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Effect of Plasma Grid Bias on Extracted Currents in the RF Driven Surface-Plasma Negative Ion Sources

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Extraction of negative ions from the large inductively driven surface-plasma negative ion source was studied. The dependencies of the extracted negative ion current and of the Plasma Grid (PG) current vs PG bias potential were recorded for two modifications of radio-frequency driver with and without Faraday screen and for the different level of PG cesium coverage conditioning. The maximal PG current was not depended on driver modification and cesium conditioning (at the fixed level of discharge power). The maximal negative ion current was ~2 higher for the activated cesium coverage of PG, and it was not depended on the driver modification as well. The acceptable minimal value of PG bias potential, at which the extracted negative ion current is maximal, was lower for the driver without Faraday screen and for the case of activated cesium. The obtained dependencies display that the extracted negative ion current depends on the potential difference between the near-PG plasma and the PG bias potentials, while the absolute value of plasma potential in the driver and in the PG area are less important for the negative ion production. The last conclusion confirms the main mechanism of negative ion production through the surface conversion of fast atoms.