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Experimental investigation of boundary-layer flashback in swirl flames DOMINIK EBI, NOEL CLEMENS, The University of Texas at Austin — Swirling flows are widely employed for flame stabilization purposes in gas turbine combustors. However, flames in swirling flows are more prone to flashback, a potentially catastrophic phenomenon leading to thermal damage of the burner. The physical mechanism driving flashback in a swirling flow is not yet fully understood. The mechanism is particularly complex if the upstream flame propagation interacts with a boundary layer. In a previous study we showed that the flame/boundary-layer interaction is important for burners, which include an axial swirler and a central body attached to the swirler hub. We are investigating the mechanism of flashback in atmospheric pressure lean-premixed methane/hydrogen-air flames inside the mixing tube of our confined model swirl combustor. Flashback occurs at an equivalence ratio of approximately 0.7. The effect of hydrogen is investigated by testing different methane-to-hydrogen ratios. The duration of a single flashback event is on the order of 100 ms, requiring high-speed diagnostic techniques. We are applying simultaneous stereoscopic PIV, flame front detection based on Mie scattering, and chemiluminescence imaging to investigate the flame/flow interaction during flashback events.

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