

Abstract Submitted
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Investigation of neutral depletion and propulsion performance in electrodeless RF plasma thrusters YOSHINORI TAKAO, KAZUKI TAKASE, SORA YOSHIKAWA, Yokohama National University, KAZUNORI TAKAHASHI, Tohoku University — Electrodeless RF plasma thrusters, consisting of an RF plasma source and a magnetic nozzle, are one of the candidates for high-power and long-lifetime thrusters because no electrodes are exposed to the plasma for its generation or acceleration. However, significant axial momentum lost to the lateral wall of the source tube was detected in experiments when a high-density plasma was generated. This momentum loss seems to be due to the neutral depletion and the resultant axisymmetric profile of the plasma. Here, the effects of neutral depletion on plasma distribution and thruster performance are numerically investigated using a particle-in-cell simulation with Monte Carlo collisions (PIC-MCC) and the direct simulation Monte Carlo (DSMC) method, where the PIC-MCC and DSMC calculations are performed reciprocally to reproduce the neutral depletion and its effect on the plasma profile, depending on the different strengths of the external magnetic field. The numerical results have shown that both downstream gas injection and stronger external magnetic field lead to a shift of the plasma density peak from the upstream to the downstream side and a resultant larger total thrust, which qualitatively agrees with a previous experiment.

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