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RESEARCH AND DESIGN CONSIDERATIONS OF 100-KILOWATTS MPD THRUSTER WITH
SUPERCONDUCTOR**Abstract**

High power magnetoplasma dynamic thrusters (MPDTs) are treated as one of the most potential candidates for future high power space missions, like manned Mars exploration, due to the high specific impulse and high thrust density. From 2013, a 100 class applied-field magnetoplasma dynamic thruster (AF-MPDT) has been developed. The thruster has reached the power of 114 kW, the thrust of 3 N, the specific impulse of 5300 s and the thrust efficiency of 69%. Firstly, in the aspect of thruster configuration, we will focus on MPDT and superconductor designing. The anode is made of copper with a cylindrical-divergent nozzle and the cathode is made of lanthanum-tungsten with more than 20 propellant channels. Independent cooling structures around anode and cathode allow high efficiency heat exchange and make sure the thruster can work steadily on a high power. The outer-ring is the magnetic coil, which can generate more than 0.4-Tesla magnetic strength at the tip of cathode. Secondly, the experiments about the MPDT with 0.4T will be introduced. The experiments were held in a cylindrical vacuum chamber (3 m $\times$ 5 m), the working vacuum of which is 0.01–0.2 Pa. A target thrust stand was designed to measure the thrust. Series of thrust measurement were held to analysis the thrust characters under the influence of propellant mass flow rates, discharge current and applied magnetic field. Finally, to match with the need of future space mission, a 100-kW class AF-MPDT with superconducting magnetic coil is under development, and moreover some considerations about future design for MPDT in space are suggested.