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Author: Dr. Yoshihiro Kajimura  
National Institute of Technology (Japan), Japan

Mr. Natsumi Hirota  
National Institute of Technology (Japan), Japan

Mr. Koutaro Nakata  
National Institute of Technology (Japan), Japan

Ms. Reiri Azuma  
National Institute of Technology (Japan), Japan

Ms. Sae Kumode  
National Institute of Technology (Japan), Japan

Ms. Mio Saito  
National Institute of Technology (Japan), Japan

Dr. Yuya Oshio  
Ryukoku University, Japan

Prof. Ikkoh Funaki  
Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency (JAXA), Japan

Dr. Yukikazu Murakami  
National Institute of Technology (Japan), Japan

DEVELOPMENT AND OPERATION DEMONSTRATION OF PULSED PLASMA THRUSTER FOR  
2U-CUBESAT

**Abstract**

In recent years, a number of CubeSat satellites have been developed and launched for the demonstration of advanced technologies and for educational purposes because of their low cost of launch and development. One of problems of CubeSat mission is that its lifespan is short due to loss of altitude caused by atmospheric drag. For example, KOSEN-1 is a 2U size CubeSat launched by JAXA's Epsilon Rocket No. 5 in November 2021, it lost 3 km of altitude in 250 days due to atmospheric resistance. In this situation, it is necessary to install a propulsion system on the CubeSat to increase the orbital altitude in order to extend its lifetime. In the present study, a 1U-size Pulsed Plasma Thruster (PPT) with low power operation was designed and manufactured in response to the demand for a propulsion system for CubeSat, especially KOSEN-3 CubeSat satellite. The PPT developed in the present study was electrothermal acceleration type with PTEF as the propellant. Their operating power, impulse bit and plasma parameters were measured in a vacuum chamber to evaluate its performance. The advantages of the PPT developed in the present research are that they can fit into a 1U size and can operate at a low power of a few watts. As a result, the PPT can operate at less than 2.5 W continuously. The impulse bit measured by using the target method was 51  $\mu\text{Ns}$ . The electron temperature and number density of the plasma measured by triple probes located at the distance of 150 mm in front of PPT were 5.26 eV and  $5.94 \times 10^{20} \text{ m}^{-3}$ , respectively. The plasma velocity of 19 km/s was measured by TOF method. The specific impulse of the PPT developed in the present study was 310 s. The mass shot was 17  $\mu\text{g}$ , and the propulsive efficiency was obtained to be 3.8%.