Module 6: Diffusion Flame

Lecture 30: Mechanism of Soot Formation

The Lecture Contains:

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Mechanism of Soot Formation

Process of soot formation:

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Mechanism of Soot Formation

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Liquid Fuel Combustion

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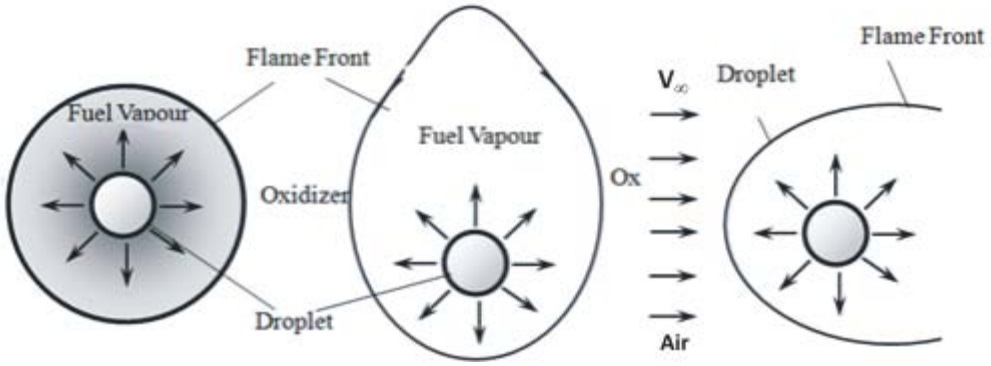
Processes during droplet combustion



(Figure 30.1)

Factors affecting the shape of the flame front:

Condition under which combustion takes place!

Zero gravity : Spherical flame front (No buoyancy)

Normal gravity : Elongated (Due to natural convection)

Forced convection condition : Fame aligned with flow

Energy required to vaporize the liquid fuel:

$$Q_V = \Delta H_V + C_L(T_S - T_\infty)$$

Latent heat of vaporization — Sensible enthalpy

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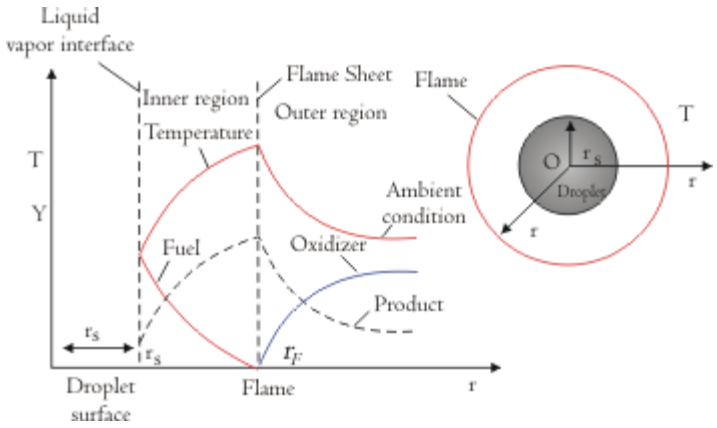
Liquid Fuel Combustion (Contd.)

Assumptions

1. Single droplet in quiescent atmosphere.
2. Droplet temperature is uniform.
3. Density of liquid fuel much higher than the gas phase.
4. Fuel is a single component with no solubility for gases.
5. Flow velocities are assumed to be low
6. Single step irreversible reaction! ⇒ Thin flame approximation.
7. Constant thermo-physical properties.
8. Unity Lewis number.
9. Radiation heat transfer is neglected.
10. No other phase is formed in the liquid fuel droplet.



(Figure 30.2)

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