

Wall interactions in Hall Effect Thruster, investigation with bidimensional Particle-in-cell model and simulation

Thursday, March 2, 2017 4:00 PM (1h 15m)

Hall effect thrusters (HET) are one of the main technology used and studies for spacecraft propulsion. Gridless, they present net advantages, resulting of an increasing need for predictive and accurate models, and a better understanding of the complex behavior of the plasma.

HETs consist of three main components : a magnetic circuit used to produce a mostly radial magnetic field; an external hollow cathode to sustain the plasma discharge and to neutralize the ion beam; an annular ceramic channel where the neutral gas is injected from the anode, and ionize before being accelerated.

One of the main characteristic of the thruster is its lifetime, limited by the ceramic channel eroded by the plasma. However long experiments are costly, and erosion diagnostics and measurements are difficult to perform.

A bidimensional r-theta particle-in-cell simulation is therefor developed to investigate the plasma interaction with the ceramic walls. The dielectric aspect is emphasized, concerning the model, its implementation, and results compared to dielectric walls. Secondary electron emissions are also implemented, to better understand the material effects on the plasma.

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Session Classification: poster (continued)