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A Numerical Study of Flame Liftoff and Blowout Using Fuel and Air Stream Dilution ALEJANDRO BRIONES, SURESH AGGARWAL, University of Illinois at Chicago, VISWANATH KATTA, Innovative Scientific Solutions, Inc. — The effects of fuel and air stream dilution on the liftoff, stabilization, and blowout characteristics of nonpremixed (NPF) and partially premixed flames (PPF) in axisymmetric coflowing jets are investigated. While the undiluted PPF is in a burner-attached mode, the undiluted NPF is lifted. Both flames exhibit a double flame structure in the near-field region, where the flame stabilization depends on a balance between flame reactivity and scalar dissipation rate (χ). As diluent mole fraction (X_{dil}) is increased, the flames become weaker, moving downstream along the stoichiometric mixture fraction line, and stabilizing at a location of lower χ. Further increase in X_{dil} moves the flames further downstream into the far-field region, where both the NPF and PPF exhibit a triple flame structure, and the flame stabilization also depends on a balance between the triple flame speed and the local flow velocity at the flame base. With fuel stream dilution, PPFs are stabilized at a higher liftoff height (L_f) and blow out at a lower X_{dil} compared to NPFs. In contrast, with air stream dilution, NPFs move to a higher L_f and blow out at a lower X_{dil} compared to PPFs. Simulations are used to examine the various mechanisms for the stabilization of lifted flames.

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