## Sooting Flames #1

### Apparatus


A water-jacketed tubular burner was constructed which was filled with silver capillary tubes. A 56 mm diameter steel capillary burner was used. The central flat flame burner was surrounded by a flat shielding burner. Both burners were protected against convection of the surrounding air by a glass tube with a grid on top (see figure). [Ref 3]

### Measurements

Soot volume fraction, fv, and particle number density, N, were evaluated from scattering (at 488 nm) and absorption (from 650 to 810 nm) signals. The complex refractive index of Dalzell and Sarofim was used (m=1.57-0.56i).

For optical temperature measurements, a calibrated halogen lamp served as light source with filters for wavelengths, in most cases 473 nm and 654 nm.

To create changes in the flame temperature (quoted at 10mm HAB), the total flow through the burner at constant fuel-air ratio was changed. The time-scale was obtained from the temperature profiles and the changes of mole numbers.

### Conditions

*Pressure*: 1 bar

=2.07 (C/O=0.69) – Fuel: 12.7 % - O2: 18.3 % - N2: 69.0 %

$V_0$=3.21 cm/s, 3.48 cm/s, 3.74 cm/s, 4.01 cm/s, 4.28 cm/s, 5.35 cm/s, 5.88 cm/s

- Temperature profiles
- Soot volume fraction profiles
- Number density profiles

=2.16 (C/O=0.72) – Fuel: 13.1 % - O2: 18.2 % - N2: 68.6 %

$V_0$=2.94 cm/s, 3.21 cm/s, 3.74 cm/s, 4.01 cm/s, 4.54 cm/s, 5.35 cm/s, 5.61 cm/s, 6.15 cm/s

- Temperature profiles
- Soot volume fraction profiles
- Number density profiles

### Notes

The residence times for the volume fraction and number density measurements were evaluated from the cold gas velocity, the local temperature, the nitrogen mole fraction, and the shape of the flame. As the temperature profile was only partially measured, as shift (in time) between experiments and simulation results is to be expected.

**References**


1. H. Bohm, D. Hesse, H. Jander, B. Luers, J. Pietscher, H. GG. Wganer, M. Weiss, Proc. Comb. Inst. 22 (1988) 403-411.
2. H. Jander, Private communication.
3. H. Matzing, H. Gg. Wagner, Proc. Comb. Inst. 21 (1986) 1047-1055.