Task Groups (TG)
Small Spacecraft – Big Science (TGCSS.1)

ELECTROSPRAY EXPERIMENT OF WATER AND GLYCERIN USING CAPILLARY AND ANNULAR SLIT TYPE EMITTER

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An electrospray thruster generates thrust by propelling ions or ionic droplets at high speeds using an ionic liquid. In this study, a novel annular slit emitter for electrospray was developed, and its operational modes were compared with varying applied voltages under atmospheric conditions. The performance of the new annular slit emitter was experimentally compared to that of a traditional capillary emitter, using water and glycerin as working fluids. The experiment confirmed the formation of Taylor cones, cone-jet transitions, stable jets, whipping jets, and multiple jets, analyzing their dependence on fluid viscosity and voltage. Significant differences were observed between the two emitters in electrohydrodynamic mode, drop-to-cone mode, and cone-to-jet transition mode. As the voltage increased, the capillary emitter produced whipping and pumping water jets, while glycerin formed a stable tilted jet. Conversely, the annular slit emitter exhibited a pulsating water jet after a unique dripping mode at high voltage, and glycerin formed stable multiple jets around the slit. Notably, the annular slit emitter generated seven multi-jets with glycerin at 18.5 kV, attributed to the emitter's unique shape and glycerin's viscosity, which created multi-cone jets at the meniscus around the slit at specific voltages.