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Effect of plasma distribution on propulsion performance in electrodeless plasma thrusters YOSHINORI TAKAO, KAZUKI TAKASE, Yokohama National University, KAZUNORI TAKAHASHI, Tohoku University — A helicon plasma thruster consisting of a helicon plasma source and a magnetic nozzle is one of the candidates for long-lifetime thrusters because no electrodes are employed to generate or accelerate plasma. A recent experiment, however, detected the non-negligible axial momentum lost to the lateral wall boundary, which degrades thruster performance, when the source was operated with highly ionized gases. To investigate this mechanism, we have conducted two-dimensional axisymmetric particle-in-cell (PIC) simulations with the neutral distribution obtained by Direct Simulation Monte Carlo (DSMC) method. The numerical results have indicated that the axially asymmetric profiles of the plasma density and potential are obtained when the strong decay of neutrals occurs at the source downstream. This asymmetric potential profile leads to the accelerated ion towards the lateral wall, leading to the non-negligible net axial force in the opposite direction of the thrust. Hence, to reduce this asymmetric profile by increasing the neutral density at downstream and/or by confining plasma with external magnetic field would result in improvement of the propulsion performance. These effects are also analyzed by PIC/DSMC simulations.

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