Introduction

The research on the dynamic behaviors of plasma against the pulse plasma flow with bursts of heat and particles is a topic in space plasma, and fusion related edge plasma physics. In particular, the time-dependence of recombination processes with pulse plasma flow has become important for characteristics of plasma detachment, in which the transitions from recombination to ionization plasma have been identified in divertor region of fusion device.

The transient behavior of the recombination plasma with pulse plasma flow has been studied by observing the short double minimum (negative) spike in De/Ha emission from the plasma. This response in De/Ha emission is explained by the electron temperature increase associated with pulse plasma flow with bursts of heat and particles along the magnetic field. However, it is required that experiments which will aid the understanding of the role of the high energy electron with pulse plasma flow are carried out.

In this study, we have carried out the experimental observation of the time evolution of electron density ne, electron temperature Te, electron velocity distribution function f_e(v), and hydrogen Balmer series spectra in hydrogen recombination plasma in a liner plasma device, TPD-Sheet IV.

Time-dependent of emission intensity with Plasma flow

It is reported by nuclear-fusion device “JET”, the recombination plasma with pulse plasma flow has been studied by observing the short double minimum (negative) spike in De/Ha emission from the plasma.

We used the Langmuir probe to measure the electron density and temperature. The electron density decreases from the flow, and the electron temperature increases. The emission intensity becomes weak because the number of excitation atoms decreases. After, the emission intensity increases by electron-impact excitation with the electron temperature increases.

Experimental Results of f_e(v)

Time-dependent of the electron temperature and the electron density is calculated by using f_e(v) because of non-Maxwellian.

Experimental and Modeling results of Hα intensity

Comparison with experimental and modeling results

Modeling: 

\[ \frac{dn_e}{dt} = k(p)[2n_e(\sum A(p,n)\eta(p)) = 0 \]

Emission intensity:

\[ I = \frac{h\nu}{A} \sum A(n_q k(p) n_e) \]

Conclusions

Experimental observations of the time evolution of electron density n_e, the electron temperature T_e, the electron velocity distribution function f_e(v), and hydrogen Balmer series spectra have been carried out on hydrogen recombination plasma with plasma flow. The emission intensity of Hα is calculated by using coronal model.

(1) The short double minimum (negative) spike in Hα emission from the plasma is observed in recombination plasma with pulse plasma flow.

(2) In the pulse plasma flow, the high energy electrons except for bulk plasma are appeared.

(3) The high energy electrons are dominant for the emission intensity of Hα in comparison with experimental and modeling results.