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Optimum Plasma Grid Bias for a Negative Hydrogen Ion Source Operation with Cs

Marthe Bacal^{1, a)}, Mamiko Sasao^{2, b)}, Motoi Wada^{3, c)}, Roy McAdams^{4, d)}

¹ *UPMC, LPP, Ecole Polytechnique, Palaiseau, UMR CNRS 7648, France*

² *R&D Promotion Organization, Doshisha University, Kamigyoku, Kyoto 602-8580, Japan*

³ *School of Science and Engineering, Doshisha University, Kyotonabe, Kyoto 610-0321, Japan*

⁴ *CCFE, Culham Science Center, Abingdon, Oxfordshire OX14 3DB, UK*

Corresponding author: marthe.bacal@lpp.polytechnique.fr

The functions of a biased plasma grid of a negative hydrogen (H⁻) ion source for both pure volume and Cs seeded operations are examined. Proper control of the plasma grid bias in pure volume sources yields: optimization of the extracted negative ion current: reduction of the co-extracted electron current: flattening of the spatial distribution of plasma potential across the filter magnetic field: change in recycling from hydrogen atomic/molecular ions to atomic/molecular neutrals and enhanced concentration of H⁻ ions near the plasma grid. These functions are maintained in the sources seeded with an alkali metal. However an additional function appears in the Cs seeded sources, namely direct emission of negative ions under positive ion and neutral hydrogen bombardment. The thickness of the Cs deposition on the plasma grid changes the local H⁻ ion density and electron density near the plasma grid, and thus the performance of the ion source. Factors affecting the source performance with and without Cs introduction are discussed.