

Sooting Flames #3

This burner and stabilization geometry has been proposed as a standard test case for the international workshop on LII. Several groups have investigated it.

Apparatus

The measurements were performed in a premixed flat *ethylene/air* flame. The flame burns on a water-cooled, McKenna burner, which has a sintered bronze plug with a diameter of 60 mm. An outer co-flow of nitrogen shields the flame from room air entrainment. The flame is stabilized with a stainless steel plate (same diameter as burner) located 21 mm above the burner.



Measurements

Gas temperatures were measured using

vibrational coherent anti Stokes Raman spectroscopy (CARS). [Ref 2]

rotational coherent anti Stokes Raman spectroscopy (CARS). [Ref 2,6]

a 50 μm Pt/Pt Rh(10%) uncoated thermocouple and were corrected for heat losses [Ref 8]

Soot volume fraction was measured using

laser extinction at 3 different wavelengths (532, 632.8, and 1064 nm) with a refractive index of $m=1.56-0.46i$, resulting in an extinction coefficient of $K_e=5.01$ [Ref 1, 4]

laser extinction at 1064 nm with $K_e=5.46$ [Ref 8]

2D Laser Induced Incandescence (LII) at 1064 nm [Ref 5]

Soot particle sizes were measured using

thermophoretically sampled soot particles analyzed by transmission electron microscopy. [Ref 6]

three angle scattering and extinction measurements using the Rayleigh–Debye–Gans theory and a fractal like description of soot [Ref 7, 8]

using temporal decay time of the laser induced incandescence signal [Ref 1]

Conditions

Pressure: 1 bar

Cold gas velocity (at 1atm and 298K): 6.44 cm/s

=2.1 (C/O=0.7) – Fuel: 12.8 % - O₂: 18.3 % - N₂: 68.9 %

- Temperature profile – Ref 6
- Soot volume fraction – Ref 1, 4, 5
- Particle diameter – Ref 1,6

=2.3 (C/O=0.767) – Fuel: 13.87 % - O2: 18.09 % - N2: 68.04 %

- Temperature profile – Ref 2
- Soot volume fraction – Ref 1, 4, 5
- Particle diameter – Ref 1

=2.34 (C/O=0.78) – Fuel: 14.0 % - O2: 18.0 % - N2: 68.0 %

- Temperature profile – Ref 8
- Soot volume fraction – Ref 8
-