Study on electrodeless electric propulsion in high-density helicon plasma with permanent magnets

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Realizing a deep space exploration in future, it is essential to extend the lifetime of an electric plasma thruster. However, in most of the present system, this time is limited by damage of electrodes due to collisions between electrodes and a plasma.

To overcome this problem, this research aims at an establishment of the next generation electrodeless electric propulsion method by an electromagnetic acceleration of high-density (~ 10^{13} cm^{-3}) helicon plasma.

The acceleration method utilizes Lorentz force by the product of the azimuthal current j_θ and the radial magnetic field B_r. In order to generate j_θ and increase B_r, we use rotating magnetic field (RMF) coils (Fig. 1) or an (azimuthal mode number) $m=0$ coil, and permanent magnets (Fig. 2) combined with electromagnets, respectively.

For the measurement of plasma parameters, the laser induced fluorescence method (LIF) has been developed along with the use of electrostatic probes and a monochromator. In the presentation, detailed experimental results on generation and acceleration of a plasma will be reported.

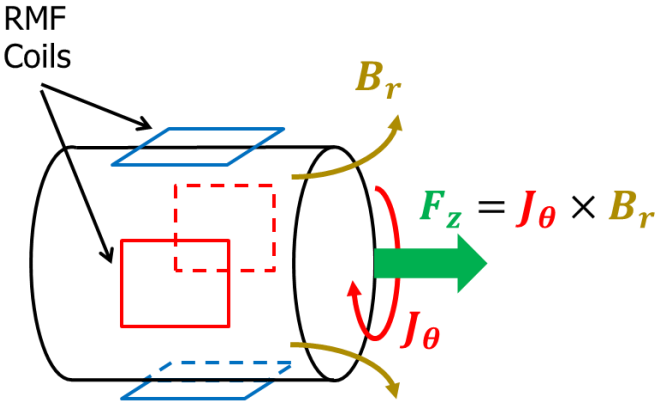

Fig. 1 Schematic drawing of RMF method.

Fig. 2 Permanent magnets.