



Contribution ID: 134

Type: **Poster presentation**

Production of Hydrogen Negative Ions in High Density Sheet Plasma.

Monday 16 October 2017 18:45 (15 minutes)

For development of a cesium-free negative ion source, we have carried out the experimental observation and modeling of negative ion, atomic and molecular ions in hydrogen sheet plasma. The sheet plasma is suitable to produce negative ions, because the electron temperature in the central region of the plasma is as high as 10-15 eV, whereas in the periphery of the plasma, a low temperature of a few eV is obtained [1], [2]. Therefore, it is considered that high density production of negative ions is possible in sheet plasma. On the experiment, hydrogen plasma sheet was produced by a linear plasma device TPD-Sheet IV. Measurements were carried out in hydrogen plasma with a hydrogen gas puff. The electron density and temperature were measured by Langmuir probe. The density profiles of hydrogen negative ion and other hydrogen positive ions were measured by omegatron mass spectrometer [3]. In addition, VUV spectroscopic measurement has been carried out to obtain the vibrational temperature of hydrogen molecules [4]. To decide vibrational temperature, we fit the spectra which are obtained by spectroscopic measurements and spectra which are obtained by corona model. In the experimental result, it has been found that negative ions are produced at periphery region (14 mm from center of plasma column) of plasma sheet. When the hydrogen gas pressure was 0.2-0.3 Pa, negative ion density became maximum ($n(\text{H}^-) \sim 10^{17} \text{ m}^{-3}$). To model the ion density in this experiment, a zero-dimensional model is developed for solving the system of rate balance equations for ion and gas species. In the calculate result, it has been found that negative ions are produced at periphery region of plasma sheet (12-16 mm from center of plasma column). When the hydrogen gas pressure was 0.2-0 Pa, negative ion density became maximum ($n(\text{H}^-) \sim 10^{16} \text{ m}^{-3}$). The experiments and the model calculates results indicate that production of negative ions in sheet plasma depends on the gas pressure and location from the plasma column

References

- [1] A. Tonegawa, et., al., "Observation of Molecular Assisted Recombination via Negative Ions Formation in a Divertor Plasma Simulator, TPD-Sheet IV, J. Nucl. Mater. 313-316 (2003) 1046.
- [2] A. Tonegawa, et., al., "Characteristics of Hydrogen Negative Ions in Sheet Plasma", Jpn.J.Appl.Phys. 45 (2006) 8212.
- [3] H. Yazawa, et., al., "Observation and Modeling of Molecular and Atomic Ions in Hydrogen Plasma", Jpn. J. Phys. 45 (2006) 8208.
- [4] A. Nakanowatari, et., al., "Characteristics of vibrational temperature of hydrogen molecules in detached plasma", Journal of Nuclear Materials 390-391 (2009) 311-314.

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Session Classification: Poster Session 1

Track Classification: Fundamental processes