

Course Name: Theory of Fire Propagation (Fire Dynamics)

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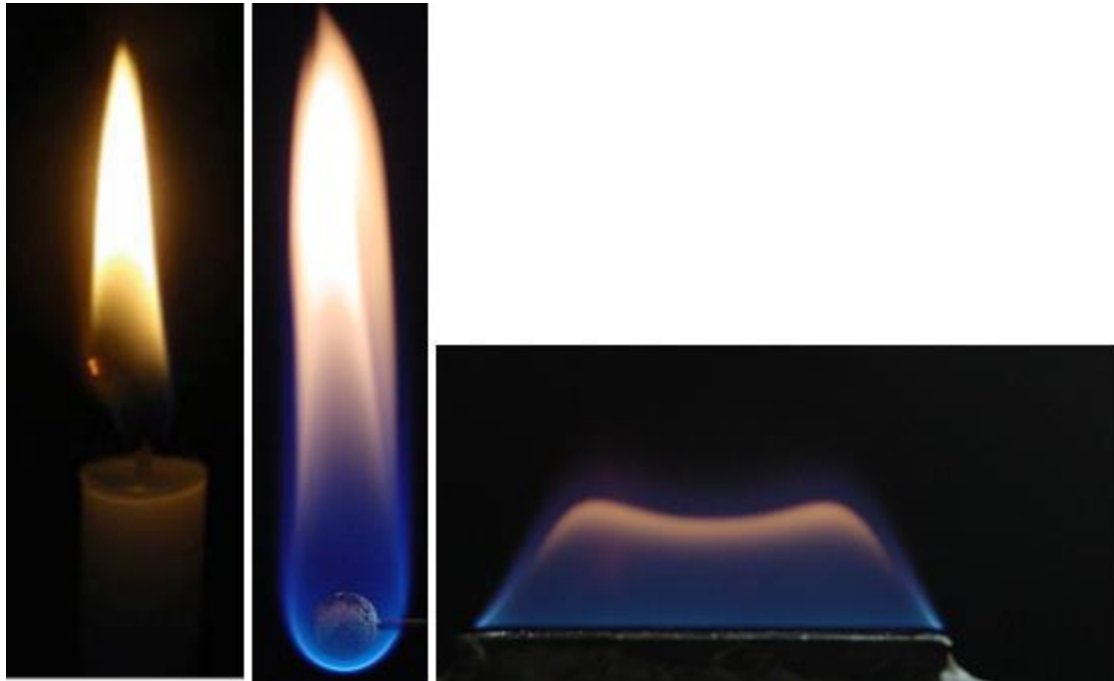
Week – 05

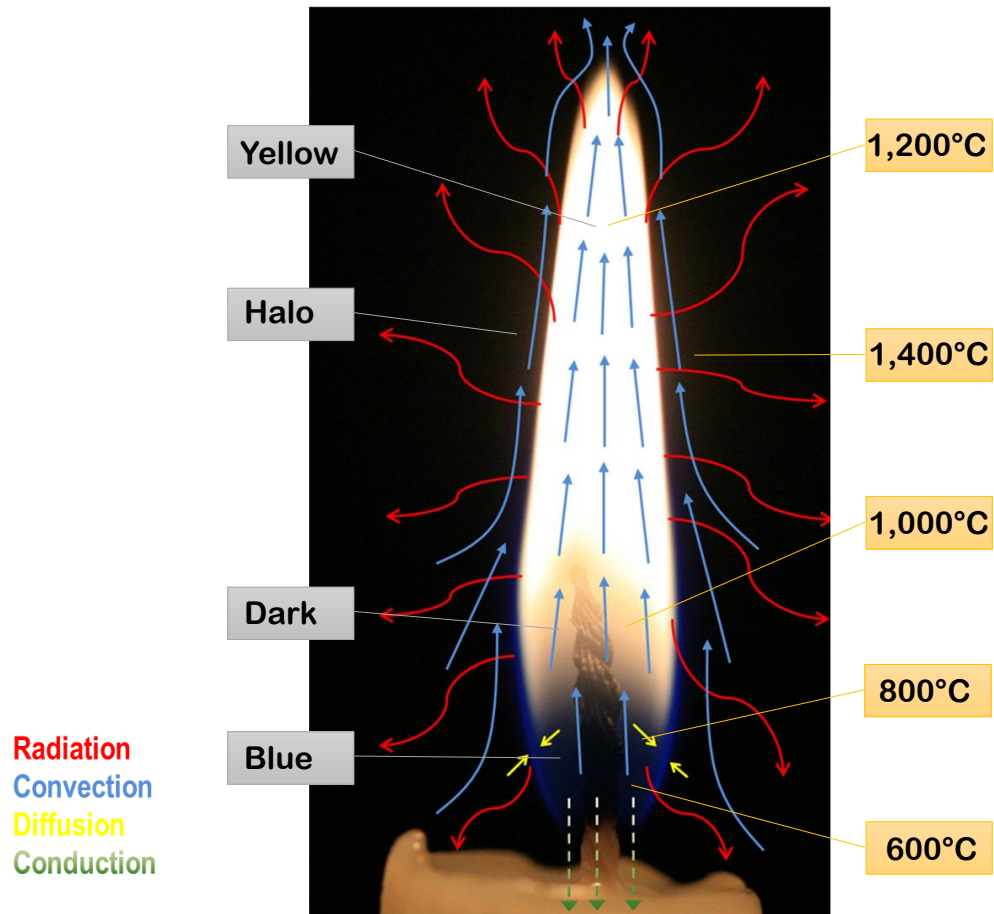
Lecture – 01

Module 3 – Review of Premixed and Diffusion Flames

Laminar diffusion flames:

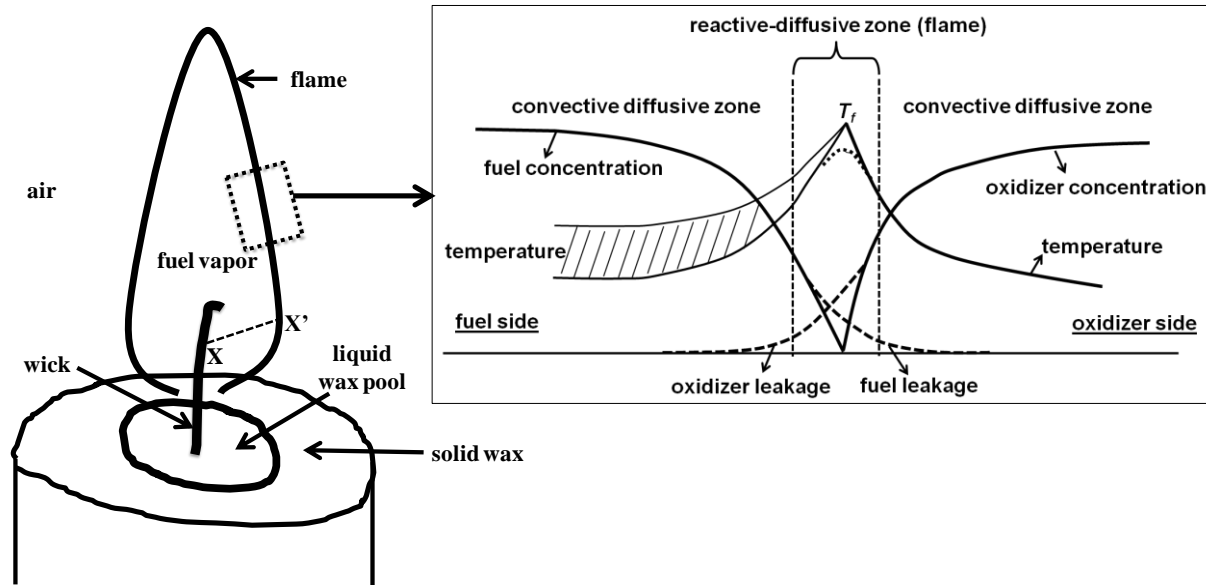
When condensed fuels such as solid and liquid fuels burn, diffusion flames are formed over their surfaces. Examples are candle flame, a flame surrounds the wick attached to the candle, flame over a porous sphere, steadily supplied with a liquid fuel and a flame over a liquid fuel pool surface.





Diffusion flame and its structure:

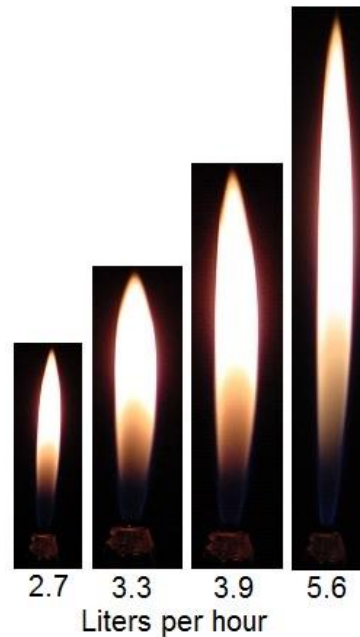
Consider a candle flame. Solid wax, melts, vaporizes and vapor reacts with oxygen in air from ambient at the flame zone.



Diffusion flame – colours and length:

Consider a jet of gaseous fuel such as Liquefied Petroleum Gas (LPG), which is a higher order hydrocarbon fuel, injected from a port. A jet diffusion flame forms. In the laminar regime, as the flow rate of the fuel increases, the

flame length also increases. Premixed flames display bright blue and non-luminous blue colours, the diffusion flames, display a range of colours including bright yellow or orange colour.



These are non-luminous near the burner rim, where fresh air from ambient mixes with the emerging fuel jet. Further upwards for burner exit, soot inception and its growth take place. The bright emission arises basically from soot radiation. Laminar jet diffusion flames are quite steady, even though tip oscillations are observed above a certain fuel flow rate. Based on the fuel and oxidizer supply, soot incepted may not be oxidized and soot particles may leave the flame tip as smoke.