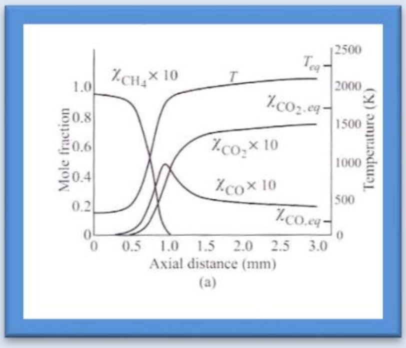
Key words Or Question???	Subject: **combustion engineering** Topic: **flame** Week: **3**

Structure of CH4-Air flame

The structure of a premixed flame in fig (1)shows the temperature distribution and selected species mole fraction profiles (the principal C-containing CH4,CO,and CO2) through a1-atm ,stoichiometric



the disappearance of the fuel, the appearance of the intermediate species CO and burnout of the CO to form CO2 .the CO concentration has its peak value at approximately the same location where the CH4 concentration goes to zero , whereas the CO2 concentration at first lags the CO concentration but the continues to rise as the CO is oxidized .Figure (6) shows that C- intermediate species CH3,CH2O AND HCO , are produced and destroyed in a narrow interval (0.4-1.1mm).

FLAME SPEED CORRELATIONS FOR SELECTED FUELS

Metghalchi and Keek experimentally:

$$S_L = S_{L,\mathrm{ref}}\left(\frac{T_u}{T_{u,\mathrm{ref}}}\right)^{\gamma}\left(\frac{P}{P_{\mathrm{ref}}}\right)^{\beta}(1-2.1Y_{\mathrm{dil}}),$$

For $Tu > 350$ K . The subscript ref refers to reference conditions defined by Tu,ref.r =289K and P =1 atm .

$S_{L,ref} = B_M + B_2(\Phi - \Phi_M)^2$ (2)

Where the constants BM, $B2$, and ΦM depend on fuel type and are given in table 1 The temperature and pressure exponents, γ and β, are functions of the equivalence ratio, expressed as

$$\gamma = 2.18 - 0.8(\Phi - 1)$$

$$\beta = -0.16 + 0.22(\Phi - 1).$$

	The term Y_{dil} is the mass fraction of diluents present in the air-fuel mixture Table 1 values for BM, $B2$, and ΦM

Fuel	Φ_M	B_M cm/s	B_2 cm/s
Methanol	1.11	36.92	-140.51
Propane	1.08	34.22	-138.65
Isooctane	1.13	26.32	-84.72
RMFD-303	1.13	27.58	-78.34

Gas- Fired Furnace combustion

Energy Balance and Furnace Efficiency

$$N_a h_a + N_f h_f = q + q_L + \sum_{J=1}^{J} N_j h_j$$

Where p stands for product in term of the sensible enthalpy fuel heating value and enthalpy of vaporization of water . The energy balance

For complete combustion 100% combustion efficiency
q = useful heat output

The fuel and air flow rates required foe a given heat output are collected from an energy and mass balance for a control volume placed around the combustion chamber heat exchanger- mixer

Furnace Efficiency

as the ration of the useful heat output to the energy input. In general for any type of fuel.

What is measures can be increased The furnace efficiency

1- Decrease the temperature of the exhaust products
2- Reduce the excess air which will reduce the moles of products per mole of fuel and also reduces the blower power.
3- Reduce the extraneous heat loss
4- Reduce the blower power requirements

$$\text{Where } \frac{N_P}{N_f} = \frac{N_P}{N_c} * \frac{N_c}{N_f} = \frac{N_c/N_f}{x_{CO_2} + x_{cc}}$$

Summery /comment: