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11-GHz Microwave-Excited Microplasma Source for Electrothermal Thruster TAKESHI TAKAHASHI, Kyoto University, YOSHINORI TAKAO, KOJI ERIGUCHI, KOUICHI ONO — The trend of space systems has recently been focused on miniaturization and simplification of the structure, to reduce the mission costs and increase the launch rates. Such concept has supported a new approach to develop micropropulsion systems, particularly for high-accuracy station-keeping and attitude control. We report on a microplasma thruster using 11-GHz microwave-excited microplasma sources, instead of 4-GHz microwaves in our previous work. Higher frequency microwaves have a shorter wavelength, and then are expected to enable more compact design suitable for miniaturizing. The thruster consists of a microplasma source and a micronozzle for exhausting the plasma. The plasma source is composed of a quartz chamber, 1.0 mm in radius and 4.5–10 mm long, and a metal around the chamber. Microwaves propagate through a coaxial cable connected to the end of the plasma chamber, and then penetrate into the chamber, where the propellant is ionized and heated up. The thermal energy is converted into directional kinetic energy through the micronozzle to obtain the thrust. We carried out numerical simulations of the microplasma production and micronozzle flow, and the numerical and experimental results indicated a significant improvement in thrust performance.

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