

A Nearly 1-D Non-Premixed Flame Near Extinction. Cell Formation and the Effect of the Direction of Bulk Flow

David Lo Jacono⁽¹⁾, Paul Papas⁽¹⁾, Moshe Matalon⁽²⁾, Peter A. Monkewitz⁽¹⁾

(1) *Fluid Mechanics Laboratory, Swiss Federal Institute of Technology, Lausanne, Switzerland*

(2) *McCormick School of Engineering and Applied Sciences, Northwestern University, Evanston, USA*

A unique burner has been constructed to realize experimentally a one-dimensional unstrained planar non-premixed flame, previously only considered in idealized theoretical models. One reactant flows vertically up towards the horizontal flame. The novelty of the design is the introduction of the other reactant from above through an array of 625 closely spaced hypodermic needles, such that its diffusion to the flame, against the upward product flow, is essentially 1-D, i.e. uniform over the burner cross section. The resulting flame is shown to be nearly unstrained and is used to study the effect of the nature of the fuel transport to the flame (convective fuel supply from the bottom versus diffusion of fuel from the top against the bulk flow) on the extinction limit of a CO₂-diluted H₂-O₂ flame. In addition, first results on the formation of cellular structures near the extinction limit are presented.

[View the extended summary](#)