

Research on Pulsed Plasma Thruster for Space Application

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Abstract :

Pulsed Plasma Thruster (PPT) is studied and developed for the auxiliary propulsion system for small satellite because its simplicity in recent years. The PPT is described as an electromagnetic plasma thruster with parallel-plate electrodes caused by micro-second, kilo-ampere level of oscillating discharged pulses. The most promising features of PPT, compared with the other electric / chemical propulsion system, are as follows; 1)Propellant storage system is not necessary 2)Precise total impulse control is possible 3)Polytetrafluoroethylene (PTFE) is an inactive material and no hazardous properties. On the other hand, the primary task for its development was the lack of understanding of the process of mass ablation from solid propellants. TMIT and JAXA have started collaborative R&D since 2000 as a feasibility study. System configuration was estimated on the PPT, and based on system requirements referred from the fabrication of small satellites, basic design parameters were established as an on-board feasibility study. For example, material for electrode, angular dependency on the specific impulse, connection between capacitor bank and thruster head, are shown in this paper. As a next step, the engineering model (EM) for the PPT was completed, and longevity test continued at the same time. Furthermore, practical experiments were performed for satellite installment concretely. Using PPT-EM, Ion velocity measurement and exhaust plume analysis were estimated. This paper introduces our process and achievements through the development of the PPT as a collaborative R&D program, and demonstrates its feasibility on small satellites.