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Capabilities in the Turbulent Combustion Lab

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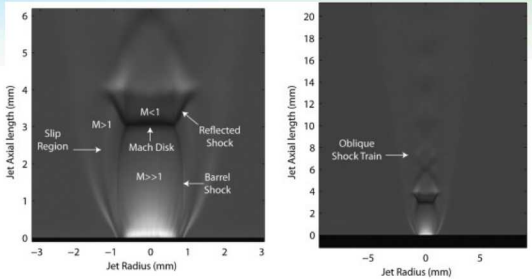
Known for optical and laser-based diagnostics on non-reacting and combusting flows

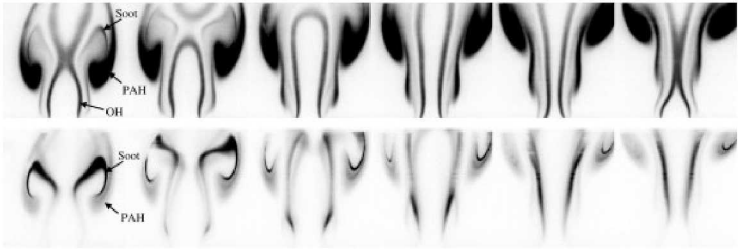
- Schlieren imaging (density gradients, spatially quantitative)
- Particle imaging velocimetry (velocity imaging)
- Laser Doppler velocimetry (velocity, at a point)
- Rayleigh imaging/Filtered Rayleigh imaging (concentration)
- Raman imaging (concentration, temperature)
- Laser induced fluorescence (concentration of specific species)
- Laser induced incandescence (soot)

Schlieren



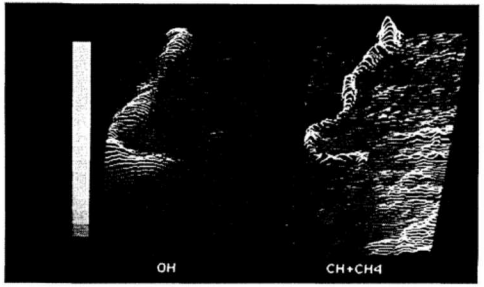
https://doi.org/10.1016/j.ijhydene.2012.03.063

LIF + LII



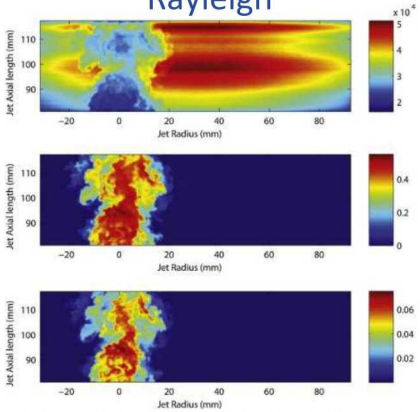
https://doi.org/10.1016/j.proci.2004.08.244

Raman + LIF



https://doi.org/10.1364/OL.16.000858

Rayleigh

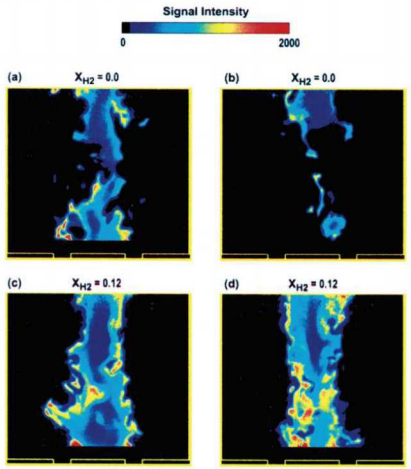


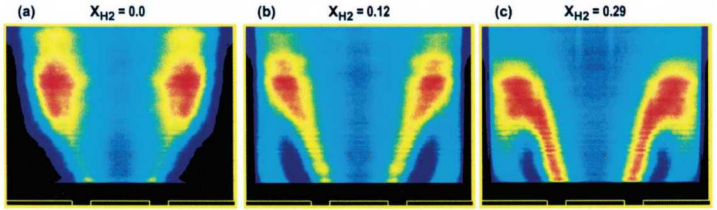
https://doi.org/10.1016/j.ijhydene.2012.03.063

2002: Combustion of hydrogen-enriched methane in a lean premixed swirl-stabilized burner

https://doi.org/10.1016/S1540-7489(02)80108-0

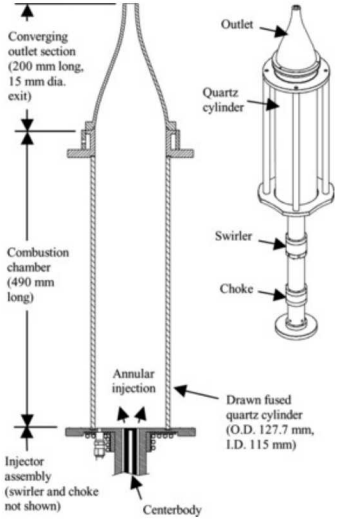
- The burner consisted of a centerbody with an annular, premixed fuel-air jet. Swirl was introduced to the flow using 45-degree swirl vanes. The combustion occurred within an air-cooled quartz chamber at atmospheric pressure. Flame stability and blowout maps were obtained for different amounts of hydrogen addition at several fuel-air flow rates.
- Lean stability limit lowered, reduction in CO by the addition of hydrogen to the fuel
- NOx and flame T not affected by H2

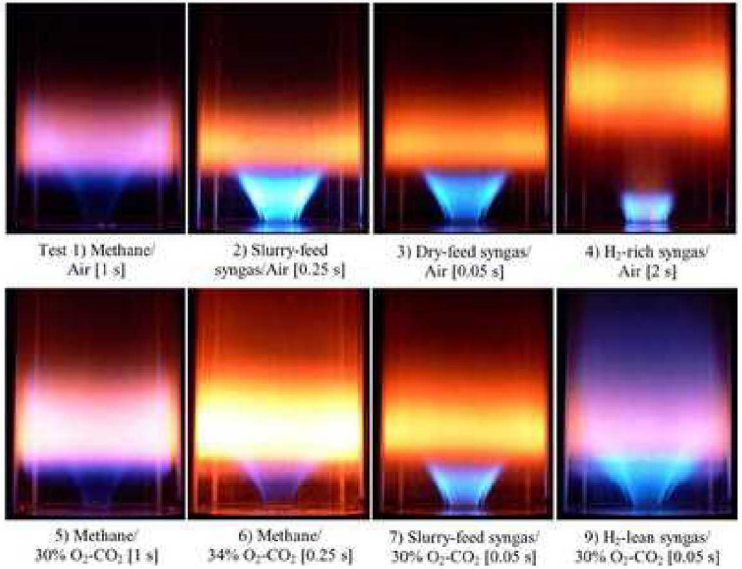




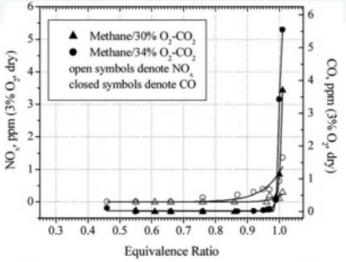
https://doi.org/10.1080/00102200701487061

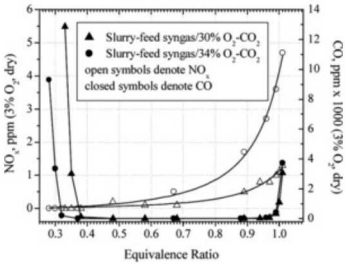
2007: Effect of Syngas Composition and CO_2-Diluted Oxygen on Performance of a Premixed Swirl-Stabilized Combustor

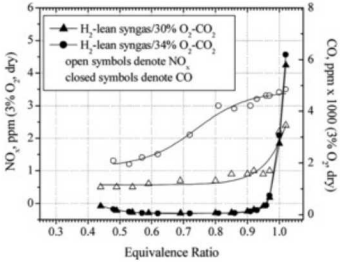




Photographs of the methane and syngas flames with the combustor operating at an equivalence ratio of 0.7. The inlet annulus is at the bottom center of each image—see Figure 5. The pink and red-orange glow originates from surface thermal emission where the flame gases impinge on the quartz cylinder that surrounds the flame. The camera exposure time of each image is indicated in the square brackets.







- Hydrogen increases flame stability and burning rate and allows lean operation
- More compact, higher temperature flames with H2 - resulting in increased flame stability and higher NOx emissions