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GAMMA10/PDX でのダイバータ模擬実験における 静電プローブを用いたイオン温度の考察

Consideration of ion temperature estimation with a Langmuir probe in divertor simulation experiments on GAMMA10/PDX

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Langmuir probe measurement at V-shaped target of Divertor simulation experimental module (D-module) has been carried out in GAMMA10/PDX to study divertor physics and plasma-wall interaction. One of the features of GAMMA10/PDX is high ion temperature. In this study, we discuss evaluation of ion temperature by using the probe data.

Figure 1 shows the probe current as a function of the probe voltage (V-I characteristic). The ion saturation current (I_{is}), electron saturation current (I_{es}), floating potential (V_f), space potential (V_s) were 0.8 mA, 8.0 mA, −5.6 V, 77 V, respectively. The electron temperature (T_e) was ~40eV , which was evaluated from the slope of the logarithmic plot of the electron currents versus V_p. The electron density (n_e) was $\sim 3.2\times10^{16}\ m^{-3}$, which was evaluated from I_{es} and T_e taking into account the secondary electron emission effect [1].

The ion saturation current is written by

$$I_{is} = 0.6eSn_e\{k(T_e+\gamma T_i)/m_i\}^{1/2} \quad , \qquad (1)$$

where S is the effective probe surface area, m_i is mass of the ion, γ is an index depending on thermodynamic property of ions [2]. The ion temperature (T_i) can be evaluated by using the equation (1), where we assume γ~1.

The ion temperature was evaluated to be ~100 eV from the data of Fig.1.

In the presentation, we will compare T_i evaluated from the probe data with the result of T_i evaluated by the End Loss Ion Energy Analyzer (ELIEA) .

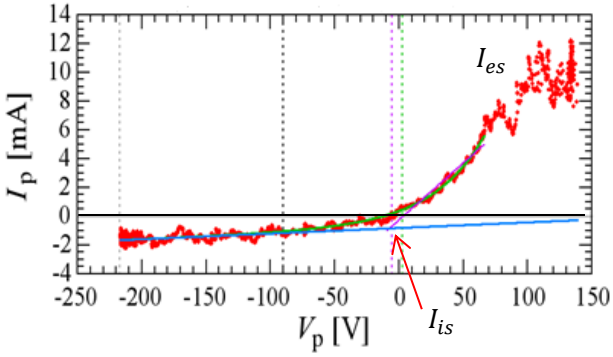

Fig.1. Probe current as a function of the probe voltage. I_{is} =0.8mA, I_{es}=8.0mA, V_f=−5.6V, V_s=77V

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