Flame & Combustion

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What is combustion

Combustion is a exothermic oxidation of a fuel at high temperature.

\[ C + O_2 \rightarrow CO_2 + Q \]

WHAT IS A FLAME

Flame is a zone of intense chemical reaction with liberation of heat and light
Flame types

Diffusion flame

Premixed flame
Flame velocity

Flame travels at a specific speed against the unburnt mixture. This speed is equal to the local mixture velocity for a stable velocity, and it depends on;

1. Fuel: air mixture ratio (increases and decreases)
2. Preheat temperature of the mixture (increases)
3. Turbulence intensity in the flow field (increases)

This velocity is also called burning velocity. This velocity is equal to the local velocity of the unburnt gas normal to the flame front.
Flame velocity

Equivalence ratio

Flammability limits
Temperature (°C)

0     3     15     200

Time (s)

Drying and Heating

Volatile Release

Ignition

Secondary fragmentation

Attrition fines

Primary fragments

\( d_v = 3 \text{ mm} \)
Coal Combustion