Course Name: Theory of Fire Propagation (Fire Dynamics)

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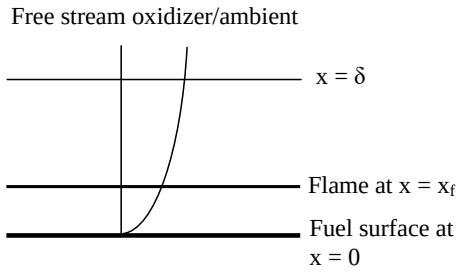
Week – 07

Lecture – 01

Module 4 – Burning of Liquid Fuels

Theoretical analysis of steady mass burning rate:

A theoretical analysis of steady mass burning rate is done using the approach to analyse a diffusion flame. Only the gas-phase is solved. Boundary conditions at the fuel surface are the coupling conditions at the interface. An infinitely fast rate chemistry formulation is considered. Since the dynamics are involved in the direction normal to the fuel surface, a one-dimensional (x) coordinate is used.



Theoretical analysis – formulation:

Oxygen is transported from ambient towards the flame ($x = x_f$). Velocity in the direction parallel to fuel surface is low (laminar). Fuel is transported to the flame from liquid surface at $x = 0$. Fuel and oxygen are consumed at the flame sheet (at $x = x_f$). Reaction zone is well within the boundary layer ($x = \delta$); δ, is calculated as a function of Reynolds number. Radiative heat transfer is neglected.