Abstract Submitted
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Large eddy simulations of a reactive jet in hot vitiated crossflow: flame stabilisation mechanism[1] OLIVER SCHULZ, EMILE PICCOLI, ETH Zurich, ANNE FELDEN, GABRIEL STAFFELBACH, CERFACS, NICOLAS NOIRAY, ETH Zurich — This numerical study investigates the flame stabilization mechanism of a reactive jet in crossflow (RJICF). A premixed ethylene-air jet is injected into a hot vitiated crossflow at 1500K. Compressible 3-d large eddy simulations (LES) were performed with the dynamic thickened flame (DTF) model and an analytically reduced chemistry (ARC) mechanism. Comparisons between LES and experiments are in good agreement for jet trajectories and velocities along the trajectories. LES capture the most common flame-flow field interactions observed in the experiments. A detailed flame analysis utilizing chemical explosive mode analysis (CEMA) identifies autoignition as the dominant flame stabilisation mechanism on the windward side of the jet. Heat is released at an optimum mixture for fast ignition. This heat is transferred to richer mixtures, which are characterized by even smaller minimum autoignition times. This so-called most reactive mixture fraction determines the position of the windward flame. A 3-d flame analysis shows autoignition regions that form close to structures resulting from the jet shear layer vortex shedding. These regions expand towards the flame tip and the side of the RJICF. Finally, they merge with the leeward propagating flame.

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