Paper ID: 44785
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IAF SPACE PROPULSION SYMPOSIUM (C4)
Electric Propulsion (4)

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DEVELOPMENT OF GALLIUM AND INDIUM MEMS FEEP THRUSTERS USING GLASS CAPILLARIES

Abstract

Glass capillaries are frequently used for miniaturized propulsion systems like Colloid thrusters, as they can be easily batch manufactured. In principle, they also provide ideal geometries for liquid-metal-ion-source (LMIS) based field emission thrusters like ultra-small inner diameters that promise very high mass efficiencies. However, wetting of glass and liquid metals is not as straightforward as metal-metal bonds. After initial tests with indium and fused quartz glass capillaries that demonstrated the proof-of-concept but limited operation time, we performed an in-depth study of different glass types and liquid metal combination bonding strengths to find an optimum material combination. We then built a series of emitter prototypes and investigated their basic performance and stability over time. A dedicated propellant feeding and test module was designed and built for that purpose. This technology may leads to a further miniaturization in high performance electric propulsion systems ideally suited also for CubeSats and Nanosatellites with increased performance.