

Numerical Analysis of the extraction of negative hydrogen ion in the extraction region of negative ion source

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Using negative hydrogen ion sources is a very promising way to obtain the high energy neutral beams required for heating plasmas in the future nuclear fusion reactors. The optimization of H⁻ extraction from the source is one of the most important issues for developing negative ion sources. The effect of the weak magnetic field [1] and plasma grid (PG bias) [2] has been studied based on the particle in cell modeling. Comparison with the Camembert III experiment [3] has been also done. These PIC simulation works already provided some understanding about the processes leading to the extraction of H⁻ ions from the source.

The purpose of the present study is to extend the 2D PIC modeling in ref. 2. The following effects are systematically studied with the extended version of the 2DPIC code;

1. The effect of grid shape.
2. The width of the extraction slit.
3. The configuration of transverse magnetic field and the field strength of transverse magnetic field.
4. The effect of EEDF (Electron Energy Distribution Function) in the source region.
5. The extraction grid voltage.

In addition, to take into account 3D effect on the H⁻ extraction, 3D PIC code development has been now started. The result will be presented in the conference.

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[2] S. Kuppel, D. Matsushita, A. Hatayama, and M. Bacal, AIP Conf. Proc., 1097, 55 (2009)

[3] M. Bacal, C. Michaut, L. I. Elizarov, and F. El Balghiti, Rev. Sci. Instrum **67**, 1138 (1996).