Flame instability development in the opened channel with counter-flow

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Evolution of the premixed lean hydrogen-air flame in the opened channel with the fresh mixture counter flow is analyzed numerically. Considered mixture compositions are characterized by intense flame surface growth via both hydrodynamic and diffusive-thermal instability [1]. All the stages of the flame front instability development are observed and discussed, including stages of linear instability growth and formation of cells on the flame front, non-linear dynamics of cells and stabilization of the flame front structure. On the basis of the numerical analysis key features of the flame instability development are investigated. Dispersion curves for linear stage are obtained and compared with available theoretical [2], numerical [3] and experimental data [4]. The role of non-linear interaction between flame cells and subsequent flame stabilization is identified. Precisely the effect of the flame front surface growth on the flame propagation speed is considered and the mechanisms responsible for the increase in flame propagation speed with flame front surface for hydrogen-air mixtures of various compositions are discussed.

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