

**Course Name: Theory of Fire Propagation (Fire Dynamics)**

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**Week – 10**

**Lecture – 01**

**Module 7 – Enclosure Fires**

Enclosure Fires:

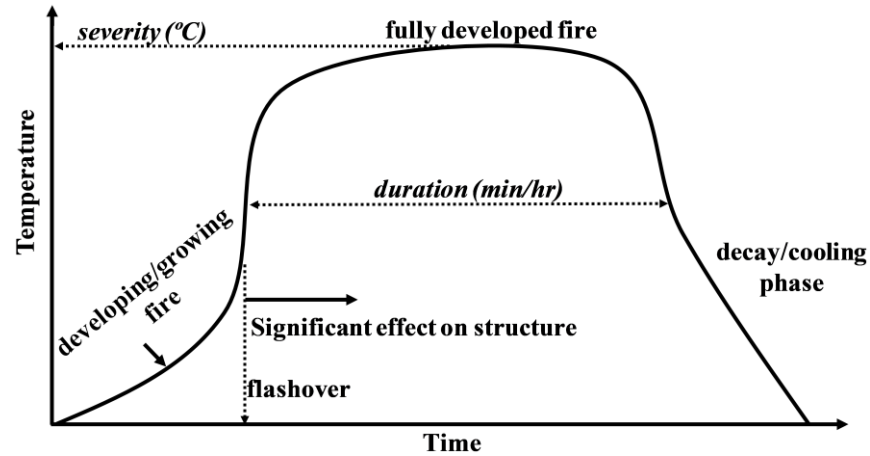
Fire happening in enclosures such as rooms, compartments, and confined spaces is called enclosure or compartment fire. An enclosed space can be a small closet, a single room in a building, a large atrium, a vehicle, an aircraft cabin, or a space shuttle. Understanding enclosure fires involves understanding of ignition of materials, pyrolysis, flame dynamics, plumes, hot layers, wall heat transfer, and fire-induced flows through openings such as vents, doors, and windows. The objective from a fire safety perspective in this analysis is to calculate the response of the fire on the structure and people. This includes analysis of fire growth rate, time to reach critical conditions that can cause maximum damage, time required to evacuate the people, and time it takes to cause structural failure.

Enclosure fire – stages:



Ignition (0 s); Growth (71 - 222 s); Flash over (~277 s); Developed fire; Decay

Enclosure fire – T vs. t:



Well before flash over, fire should be detected & people should be evacuated. Fire should be put-off before flash over to save structures.

Enclosure fires – ignition and growth:

Ignition can occur by piloted ignition (flame, spark, hot spot, high radiative heat flux) or by spontaneous ignition. This often results in a flaming combustion scenario. Fire grows within the ignition zone and soon ignites the other commodities in the room. In the early stages, enclosure seems to have no effect on the fire. Fire spreads and ignites the adjacent flammable materials. The flame rises and eventually touches the ceiling, besides spreading on other objects in the room. Hot gases rise upward because of buoyancy and fill the ceiling as a light grey smoke initially and then as a thick black smoke. The temperature of the smoke layer varies between 500°C – 600°C and contributes to radiatively heating the entire enclosure.