Modelagem e Simulação de Incêndios

Fire dynamics

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INTRODUÇÃO

Fire dynamics is a very quantitative and mathematically complex subject.

The term fire dynamics came into common use in the fire community only in 1980, 1990. Even “fire protection engineering” programs in the 1970s weren’t teaching courses entitled fire dynamics. However, the science of fire growth and mathematical descriptions of fire phenomena were taught.

In 1978, the Worcester Polytechnic Institute (WPI) developed a curriculum for its Master of Science degree in fire protection engineering. They decided to include a course called Fire Dynamics. There was a clear understanding of the need to teach students about the physics of fire.

Introdução

At that time, there were no textbooks on the subject suitable for engineering students. So WPI invited Douglas Drysdale, Ph.D., of the University of Edinburgh's Department of Fire Safety Engineering, to come for a semester to develop the course and textbook. The book resulting from this collaboration, *An Introduction to Fire Dinamics,* was published in 1985 and quickly become a "best seller“ in the fire protection engineering profession.

The term fire dynamics became an integral part of the language of fire and fire protection. Fire dynamics is a recent and now universal term. The distinction of “fire dynamics” as the study of the physics of fire, and “fire chemistry” as the study of the chemistry of fire has, to some extent, been lost.

Tipos de Chamas

Diffusion Flames

Premixed Flames

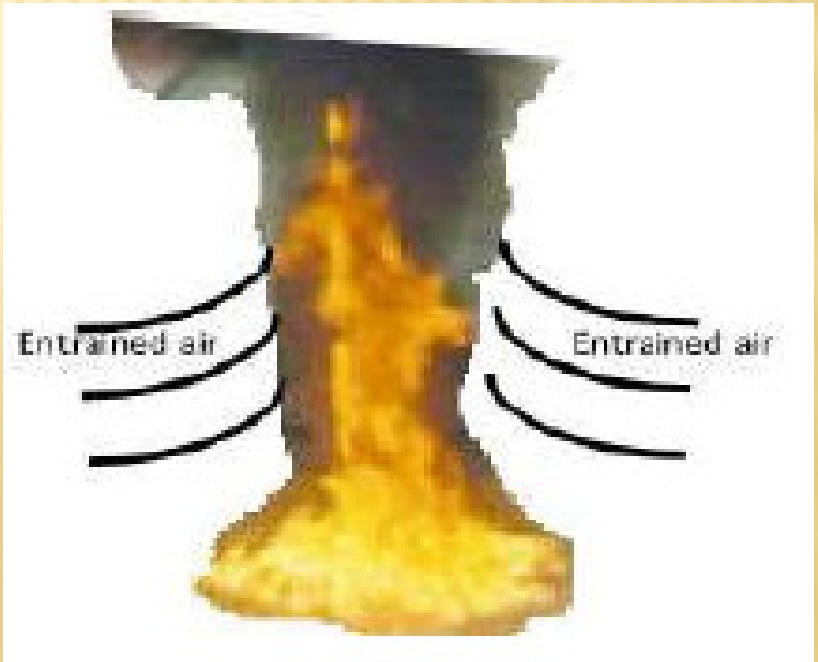
Tipos de Chamas

Diffusion Flames

When the fuel and oxygen are initially separate and mix only in the flame, they are known as “diffusion flames”. Figure illustrates the mixing of entrained air with the fuel, providing oxygen for combustion. Most hostile fires we see have diffusion flames.

Fuel

gas **liquid** **solid**



Tipos de Chamas

Diffusion Flames

Combustível: **gás** A vazão de combustível é dada pela vazão de escape do gás.

Jet fire

Tipos de Chamas

Diffusion Flames

Combustível: **líquido**

A vazão de combustível depende da taxa de passagem de líquido para gás.

Pool fire

石油タンクの全面火災
Total fire of a petroleum tank

Tipos de Chamas

Diffusion Flames

Combustível: sólido

A vazão de combustível depende da taxa de passagem de sólido para líquido e deste para gás. Embora alguns combustíveis sólidos possam passar direto para gás.

Tipos de Chamas

Diffusion Flames

Combustível: sólido

A vazão de combustível depende da taxa de passagem de sólido para líquido e deste para gás. Embora alguns combustíveis sólidos possam passar direto para gás.

Esse tipo de estrutura é usada para classificar eficiência (e equivalência de extintores para Classe A)

Tipos de Chamas

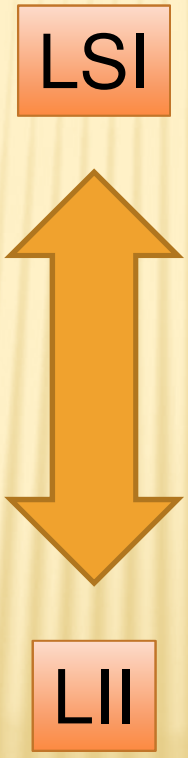
Premixed Flames

Flames where fuel and oxygen are mixed prior to combustion are known as “premixed flames”. When there is an explosion there is a premixed flame (fuel and air).

One example is natural gas leaking into a building. The natural gas mixes with the air in the building, then finds an ignition source, and explodes.

Tipos de Chamas

Premixed Flames



NOMENCLATURA BÁSICA

Energy, heat rate and flux

Energy:

In the S.I. system of units, joules (J) is the unit for energy, including heat.

Q (Example: heat release rate): → **Taxa**

We usually use joules per second (J/s) for the rate of heat transfer.
This is simplified to the watt (W) which is joules per second (J/s.)
Generally we use 1000 watts abbreviated as kW.

q" (Example: heat flux): → **Fluxo**

Another useful unit for fire protection is the amount of heat transferred per unit area.
This is kilowatts per square meter (kW/m2).

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É importante reconhecer a unidade,
pois muitas vezes
a variável é descrita apenas como “heat”.

q” (Example: heat flux):

Another useful unit for fire protection is the amount of heat transferred per unit area.
This is kilowatts per square meter (kW/m2).

Energy, heat rate and flux

One J/s = one W

Q = heat transferred, kW.

q'' = heat transferred per unit area, kW/m^2