

Volume Production of D⁻ Negative Ions in Low-Pressure D₂ Plasmas

- Negative Ion Densities versus Plasma Parameters -

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Volume production of D⁻ negative ions including isotope effects is studied in a rectangular arc chamber. Production and control of plasma parameters in D₂ plasmas are performed by varying the intensity of the magnetic filter. The values of T_e and n_e in D₂ plasmas are slightly higher than ones in H₂ plasmas. T_e in D₂ plasmas cannot be decreased and is kept above 1 eV in the extraction region with the same MF intensity for optimizing H₂ plasmas. The stronger MF field is required for control of T_e in D₂ plasmas. Therefore, plasma production between H₂ and D₂ plasmas is different from each other. Namely isotope effect of plasma production is observed. H⁻ and D⁻ densities have different spatial distributions corresponding to those different plasma parameters. Extracted H⁻ and D⁻ currents are mainly determined by H⁻ and D⁻ densities in front of the extraction hole, respectively. According to the discussions based on estimated rate coefficient and collision frequency of main collision processes, it is reconfirmed that T_e in the extraction region should be reduced below 1 eV with n_e keeping higher for enhancement of H⁻ and D⁻ production. For studying enhancement of D⁻ production, simultaneous measurements of VUV emission and negative ion density in the source is now under study.