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Characteristics of Edge Flames in Microcombustors JOANNA BIERI, University of Redlands, MOSHE MATALON, University of Illinois at Urbana-Champaign — Two streams, one containing fuel and the other oxidizer, are flowing into a relatively narrow channel where they mix and support an edge flame at some distance downstream. Our analysis is based on two models; one that fully couples the fluid dynamics and transport equations, used to determine the flame shape and location, and the other that assumes a constant-density flow, used to test the steady solutions for stability. It is found that in relatively wide channels the flame has a premixed, rounded edge with a trailing diffusion flame, but when the channel width decreases the flame is located further away from the supply and has a broader edge that can span the entire channel, when its width becomes comparable to the characteristic flame thickness. The effect of thermal expansion is to relocate the edge flame closer to the reactant supply. Heat losses at the channel walls cause a drop in the overall temperature and, as a result, the edge flame is confined to the center of the channel and the trailing diffusion flame is shortened significantly. Depending on the Lewis number, the flow rate, and the extent of heat loss, the edge may either remain steady, oscillate, or be blown off by the flow. With appreciable heat losses, residual fuel and oxidizer are observed at the end of the channel, so that under appropriate conditions, they could re-ignite and support a streak of diffusion flamelets, as seen experimentally.

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