

Abstract Submitted
for the GEC17 Meeting of
The American Physical Society

Ion extraction process from a decaying plasma by introducing an external electron source HE-PING LI, JIAN CHEN, HENG GUO, DONG-JUN JIANG, MING-SHENG ZHOU, Tsinghua University, DEPARTMENT OF ENGINEERING PHYSICS TEAM — Ion extraction is a complex physical process with multi-particle and multi-field coupling, and is important in many fields, such as materials processing, etching and some pulsed processing with plasmas induced by an intense laser. Under such a typical pulsed processing, plasmas are usually decaying; and thus, it is indispensable to develop the novel methods to improve the extraction efficiency and shorten the extraction time. However, due to the shielding effects of the electrode sheath, the electric field cannot penetrate the whole plasma region, and only the ions in the sheath can be accelerated, which limits significantly the improvement on the ion extraction efficiency for a conventional parallel-plate ion extraction process. In this study, a novel method by introducing an external electron source is proposed to weaken the shielding effects. The modeling results show that the introduction of the external electrons can implement the loss of the plasma electrons and restrain the charge separation. Under such conditions, the conventional Child-Langmuir sheath will not form, and the ion extraction time will be shortened significantly resulting from the weakening of the shielding effects of the sheath.

He-Ping Li
Tsinghua University

Date submitted: 13 Jun 2017

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