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Optical Measurement of a Microwave-excited Miniature Plasma Source for Micro Propulsion YOSHINORI TAKAO, TAKESHI TAKAHASHI, SHUNSUKE KITANISHI, KOJI ERIGUCHI, KOUICH ONO, Department of Aeronautics and Astronautics, Kyoto University — Reducing the scale of propulsion systems is of critical importance for microspacecraft. This paper is concerned with an application of microplasmas to a microthruster. The microthruster consists of a cylindrical microplasma source 10 mm in length and 1.5 mm in inner diameter and a conical Laval micronozzle 1.0 mm in length with a throat diameter of 0.2 mm. The microplasma source produces hot Ar plasmas by $2-11$ GHz microwaves in the pressure range from 5 to 50 kPa at input powers below 6 W; and the micronozzle converts such high thermal energy into directional kinetic energy as a supersonic jet. The gas/rotational temperature and the plasma electron density were measured by adding a small amount of N_2 and H_2, respectively, and then fitting the experimental data to theoretical calculations. Plasma diagnostics showed that the electron density and rotational temperature obtained were $10^{19}-10^{20}$ m^{-3} and $700-1000$ K, respectively, in the range of Ar gas flow rate from 10 to 70 sccm at input powers of 3 and 6 W.

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