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ヘリコン静電加速スラスター
Helicon Electrostatic Thruster

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Electric propulsion has higher exhaust velocity capability than chemical propulsion, which leads to an increase in the payload ratio. From this advantage, many satellites use electric propulsion for station keeping or even orbit transfer[1]. However, due to its low thrust density, the orbit transfer period becomes at least a hundred times longer than with chemical propulsion. A promising method to increase thrust density is utilizing helicon plasma source, which has capable of making high density plasma on the order of 10^{19} m^{-3}.Charles and Boswell et al demonstrated that helicon plasma can be accelerated up to 100eV through the double layer[2]. But, this ion energy is still lower than accelerated ion thrusters in ion engine or Hall thrusters with about 800-1000V. In order to increase the ion beam energy, radiofrequency heating[3], steady[4] and quasi-steady[5] electromagnetic acceleration were examined.

Harada et al developed the Helicon electrostatic thruster (HEST) and electrostatically accelerated helicon plasma. Fig. 1 shows the schematic image of HEST in side view. HEST had helicon plasma source in upstream (left side in Fig. 1) and acceleration section in downstream (right side). Helicon plasma source was consists of 27mm inner diameter ceramic tube and 170mm length helical antenna which connected to 13.56MHz radio-frequency power supply through an auto matcher. Solenoidal coil applied diverging magnetic field up to 100mT at antenna exit. NdFe magnets and pure iron yokes make field free region in downstream. Anode was set at 25mm downstream from antenna exit and hollow cathode (DLHC1000, Kaufman & Robinson Inc.) was set inside the field free region. The result of ion beam energy using Retarding Potential Analyzer (RPA), electrostatically accelerated ion energy is almost equal to supplied discharge voltage[6]. However, how affect the each operation conditions to ion beam characteristics have not been much investigated. To clear this influence, both ion beam energy measurement varying anode geometry and ion beam current and its distribution were measured using circumference direction sweeping Faraday cup (Fig. 2). In this presentation, the effect of anode geometry to ion beam characteristics was especially focused on to understand of ion acceleration mechanisms and thruster performances.

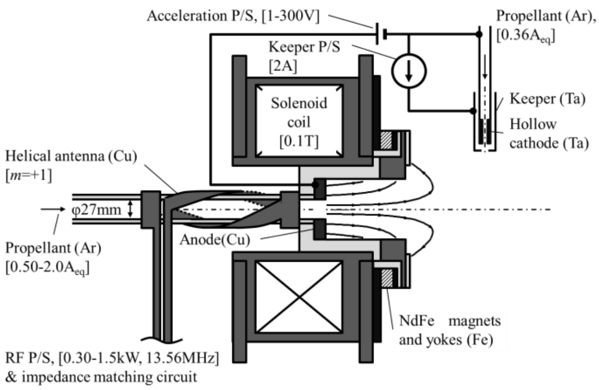

Fig. 1 Schematic illustration of HEST, side view

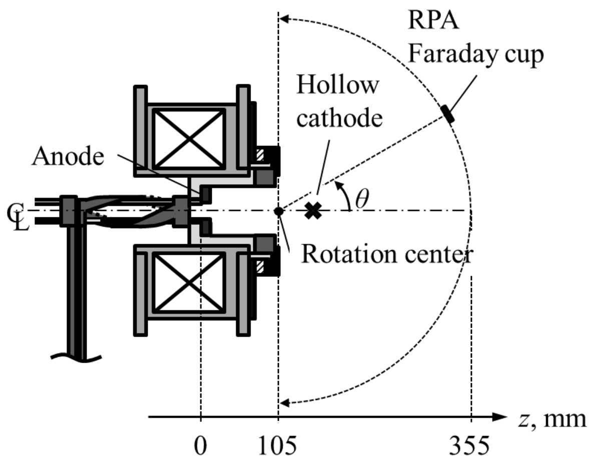

Fig. 2 Beam survey path, top vie

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