Glossary of symbols

Symbols used in this thesis are listed below. Units, where given, refer to the most common usage and other units were sometimes used when convenient. Values of constants are from *NIST standard reference databse number 69*, March 2003, `http://webbook.nist.gov/chemistry/`.

A	Integrated absorbance due to a spectral line $[\mathrm{cm}^{-1}]$
A	Area $[\mathrm{m}^2]$
A_m	Measured, or apparent, integrated absorbance $[\mathrm{cm}^{-1}]$
c	Speed of light $(2.997 \times 10^8\,\mathrm{ms}^{-1})$
c_2	Second radiation constant, $c_2 = hc/k$
C_f	Feedback capacitor.
C_p	Specific heat capacity
d	Characteristic length scale, cylinder diameter $[\mathrm{m}]$
e	The electronic charge $(1.602 \times 10^{-19}\,\mathrm{C})$
E'	Upper state energy level $[\mathrm{cm}^{-1}]$
E''	Lower state energy level $[\mathrm{cm}^{-1}]$
G	Detector gain
$g(\nu)$	Absorption line shape
h	Planck's constant $(6.626 \times 10^{-34}\,\mathrm{Js})$
h	Convective heat transfer coefficient
I	Initial beam intensity
I_0	Transmitted beam intensity
i_ref	Reference beam photocurrent
i_sig	Signal beam photocurrent

I_{ref}	Reference beam intensity
I_{sig}	Signal beam intensity
J_{K_a,K_c}	Rotational quantum numbers, see section 4.1
k	Boltzmann's constant (1.381×10^{-23})
k	Thermal conductivity
k_ν	frequency-dependant absorption coefficient $[\text{cm}^{-1}]$
l	The length the beam travels through the absorbing medium [cm]
L/D	Length-to-depth ratio (of a cavity)
M	Molecular mass $[\text{g mol}^{-1}]$
n	Refractive index
N_A	Avogadro's number ($6.022 \times 10^{23}\,\text{mol}^{-1}$)
N_K	Number density of species K $\left[\text{molecules cm}^{-3}\right]$
Nu	Nusselt number, $\text{Nu} = hd/k$
P	Pressure [kPa]
P_K	Partial pressure of species K [kPa]
Pr	Prandtl number, $\text{Pr} = C_p\mu/k$
$Q(T)$	Partition sum
$Q_1, Q_2, \ldots$	Semiconductor device 1, semiconductor device 2,...
$\dot{q}_{\text{c}}$	Convective heat transfer per unit area
$\dot{q}_{\text{r}}$	Radiative heat transfer per unit area.
R_{ls}	Ratio of line strengths, $R_{ls}(T) = S_1(T)/S_2(T)$
R	The molar gas constant ($8.314\,\text{Jmol}^{-1}\text{K}^{-1}$)
R_K	The specific gas constant for species K $\left[\text{Jkg}^{-1}\text{K}^{-1}\right]$
$R_1, R_2, \ldots$	Resistor 1, Resistor 2,...
Re	Reynolds number, $\text{Re} = \rho u d/\mu$
$S(T)$	Line strength $[\text{cm}^{-1}/(\text{molecule cm}^{-2})]$
T	Temperature [K]
T_{f}	Film temperature $T_{\text{f}} = \left(T_{\text{g}} + T_{\text{tc}}\right)/2$
T_{g}	Gas temperature [K]
T_{s}	Temperature of surrounding environment [K]

T_{tc}	Thermocouple junction temperature [K]
u	Velocity $[\mathrm{ms}^{-1}]$
v_1, v_2, v_3	Vibrational quantum numbers, see section 4.1
V_{out}	Output signal [V]
α	Absorptivity
γ_d	Gaussian, or Doppler broadening, width at half-maximum $[\mathrm{cm}^{-1}]$
γ_l	Lorentzian, or pressure broadening, width at half-maximum $[\mathrm{cm}^{-1}]$
ϵ	Emissivity
λ	Wavelength [nm]
μ	Viscosity
ν	Frequency $[\mathrm{cm}^{-1}]$
ν_0	Transition centre frequency $[\mathrm{cm}^{-1}]$
ν_{FSR}	Free spectral range $[\mathrm{cm}^{-1}]$
ρ	Density
σ_K	Standard deviation in variable K
σ	Stefan–Boltzmann constant ($5.6704 \times 10^{-8}\,\mathrm{Wm^{-2}K^{-4}}$)
ϕ	Fuel–air equivalence ratio