

NASA SBIR/STTR Technologies

Predicting Hall Thruster Operational Lifetime Using a Kinetic Plasma Model and a Molecular Dynamics Simulation Method

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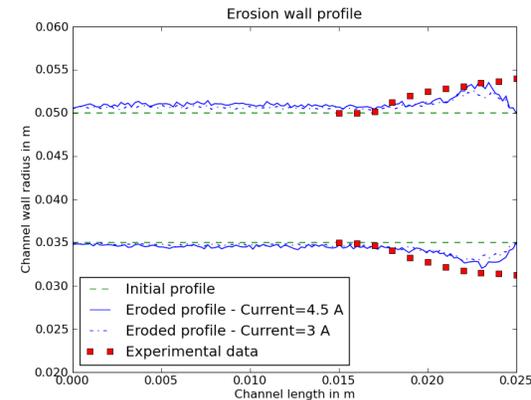
Identification and Significance of Innovation

Identification:

- Kinetic and molecular dynamic modeling allows for the accurate lifetime prediction of Hall thrusters.

Significance:

- Hall thruster industry needs an accurate lifetime prediction model.
- Model can provide the reliable lifetime prediction of Hall thrusters with a fast and in-expensive way.



SPT-100 channel wall erosion results using a kinetic and molecular dynamics methods. Life-time of the Hall thrusters such as HiVHAc can be accurately estimated via computational modeling.

Technical Objectives

1. Demonstrate the feasibility of the Hall thruster channel plasma simulation using an axisymmetric kinetic model.
2. Demonstrate the feasibility of the Hall thruster channel wall erosion simulation using an axisymmetric kinetic model and a molecular dynamics method.

Work Plan

- Task 1: Implement potential functions of Xe, and hBN into LAMMPS
Task 2: Calculate the sputter yields of hBN using LAMMPS.
Task 3: Implement axisymmetric electrostatic Poisson solver into VORPAL.
Task 4: Investigate the lifetime of the Hall thruster for various operational conditions.

NASA Applications

- NASA focuses on developing of Hall thrusters with increased specific impulse and lifetime.
- Lifetime prediction of Hall thrusters by NASA researchers is critical.

Non-NASA Applications

- Aerospace industry, with engineers and researchers developing Hall thrusters and Hall thruster models
- Material coating industry, with engineers for fabrication of hard coatings.
- Future fusion device development

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