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# Relaxational diffusive-thermal oscillations of flat burner-stabilized flames: experiments versus computations

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The highly transient relaxational diffusive-thermal oscillations of flat burner-stabilized flames have become an attractive phenomenon to extend and to improve the experimental data to verify combustion models [1,2]. The experimental results can be used to test the performance of detailed reaction mechanisms in the regimes close to ignition/extinction [1]. In such regimes, certain reaction zones can travel over distances of the order of 10 mm [2,3]. In this case one dimensional numerical models for quantitative comparison can be in question. In this respect, both experimental and computational investigations on relaxational oscillations of methane-air flames on a flat porous burner with a surrounding nitrogen co-flow have been performed [3]. For this fully resolved 2D numerical simulations (same burner configuration as in the experiments) by using a detailed reaction mechanism and molecular diffusion model are performed. The effects of nitrogen co-flow velocity, buoyancy and radiation are investigated though the main focus is on the effect of the nitrogen co-flow [3].

The results show that there is an optimal co-flow velocity that removes the secondary diffusion flame and extinguishes the edge flame settled in the stagnation flow region. This optimal regime makes the flame flatter and closer to a one-dimensional configuration and this is a most favorable condition for validation of kinetic mechanisms. The study shows that the results of both numerical and experimental approaches agree quantitatively. The detailed data from the simulations are useful for improving understanding of the interplay between chemistry and diffusion controlled combustion regimes under transient conditions, for definition of the applicability limits of the 1D assumption limit and even might guide the design of the next generation of the burner configurations to study the kinetics and dynamics of complex fuels required for a sustainable energy transition [3]. The synergy of modeling, computations with experimental measurements shown in the study can be used for validation of combustion models for chemistry controlled combustion processes. The latter becomes extremely important since efficiency and pollutant mitigation issues require lean compositions used in the combustion facilities.

**References**

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