INGENIERÍA EN SEGURIDAD CONTRA INCENDIOS

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CONOCIMIENTO

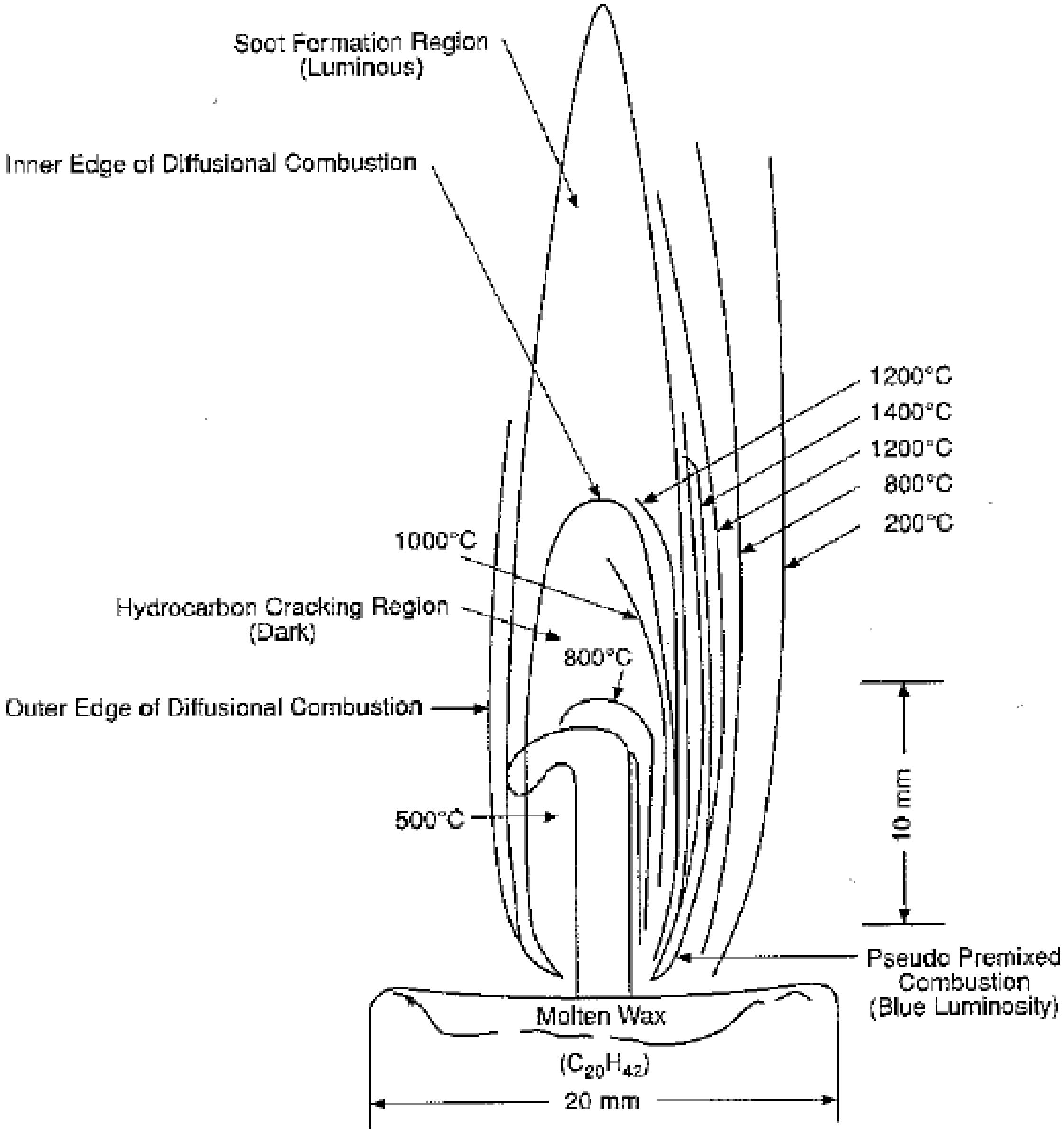
INGENIERÍA EN SEGURIDAD CONTRA INCENDIOS

"Es la aplicación de la Ciencia y los principios de la Ingeniería para la protección de las personas y su medio de los daños provenientes de los incendios"

HISTORIA

Idiem
UN SIGLO DE CONFIANZA Y RESPALDO

Combustión



Soot Formation Region
(Luminous)
Inner Edge of Diffusional Combustion
1200°C
1400°C
1200°C
800°C
200°C
1000°C
Hydrocarbon Cracking Region
(Dark)
800°C
Outer Edge of Diffusional Combustion
500°C
10 mm
Pseudo Premixed
Combustion
(Blue Luminosity)
Molten Wax
$(C_{20}H_{42})$
20 mm

Incendios

- Ignición
- Gases calientes
- Jets de cielo
- Modelos de zona
- Descenso capa gas
- Transferencia de calor
- Ventilación
- Flashover
- Incendio totalmente desarrollado
- Falta de oxígeno
- Backdraft
- Explosión de humos

Incendios

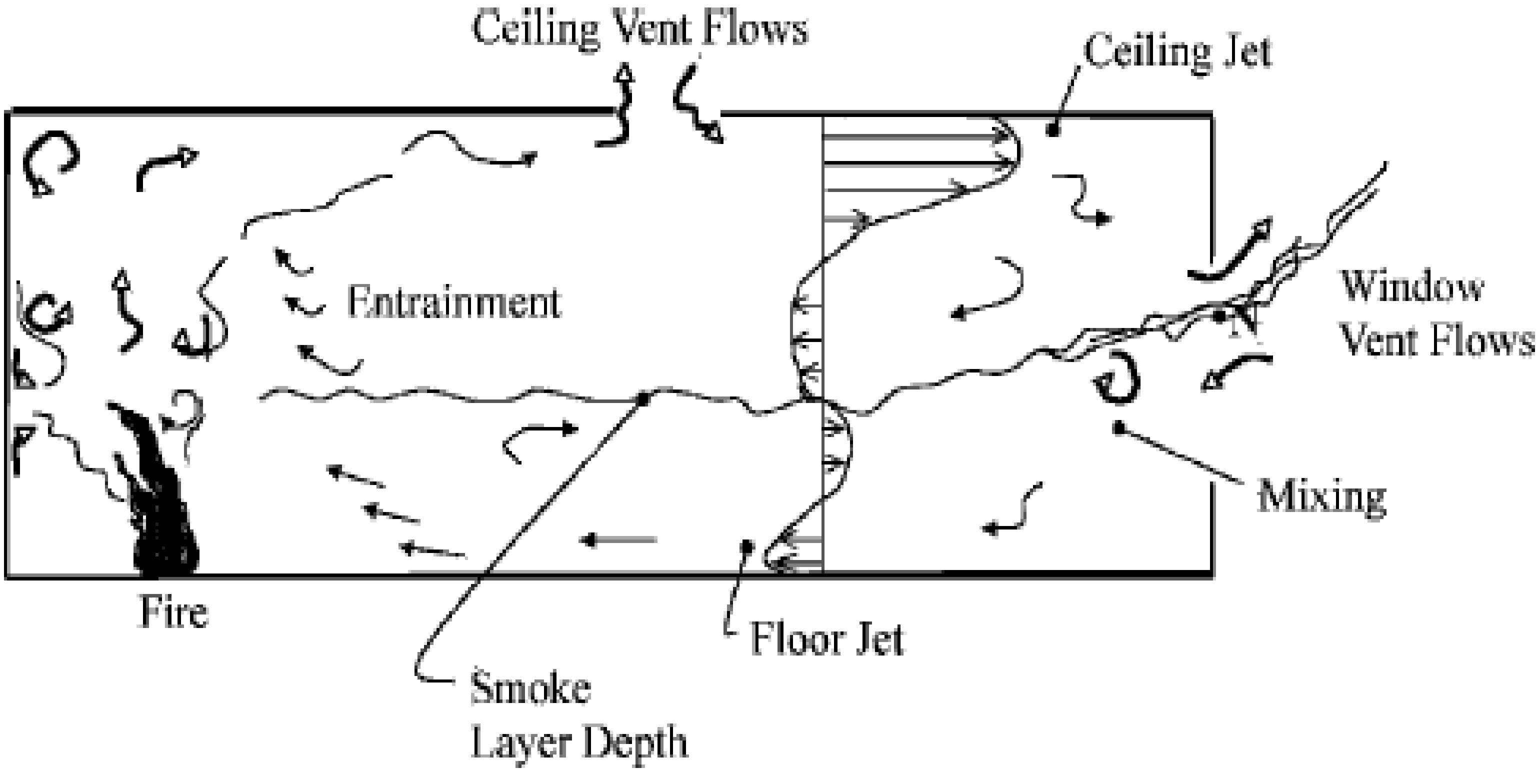
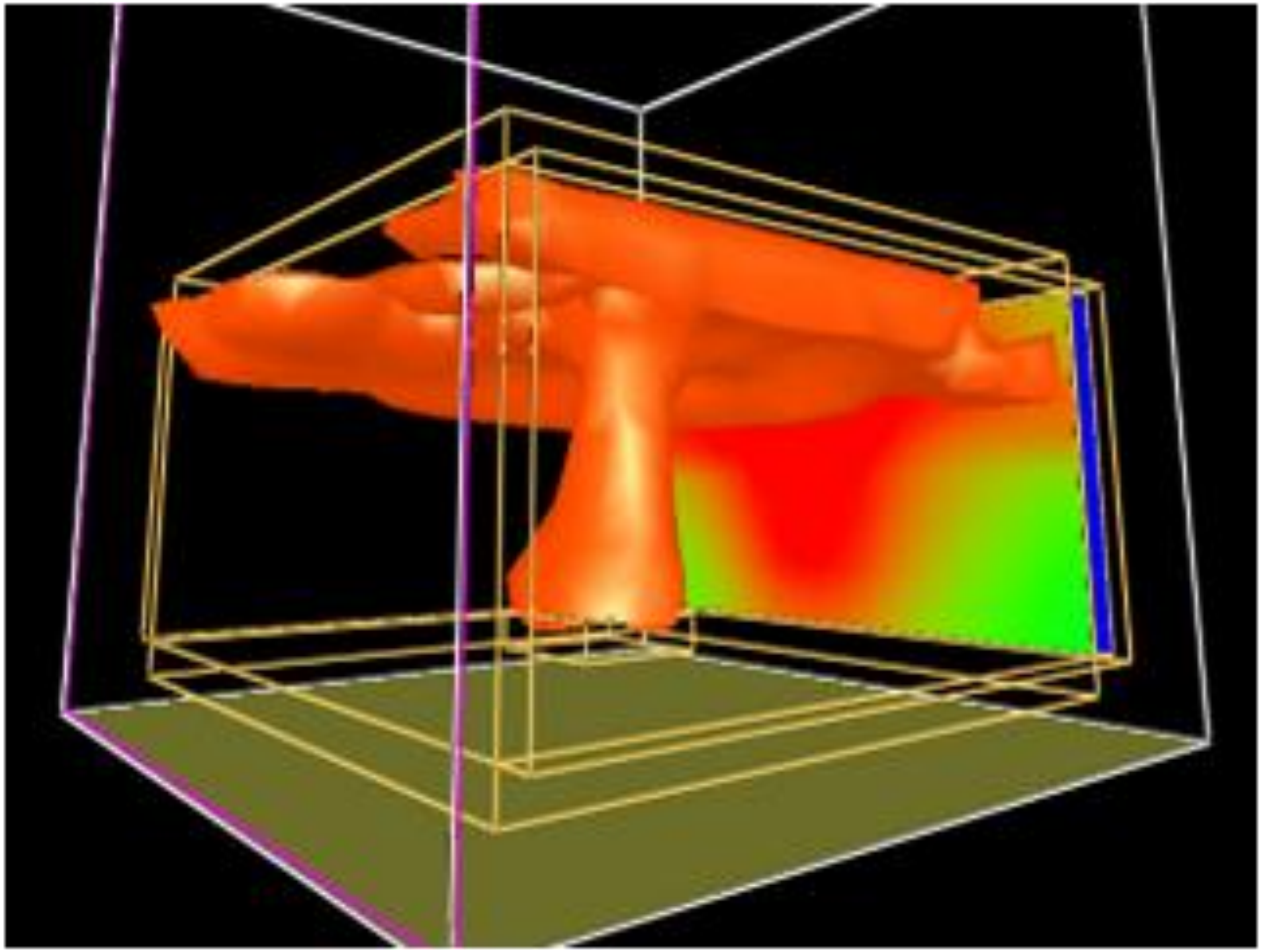
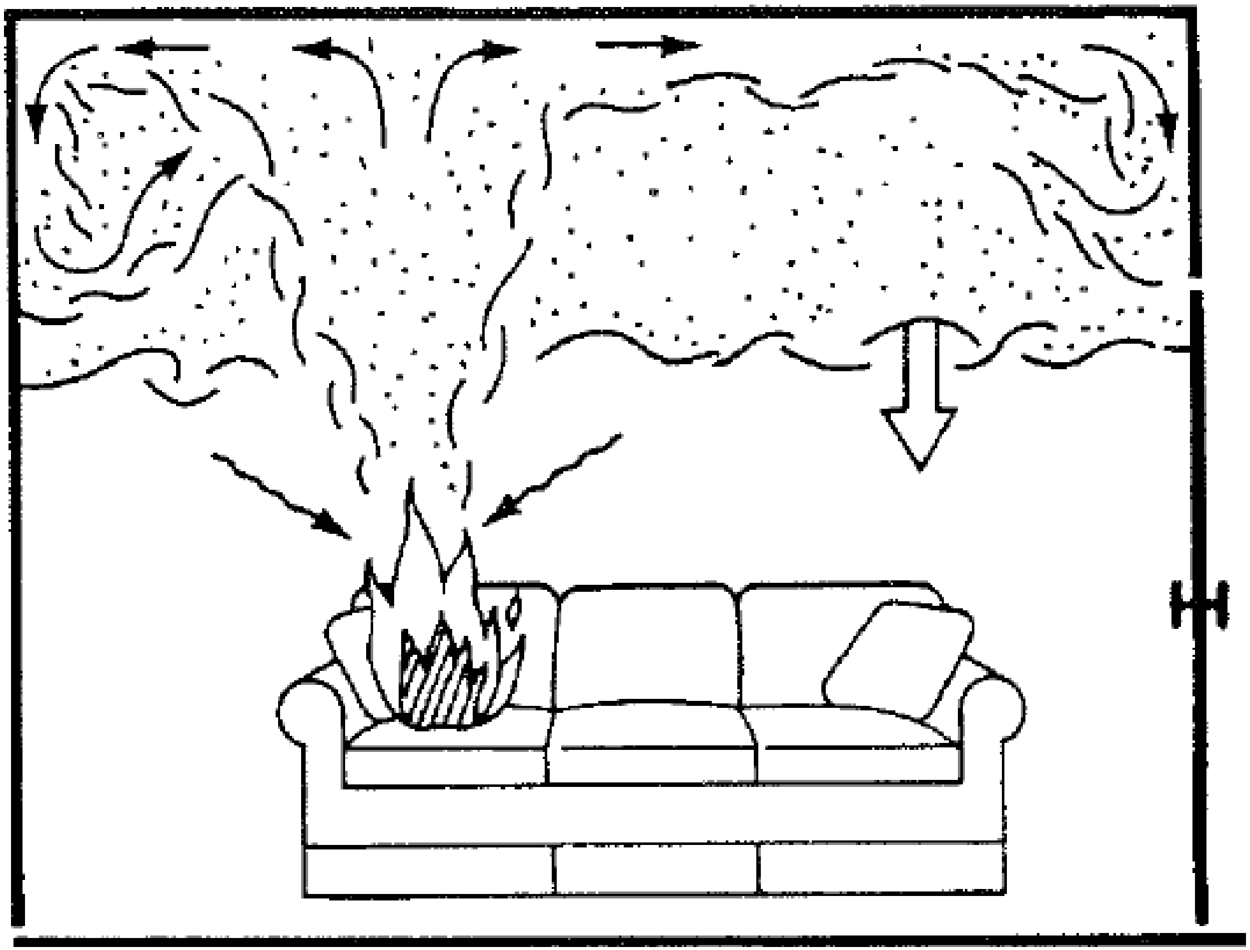


Figure 11.3 Flow pattern in a compartment fire

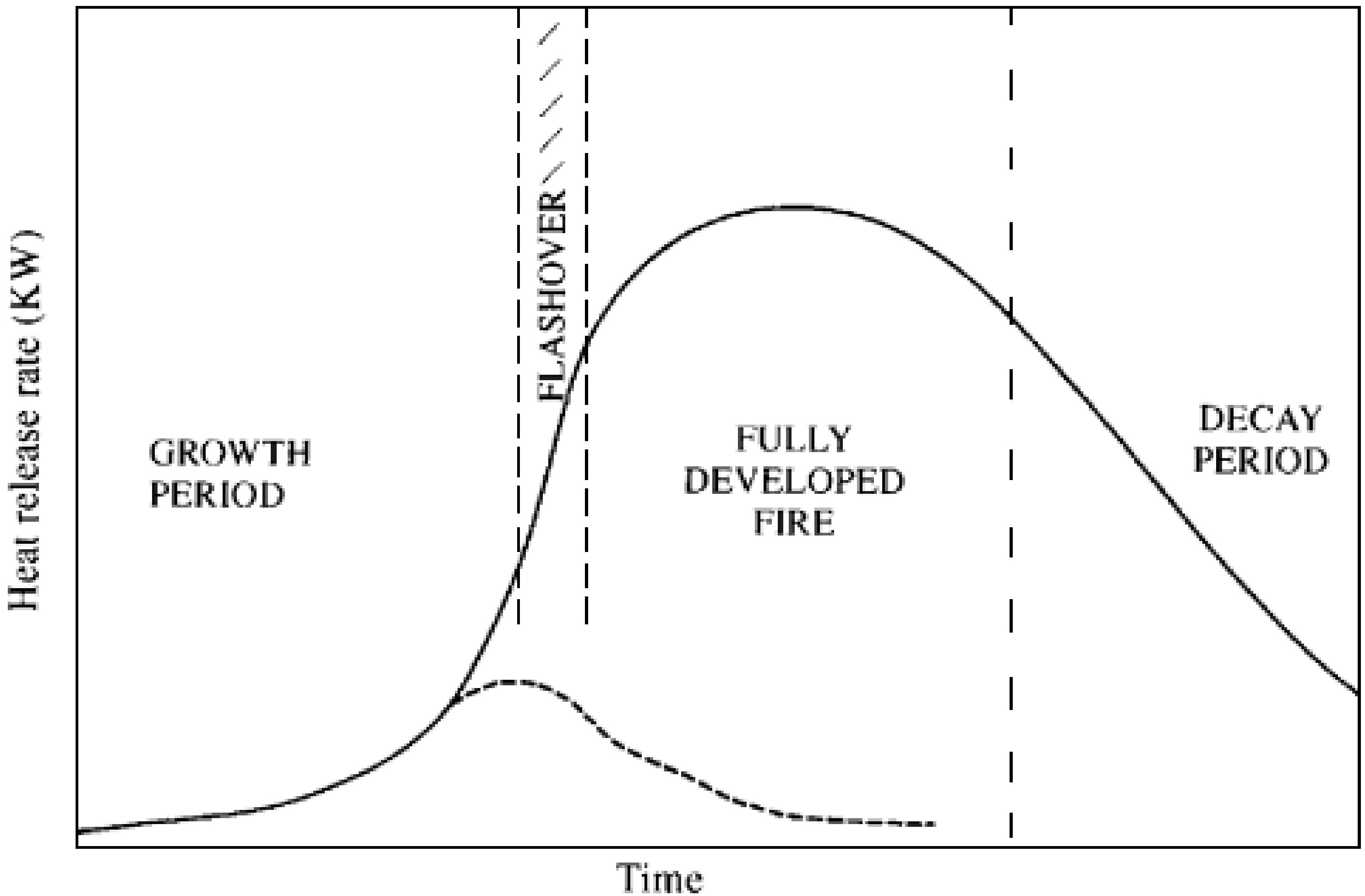
Incendios



Incendios



Etapas



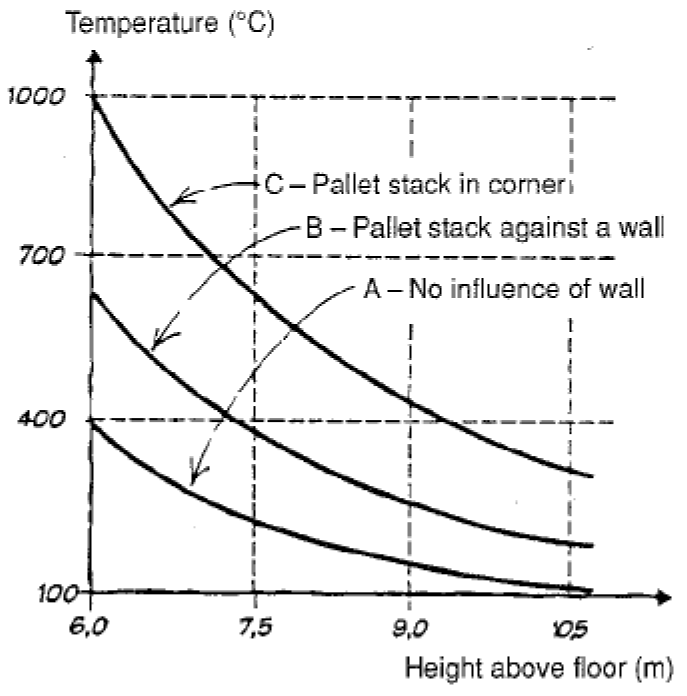
FLASHOVER
GROWTH PERIOD
FULLY DEVELOPED FIRE
DECAY PERIOD
Heat release rate (KW)
Time

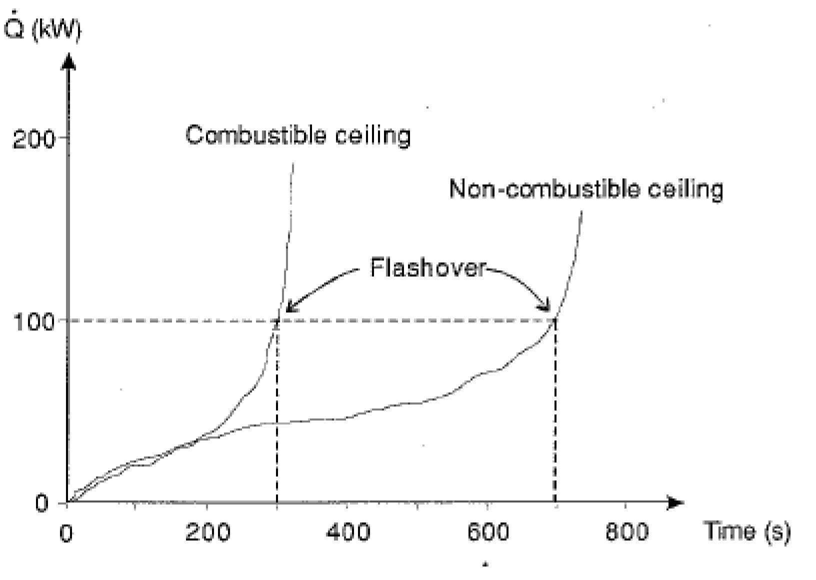
Incendios

UN SIGLO DE CONFIANZA Y RESPALDO

Influencias

- Ignición
- Combustible



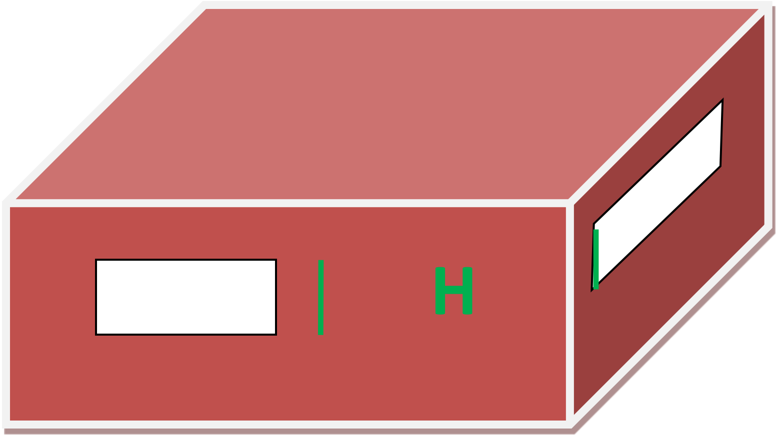


UN SIGLO DE CONFIANZA Y RESPALDO

Influencias

- Geometría
- Aberturas
- Aislación

$$F = \frac{A\sqrt{H}}{A_T}$$



Potencia, Energía.

- Burning rate (kg/s) (kg/m^2s)
- Eficiencia de la combustión.
- Potencia (Heat release rate) (kW, MW)
- Calor de combustión (kJ/kg)

TABLE 3.1
Rough Measure of Energy Released or Generated from Various Sources

A burning cigarette	5 W
A typical light bulb	60 W
A human being at normal exertion	100 W
A burning wastepaper basket	100 kW
A burning 1m^2 pool of gasoline	2.5 MW
Burning wood pallets, stacked to the height of 3 m	7 MW
Burning polystyrene jars, in cartons, 2 m^2, 4.9 m high	30–40 MW
Output from a typical reactor at a Nuclear Power Plant	500–1000 MW

Design Fire.

- Relación Potencia v/s tiempo
  - Tipo, cantidad y orientación del combustible, y el compartimento.

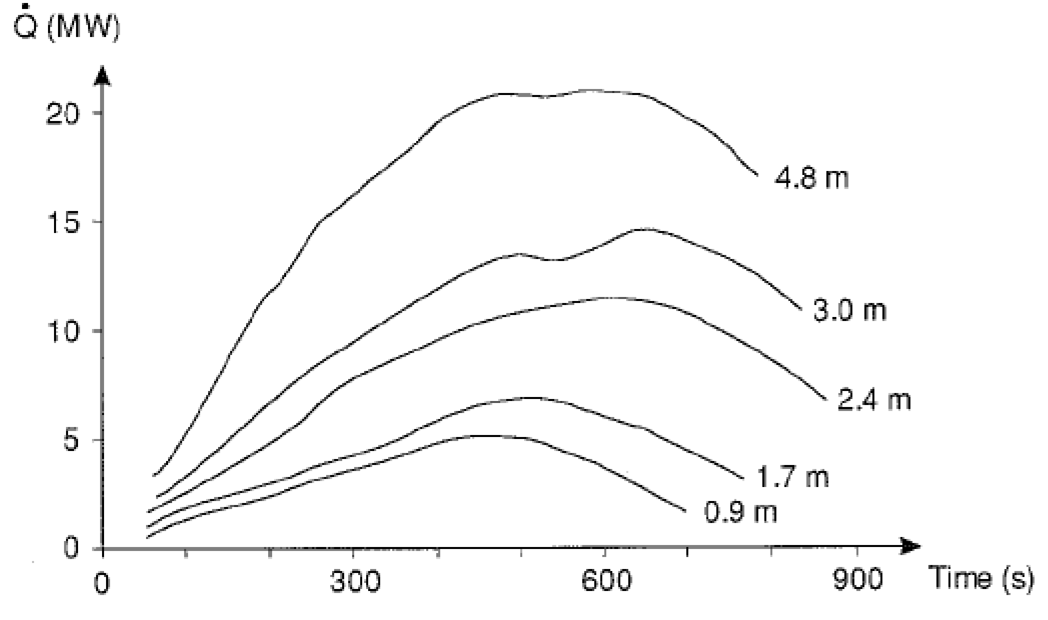


FIGURE 3.1 Energy release rate measured when burning 1.2 m by 1.2 m wood pallets, stacked to different heights.

Design Fire.

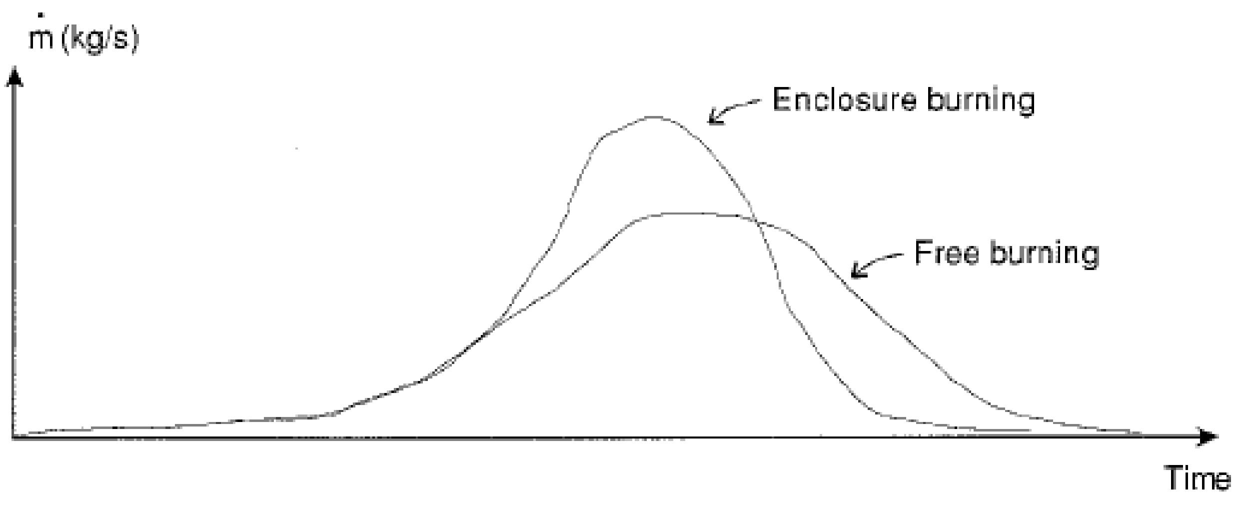


FIGURE 3.2 The enclosure effect on mass loss rate.

Design Fire.

- Ejemplo: Pool Fires

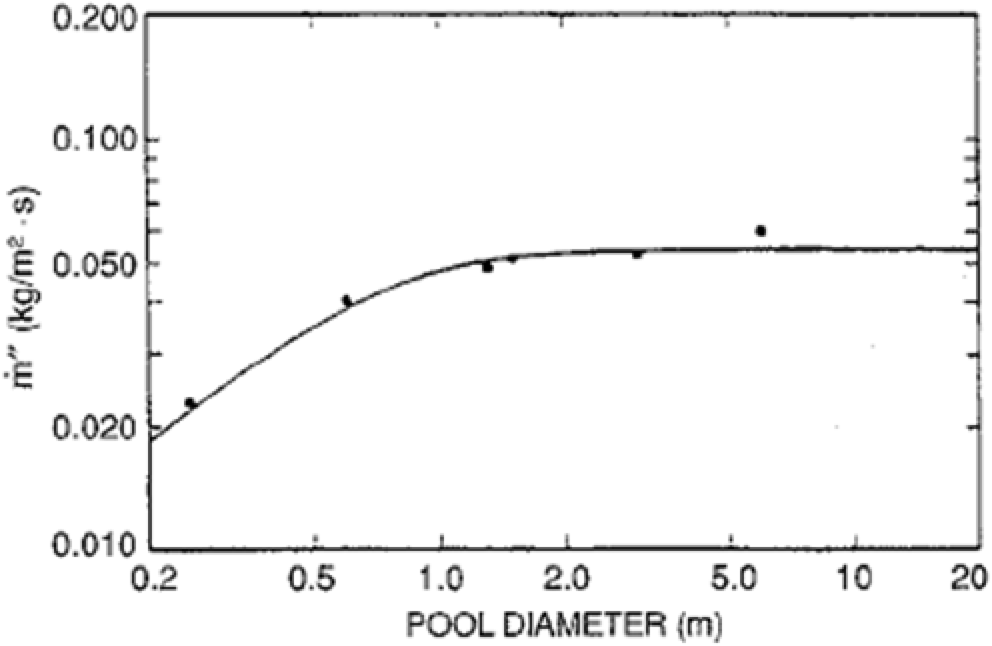


FIGURE 3.5 Mass loss rate for gasoline pools of various diameters. (From Babrauskas[1]. With permission.)

$$\dot{m}'' = \dot{m}_\infty''\left(1 - e^{-k\beta D}\right)$$

Design fire.

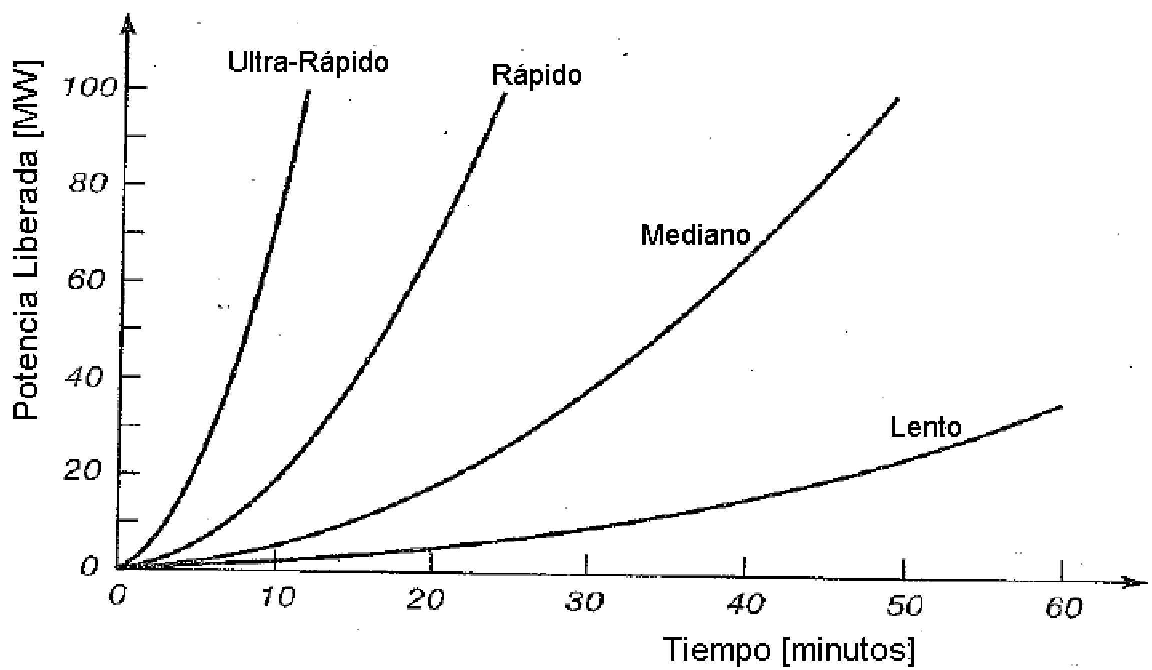
•Productos de madera densamente empacados

•Muebles de madera sólida, escritorios.
•Pequeños objetos plásticos.

•Algunos muebles tapizados
•Pallets en altura
•Cartón sobre pallets

•La mayoría de los muebles tapizados
•Materiales plásticos apilados
•Muebles de madera de bajo espesor

T-squared fire



$$\dot{Q} = \alpha \cdot t^2$$

Design fire.

UN SIGLO DE CONFIANZA Y RESPALDO

T-squared fire

TABLE 3.5
Values of α for Different Growth Rates According to NFPA 204M

Growth Rate	α (kW/s^2)	Time (s) to reach 1055 kW
ultra fast	0.19	75
fast	0.047	150
medium	0.012	300
slow	0.003	600

Source: NFPA, *Guide for Smoke and Heat Venting*, NFPA 204M, National Fire Protection Association, Quincy, MA, 1985.

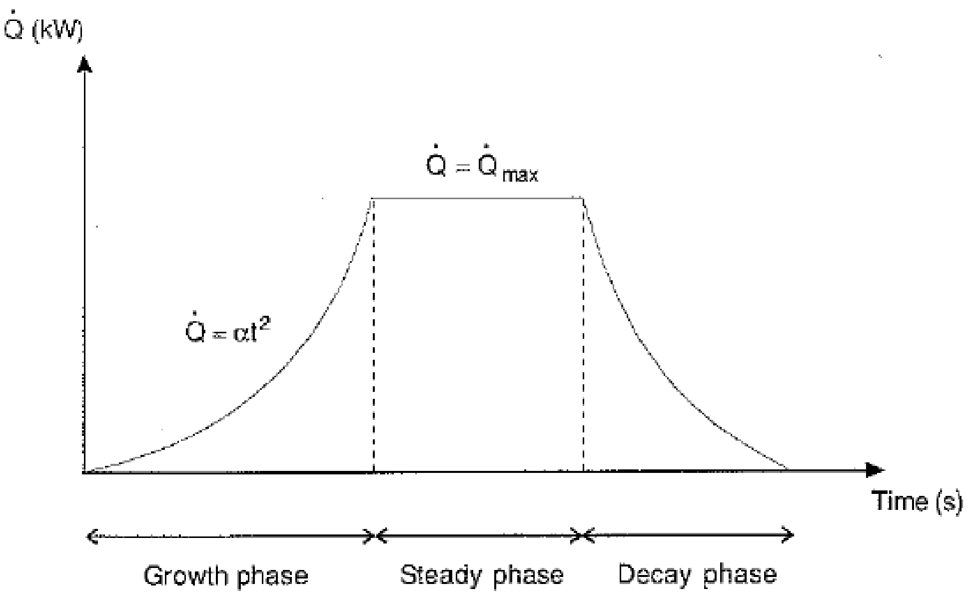
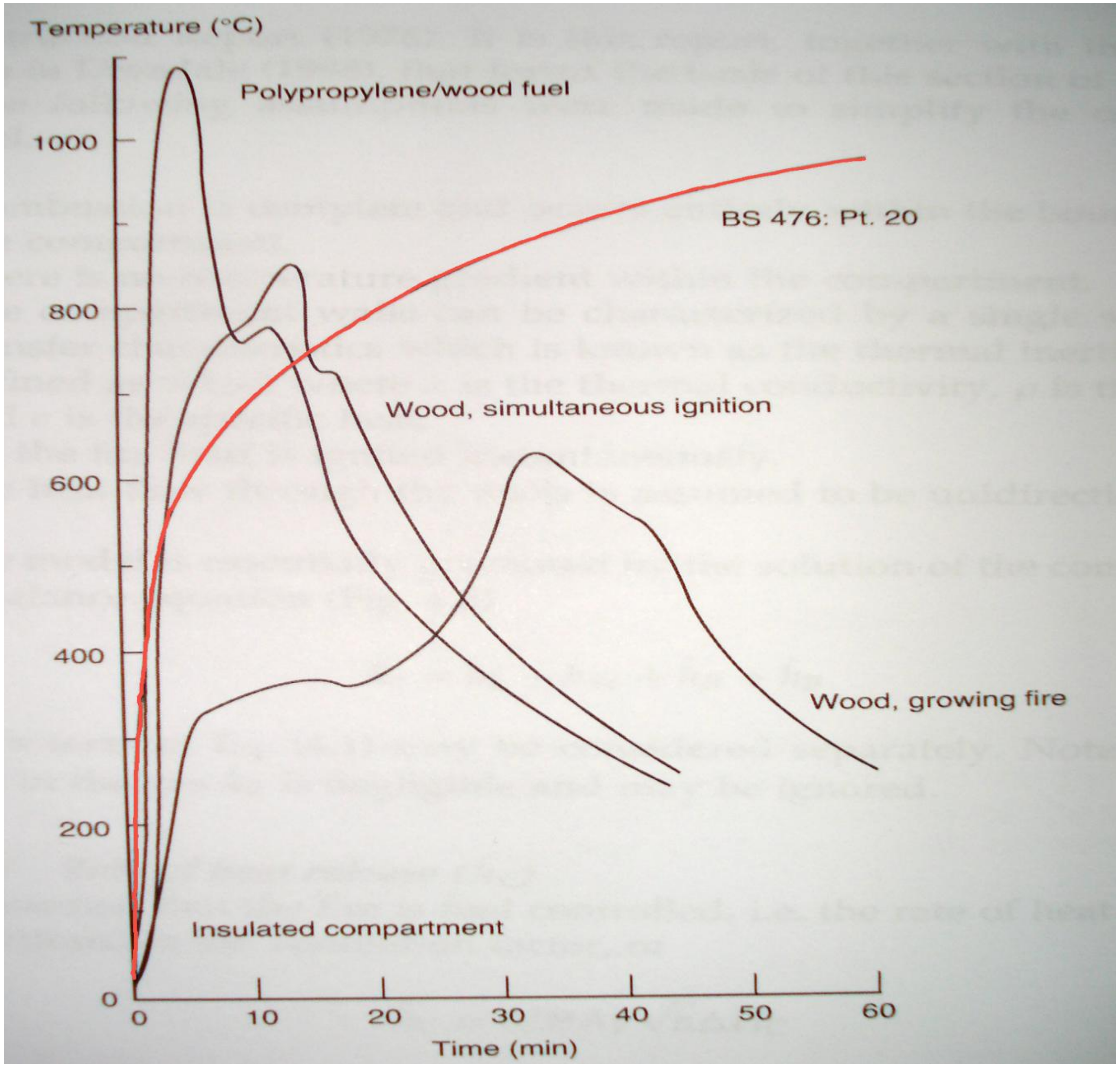
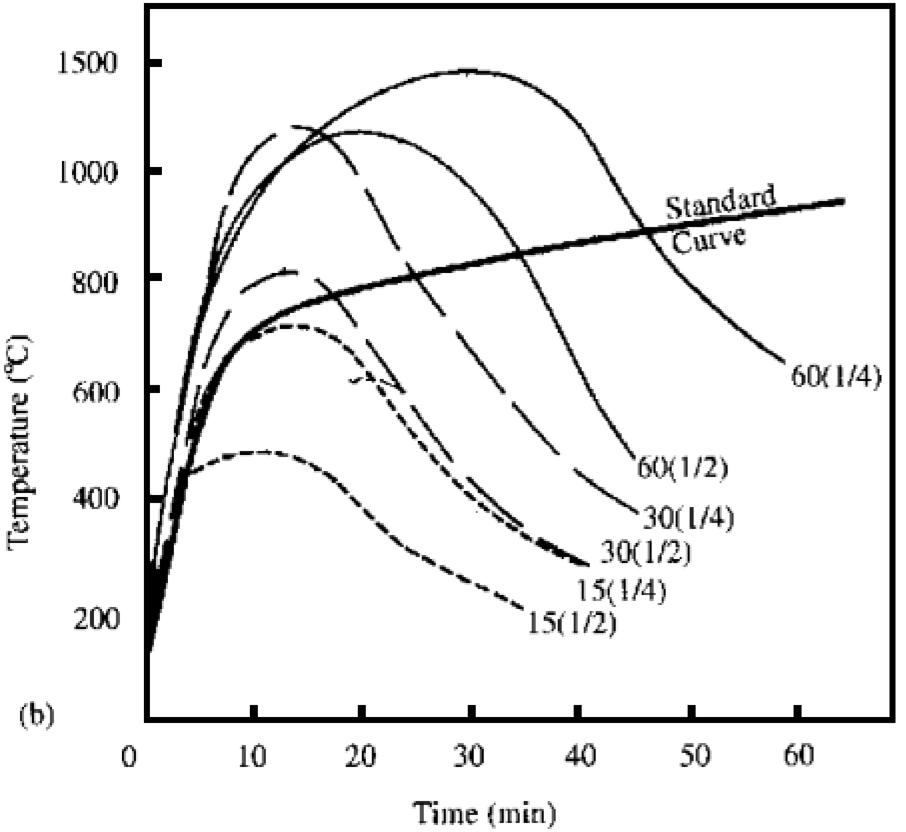


FIGURE 3.15 A simple design fire curve.

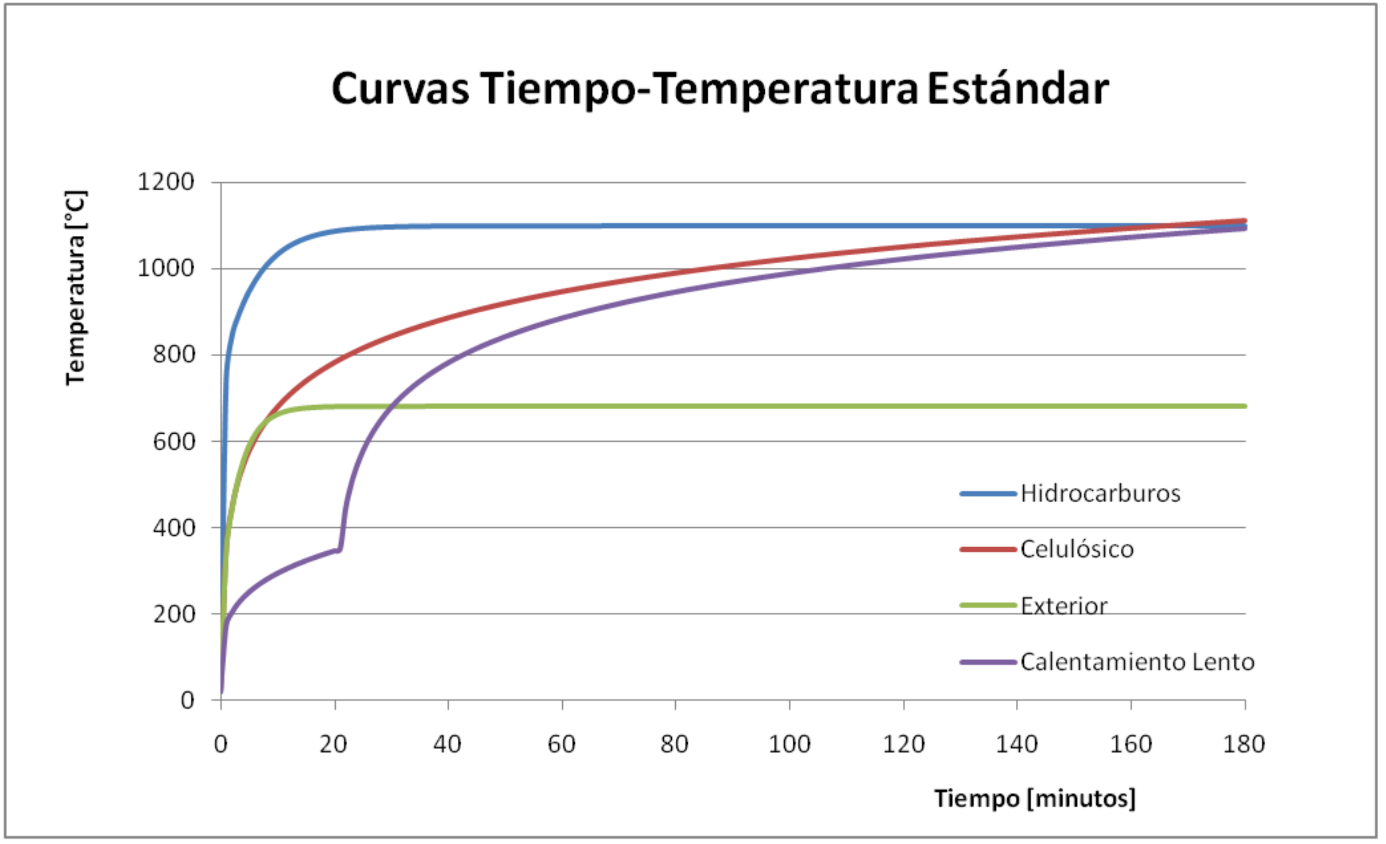
Tiempo-Temperatura



Tiempo-Temperatura



Tiempo-Temperatura



Tiempo-Temperatura

Celulósico

$$T = 345 \cdot \log_{10}(8t+1) + T_o$$

Hidrocarburos

$$T = 1080\left[1 - 0{,}325e^{-0{,}167t} - 0{,}675e^{-2{,}5t}\right] + T_o$$

Exterior

$$T = 660\left[1 - 0{,}687e^{-0{,}32t} - 0{,}313e^{-3{,}8t}\right] + T_o$$

Calentamiento Lento

$$T = 154t^{0{,}25} + 20 \qquad 0 < t \leq 21\,\mathrm{min}$$

$$T = 345\log_{10}(8\cdot(t-20)+1) + 20 \qquad t > 21$$