25 \times 10^{19}) \sim -0.4 \text{ [km/sec]}$$

for poloidal direction.

Figure 1 shows the region of ablation cloud velocities for experimental results and the estimated values. A difference between the experimental and estimated values might come from the error in the estimation and from less validity of the assumption for the approximate equation.

On the other hand, in the case where the injection angle is parallel to the electron diamagnetic direction in poloidal plane (i.e., in the case of so-called downward injection), the

direction of the potential change is positive, and as a result the final potential after pellet injection is not clear in this case, because it depends on the potential depth of ohmic plasmas before injection. For example, if $E_r \sim -(10 - 20)$ V/cm before injection and the potential change by pellet injection is + (500 - 800) V, then the electric field will become $0 \sim +10$ V/cm. By using these values, it will turn out that the ablation cloud velocity becomes zero or positive value. Therefore, this may explain the complicated behavior of experimental results in this case; that is, the ablation cloud decelerates and stays at the same location, or sometimes even flows back to the reverse direction.

References

- 1) Sakakita, H., et al.: Ann. Rep. of NIFS (Apr. 1996 - Mar. 1997) preceding page.
- 3) Sakakita, H. et al., 22nd EPS Conf., I-125 (Bournemouth, 1995).
- 4) Sato, K.N. et al., 23rd EPS Conf., I-a070 (Kiev, 1996).
- 5) Hamada, Y. et al., Nuclear Fusion 36 (1996) 1047.

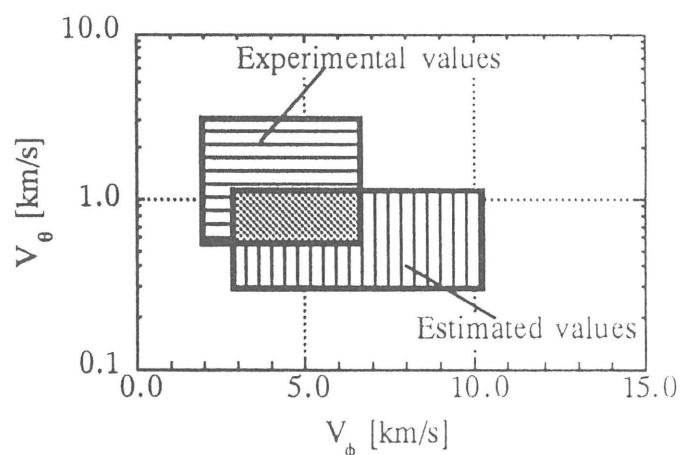


Fig. 1. Region of ablation cloud velocities for experimental results and the estimated values.