Abstract Submitted
for the GEC18 Meeting of
The American Physical Society

On understanding of a magnetically enhanced hollow cathode arc plasma LIANG XU, Ruhr University Bochum, JENS PETER HEINSS, Fraunhofer Institute for Organic Electronic, Electron Beam and Plasma Technology (FEP), DENIS EREMIN, PETER AWAKOWICZ, RALF PETER BRINKMANN, Ruhr University Bochum, FRAUNHOFER INSTITUTE FOR ORGANIC ELECTRONIC, ELECTRON BEAM AND PLASMA TECHNOLOGY TEAM, RUHR UNIVERSITY BOCHUM TEAM — Hollow cathode arc discharges have been studied for decades, particularly in the field of physical vapor deposition, but the underlying physics of these discharges is still not fully understood. In this work, the hollow cathode arc discharge with a strong axial magnetic field was investigated analytically and by means of particle-in-cell/Monte Carlo method. The models relate input parameters such as cathode geometry, magnetic field, discharge voltage, and feed gas flow rate with cathode electron emission, ionization, and particles fluxes. The dynamics of energetic electrons, i. e., cathode-emitted thermionic electrons after acceleration in the cathode fall, is studied by considering Coulomb collisions with Maxwellian bulk electrons and inelastic collisions with neutrals. The axial magnetic field within the cathode not only allows a discharge operation at a very low gas flow rate, but also presents a cross-field discharge in which the electron mobility decreases and instabilities may occur. The voltage-current and voltage-gas flow characteristics obtained by the analytical model are in good agreement with available experimental data.

Liang Xu
Ruhr University Bochum

Date submitted: 19 Jun 2018 Electronic form version 1.4