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Quantification of local combustion modes in laminar nonpremixed *n*-dodecane/air coflow flames CHAO XU, SIBENDU SOM, Argonne National Laboratory — Nonpremixed lifted jet flames in heated air coflow are important to a range of practical propulsion systems, while stabilization mechanisms for complex fuels have not been fully understood. To better understand the structure and stabilization mechanisms, two-dimensional laminar *n*-dodecane jet flames in heated air coflow at 30 atm are simulated with detailed chemical kinetics. To quantify roles of different sub-processes (e.g, chemistry, diffusion, radiation, etc.) and associated local combustion modes, a new flame diagnostic based on chemical explosive mode (CEM) analysis (CEMA) is developed, by projecting local chemical and diffusion source terms to the direction of CEM and quantifying the competition between these terms. Diffusion processes in both normal and tangential directions of the non-premixed flame sheet (defined as the mixture fraction isocontours) are further accounted for. Additional local combustion modes specific to nonpremixed flames (compared to premixed flames) are identified, highlighting different roles of flame-normal and flame-aligned diffusion processes in stabilizing the flames. Effects of radiative loss on local combustion modes and the flame stabilization mechanism, are also discussed based on an optically-thin radiation model.

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