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Negative Ion Density Distribution in a Volume Negative Ion Source -Its Dependence on Plasma Parameters-[†]

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In a volume negative ion source, H^- ions are formed in hydrogen plasmas by dissociative attachment of slow plasma electrons to highly vibrationally excited hydrogen molecules, and these vibrational molecules are produced by energetic electron impact. Production of D^- ions is believed to be the same as that of H^- ions.

To develop efficient D^- ion sources, it is important to study production and control of D_2 plasmas, and to understand difference in the negative ion volume production between H_2 plasmas and D_2 plasmas [1].

For this purpose, we will discuss isotope effect of H^-/D^- production and to clarify the dependence of negative ion production on plasma parameters by measuring negative ion densities in the source.

The rectangle arc chamber of the ion source is 25 x 25 cm in cross section and 19 cm in height. Four tungsten filaments are installed from the side walls of the chamber. The line cusp magnetic field is consisted of permanent magnets which surround the chamber. The external magnetic filter (dipole magnetic field) is produced by a pair of permanent magnets, and the field separates extraction region from a high temperature bulk plasma produced by arc discharge between filament cathodes and the chamber anode.

Plasma parameters are measured by Langmuir probe. Extracted negative ion currents are measured by using Faraday cup. Negative ion densities across the external magnetic filter are measured by laser photodetachment method [2].

We have started to measure H^- ion densities in the source. Axial distributions of plasma parameters (T_e and n_e) were controlled by two different magnetic filters (about 150G and 70G on the axis). For the magnetic filter with 150G, T_e and n_e are decreased far from the magnetic filter in the source region because of the influence of stronger and wider magnetic field. On the other hand, decreasing points of T_e and n_e were shifted to the magnetic filter for the case of 70G. With measuring H^- density in the source, we have found that H^- ion density has the different spatial distributions corresponding to those two different plasma parameters. Details are now under study.

References:

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