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Spatiotemporal plasma heating mechanisms in a radio-frequency electrothermal microthruster[1] JAMES DEDRICK, SCOTT DOYLE, ANDREW GIBSON, University of York, TECK HO, RODERICK BOSWELL, CHRISTINE CHARLES, Australian National University, MARK KUSHNER, University of Michigan — Low power, compact and neutralizer-free propulsion sources are of significant interest for meeting the challenges of space missions with small satellites. Radio frequency (rf) electrothermal plasma thrusters provide enhanced spatial control of power deposition to the propellant for increased thrust. In this study, we investigate the mechanisms for electron and neutral-gas heating in an rf 13.56 MHz electrothermal microthruster operating in argon at 1.4-1.7 Torr plenum pressure. Two dimensional, fluid-kinetic simulations undertaken with the Hybrid Plasma Equipment Model corroborate measurements of the electron-impact excitation rate via phase-resolved optical emission spectroscopy. The relative role of each heating mechanism on the spatially resolved power deposition is investigated across the alpha-gamma mode transition and pressure gradient on-axis. Prospects for achieving enhanced control of the sheath dynamics, ion-power fraction and neutral-gas heating via tailored voltage waveforms are also discussed.

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