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DEVELOPMENT OF A 50 W POROUS EMITTER ELECTROSPRAY THRUSTER TOWARDS
 FLIGHT

Abstract

Electrospray thrusters are an attractive approach for CubeSat propulsion due to their low power, relatively high thrust and high specific impulse. Electrospray propulsion consists of the extraction and acceleration of charges from a room temperature ionic liquid via electrostatic force to emit a spray of charges that provides thrust to the spacecraft. One such thruster termed the “Porous-emitter Electrospray Thruster” (PET) is being developed and tested at the University of Southampton in collaboration with RHP Technology (Austria) and AVS UK. RHP Technology’s role is to develop the porous emitters and reservoirs using additive manufacturing and powder injection molding sintering techniques. AVS UK is responsible for the design of a flight-ready PET thruster and the development of the associated Power Processing Unit (PPU) and is leading the commercial exploitation of the technology. The University of Southampton (UoS) is leading the testing as well as contributing to the design of the thruster.

The flight model PET assembly consists of 4 thruster units functioning in pairs and operated by single PPU. Each thruster unit incorporates emitter array, metal extractor plate and conductive porous reservoir, also working as distal electrode. The research is focused on achieving total thrust of 1 mN with maximum power of 50 W. The preliminary results from an additively manufactured 105 emitter

arrays have depicted emission current of +192/-378 A at a voltage of 3.50 kV with an estimated thrust of 90 N. Given the 313 emitters that we are designing for in our standard arrays, this will provide 270 N across an array of single thruster unit. Four such thrusters operating together can achieve total thrust of 1 mN. The thruster units and PPU for PET are currently undergoing critical tests, which will lead to the complete development of the assembly in mid-2023.

PET thruster is planned to fly on the LUR-1 mission, which is a satellite with a wet mass of approximately 50 kg, designed to last 5 years. The mission is an IOD (In-Orbit Demonstration) of the satellite platform and several subsystems. The propulsion subsystem will be provided by AVS UK, and it will include two PET thrusters. The launch is targeting early 2024 and the spacecraft will orbit at 500 km of altitude. The electro spray thrusters will be tested with maneuvers such as orbit change and drag compensation.