Abstract Submitted
for the GEC12 Meeting of
The American Physical Society

Simulation of the Partially Ionized Reacting Plasma Flow in a Negative Hydrogen Ion Source[1] NIKOLAOS GATSONIS, SERGEY AVERKIN, WPI, LYNN OLSON, Busek Co. Inc. — A High Pressure Discharge Negative Ion Source (HPDNIS) operating on hydrogen is been under investigation. The Negative Ion Production (NIP) section of the HPDNIS attaches to the 10-100 Torr RF-discharge chamber with a micronozzle and ends with a grid that extracts the negative ion beam. The partially ionized and reacting plasma flow in the NIP section is simulated using an unstructured three-dimensional Direct Simulation Monte Carlo (U3DSMC) code. The NIP section contains a low-pressure plasma that includes H_2, vibrationally-rotationally excited H_2^*, negative hydrogen atoms H^-, and electrons. Primary reactions in the NIP section are dissociate attachment, $H_2^*+e \rightarrow H^0+H^-$and electron collisional detachment, $e+H^- \rightarrow H+2e$. The U3DSMC computational domain includes the entrance to the NIP nozzle and the extraction grid at the exit. The flow parameters at the entrance are based on conditions in the RF-discharge chamber and are implemented in U3DSMC using a Kinetic-Moment subsonic boundary conditions method. The rotational and vibrational degrees of freedom in U3DSMC are implemented using the Larsen-Borgnakke model. Chemical reactions are implemented in U3DSMC using the Quantum-Kinetic model. Simulations cover the regime of operation of the HPDNIS and examine the flow characteristics inside the NIP section.

[1]Supported by the Department of Energy.

Nikolaos Gatsonis
WPI

Date submitted: 14 Jun 2012 Electronic form version 1.4