NUMERICAL STUDY OF THE PROPAGATION OF LEAN HYDROGEN-AIR FLAMES IN HELE-SHAW CELLS

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Work-In-Progress Abstract

The premixed propagation of lean hydrogen-air flames (equivalence ratio 0.3) in adiabatic Hele-Shaw cells (i.e. two parallel plates separated by a small distance h) is investigated using numerical simulations with detailed chemistry and transport. We focus on the effect of the distance between plates, h, for a semi-closed system of size $50\delta_f \times 50\delta_f \times h$, where $\delta_f = 3.45$ mm is the flame thickness of the planar adiabatic flame. The mixture is ignited at the open end and a reactive front propagates towards the closed end. The simulations compare three cases, $h=0.1\delta_f$, $h=\delta_f$ and $h=3\delta_f$, in which the flow field is driven by viscous effects. Hydrodynamic and diffusive-thermal instabilities wrinkle the flame front to form small cellular structures that increase the overall propagation velocity. Symmetric and non-symmetric shapes are seen to emerge in the third dimension (i.e. along h).