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Numerical Simulation of Acceleration and Deceleration of Weakly-Ionized Rarefied Arc-Jet along Diverging Magnetic Field HIROSHI AKATSUKA, SATOSHI TSUNO, AMPAN LAOSUNTHARA, ATSUSHI NEZU, HARUAKI MATSUURA, Tokyo Institute of Technology — We are studying supersonic helium plasma jet along a diverging magnetic field with low-ionization degree and low electron density. It had been experimentally found that the ion Mach number had its maximum about 3 at 1 cm downstream after passing the magnetic nozzle, and after that, the ion Mach number turned to decrease, and the plasma potential dropped. We numerically simulated the expanding plasma along the open magnetic field. Considering dimensionless numbers of the plasma flow, we chose hybrid scheme, i.e., Direct Simulation Monte Carlo (DSMC) method for neutral particles and ions, and fluid method for electrons. Residual molecules in the vacuum chamber were also included as particles. Consequently, we find the velocity increase just after passing the open field line, followed by deceleration due to collisions with residual molecules with temperature increase. In this acceleration-deceleration phenomenon, the velocity difference between neutrals and charged species are found, which also affects the space potential. We discuss the mechanisms of potential formation by the pressure difference and the friction force between the charged particles and neutral species. The numerical results are, at least qualitatively, consistent with our previous experimental results.

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