Abstract Submitted
for the GEC19 Meeting of
The American Physical Society

Predicting secondary electron emission rate in Hall Effect Thrusters[1] ANTOINE TAVANT, LPP, CNRS, Ecole Polytechnique and SAFRAN Aircraft Engines, ROMAIN LUCKEN, ANNE BOURDON, PASCAL CHABERT, LPP, CNRS, Ecole Polytechnique — In Hall Effect Thrusters (HET), the dielectric material used for the lateral walls is observed to have an impact on the discharge behavior and thruster performances. Recent particle in cell (PIC) simulations have shown that the electron cross-field transport in HET comes chiefly from both the azimuthal instability and the electron-wall collisions and not from the secondary electron emission (SEE) induced by electron impact on the lateral walls. On the other hand, an increase of the SEE yield can reduce the sheath potential drop at the wall, and hence increases the electron power losses. Using a two-dimensional PIC simulation of the radial-azimuthal plane at the exit plane of a HET, we have carried out a parametric study over the parameters of SEE at the wall. From the simulation results, we have derived a polytropic state law that allows us to close the fluid equations for the electrons with a non-Maxwellian energy distribution function. This model allows to link the electron temperature at the center of the discharge with the temperature at the wall and then to model more accurately the effects of the wall material in HET in low dimensional simulations, hence reducing the time and cost of HET development.

[1]The authors thank the ANR (ANR- 16-CHIN-0003-01) and Safran Aircraft Engines for the POSEIDON project and also ANRT for the CIFRE PhD fellowship for AT. This work was granted access to the HPC resources of CINES (A0060510439, A0040510092), and CERFACS.

Anne Bourdon
LPP, CNRS, Ecole Polytechnique

Date submitted: 27 May 2019 Electronic form version 1.4