Negative Ions Extraction and Acceleration

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Negative ions extraction and acceleration represents, today, an important issue in low temperature plasma, since the use of these ions might provide a very useful advantage for a large variety of technological applications, e.g. plasma etching, neutral beam injector for controlled thermonuclear fusion and electric propulsion applications (PEGASES) [1].

The presence of electrons, in addition to positive and negative ions, within the electronegative plasmas makes negative ions extraction and acceleration very difficult. In fact, the sustain of an electric field to extract and accelerate negative species can easily leads to a very large co-extracted undesirable electron current due to their high mobility, even when the electron density is marginal, e.g. 1/1000 of negative ion density. Moreover, this co-extract electron current limits the extracted negative ion by limiting the negative ion flux entering the sheath in front of the first extraction grid [2].

In this work we present a comparative study between two techniques developed to reduce significantly the co-extracted electron current and to improve the extracted negative ion current. The first one consists in the use of extremely high electronegative plasma, limit of ion-ion (electron free) plasma [2]. The second one consists of using a magnetic field such a manner to drastically reduce the electron conductivity in the extraction direction [3].