Course Name: Theory of Fire Propagation (Fire Dynamics)

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Week – 01

Lecture – 03

Module 1 – Basics of Fires

Properties of combustible materials

Calorific value (J/kg): One of the important properties for all the combustible materials - heat released when one kg of the material is completely burnt.

Important thermo-physical properties: Thermal conductivity, k, (W/m-K), specific heat, c, (J/kg-K) and density, ρ kg/m^3). From these, two more properties are derived: thermal diffusivity - $k/(\rho c)$ and thermal inertia – $\rho k c$.

Stoichiometric air: Quantity of air (in kg) required to burn one kg of the material completely.

Standard heat of combustion (J/kg-fuel): Heat released when one kg of combustible material from standard condition (1 atm, 298 K) is burnt completely using air and the products are cooled to 298 K. This is also same of calorific value; called lower calorific value when all the water in the product of combustion is in vapor-phase and called higher calorific value, if water is in liquid-phase. Heat of combustion is also written in terms of per kg of oxygen (J/kg-O_2) and are calculated based on the chemical composition of the fuel.

Standard enthalpy (J/kmol): A specific property equal to the sum of standard enthalpy of formation (enthalpy associated with the formation of the material from its naturally occurring elements) and sensible enthalpy (enthalpy rise due to increase intemperature from 298 K to the given temperature value).

Adiabatic flame temperature: Maximum flame temperature in firewhen there is no loss of heat to the surroundings (theoretical quantity).