KINETIC EFFECTS IN HALL PLASMA THRUSTERS*

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The plasma-wall interaction in the presence of strong secondary electron or thermionic emission has been studied theoretically and experimentally both as a basic phenomenon and in relation to numerous plasma applications such as, for example, fusion devices and plasma propulsion. For Hall thrusters, existing fluid models predict that secondary electron emission (SEE) is strong enough to enhance electron energy losses at the walls. According to the kinetic simulations, the electron velocity distribution function in a collisionless thruster plasma is non-Maxwellian, anisotropic, and features beams of secondary electrons emitted from the walls.[1,2] Under such conditions, the effects of SEE on the plasma can be substantially weaker than predicted by the fluid models. This talk will review previous and recent experimental results, including probe measurements in the Hall thruster with various wall materials, which support the predictions of the kinetic studies.[3,4] It is also shown that the wall material properties affect the electron cross-field transport in the thruster discharge. We will also discuss how these results can help in implementation of highly efficient and stable plasma regimes of the Hall thrusters.

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