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Flow field characteristics of low-power arc-heated plasma jets[1] XIAN MENG, JINWEN CAO, CHUNLING YANG, WENXIA PAN, CHENGKANG WU, Institute of Mechanics, Chinese Academy of Sciences — In an arc-heated plasma thruster, working gas is heated by a dc arc discharge to a temperature over 104 K, and subsequently, converted into a supersonic plasma jet through a convergent-divergent nozzle, issuing into the ambient atmosphere, where the pressure is a few pascals or even lower, producing a thrust force. It is desirable to know the structure of the flow field in such an arrangement. In this paper, with a self-designed low power DC arc-heated plasma thruster, the discharge processes and flow field of the plasma jet have been systematically studied based on experimental method. An observation system for plasma discharge and arc root attachment has been developed to detect the discharge condition in the thruster nozzle. The distributions of electron temperature and electron number density have been measured by using electrostatic probe method and emission spectroscopy method, and the axial distribution of the pressure within the nozzle has been measured by pressure sensor. Results show that the low-power arc-heated plasma thruster can be operated stably and repeatably; The plasma thruster tends to work in a small current and high voltage mode; The current density to the anode wall is only tens of mA/mm2, and there is almost no ablation on the anode surface.

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