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Simulation Studies of Direct-Current Microdischarges for Electrostatic Mode Microelectric Propulsion THOMAS DECONINCK, SHANKAR MAHADEVAN, LAXMINARAYAN RAJA, The University of Texas at Austin — We are currently developing an electrostatic plasma thruster device based on a direct-current microdischarges. The design uses a dual-stage tri-electrode microdischarge configuration. The pilot stage ($\sim$100 μm dia.) provides sufficient constriction to enable low propellant (argon) flow rates $\sim$ 1 sccm, while keeping the pressures high enough ($\sim$ 100 Torr) to sustain a pilot microdischarge. A second stage ($\sim$300 μm dia.) downstream of the pilot microdischarge expands the flow to near vacuum conditions. In this work we simulate the tri-electrode microdischarge using a coupled plasma-bulk flow computational model. The plasma model provides a self-consistent, multi-species, multi-temperature description of the microdischarge phenomena while the gas dynamics model provides a description of the high-speed low Reynolds viscous compressible flow. A detailed description of the plasma dynamics in the microdischarge including power deposition, ionization, coupling of the plasma phenomena with high-speed flow, and propulsion system performance will be reported. The computational results will be compared to experimental results based on work being done in our group.

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