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Dynamics of a Variable Density Ratio, Reacting Jet Issuing into a Vitiated Crossflow BENJAMIN WILDE, JERRY SEITZMAN, TIM LIEUWEN, Georgia Institute of Technology — This work reports recent experimental characterization of a reacting jet issuing into a turbulent vitiated crossflow. Previous studies on unforced, non-reacting jets in crossflow showed that the flow transitions from global to convective instability with increasing jet-to-crossflow momentum flux ratio, J, whose value is a function of the jet-to-crossflow density ratio, ρ_j/ρ_∞. This work utilizes a new facility designed to study both of these stability boundaries in a reacting configuration, where the densities of the inflow jet, approaching crossflow, and flame can be systematically varied. The jet, consisting of varying mixtures of CH_4, H_2, N_2, and He, enters the test section through a flush-mounted contoured nozzle. The density ratio spans from 0.4 to 1.0 as a function of the jet constituent concentrations. The vitiated crossflow temperature, T_∞, varies from 1000 to 1600K, and the J range is 2 to 25. High-frame-rate imaging and PIV measurements show evidence of narrowband, self-excited fluctuations. Cross correlations computed from the windward and leeward flame edge motion show a tendency towards classical wake-like sinuous motion at lower J and jet-like varicose motion at higher J. Varying crossflow temperature alters the flame stabilization location but not the spectral content of the flow.

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