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A Microwave-Excited Microplasma Thruster: Plasma Diagnostics, Performance Testing, and Numerical Analysis YOSHINORI TAKAO, KOUICHI ONO, KOJI ERIGUCHI, Department of Aeronautics and Astronautics, Kyoto University, Kyoto, Japan — Decreasing the scale of propulsion systems is of critical importance on the development of microspacecraft. This paper is concerned with an application of microplasmas to a microthruster, presenting some experimental and numerical results. The microthruster consists of a cylindrical microplasma source 10 mm in length and 1.5 mm in inner diameter and a conical micronozzle fabricated in a 1.0 mm thick quartz plate with a throat diameter of 0.2 mm. The microplasma source produces hot plasmas by 4-GHz microwaves in the pressure range from 5 to 50 kPa, and then the micronozzle converts such high thermal energy into directional kinetic energy as a supersonic jet. Plasma diagnostics and performance testing showed that the electron density, rotational temperature, thrust, and specific impulse obtained were 10^{19} m^{-3}, 1000 K, 1.1 mN, and 73 s, respectively, at an Ar/N_2 gas flow rate of 50/0.5 sccm and an input power of 9 W. Comparison with a numerical analysis implies that the micronozzle has an adiabatic wall rather than an isothermal one.

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