

matrix
polymers

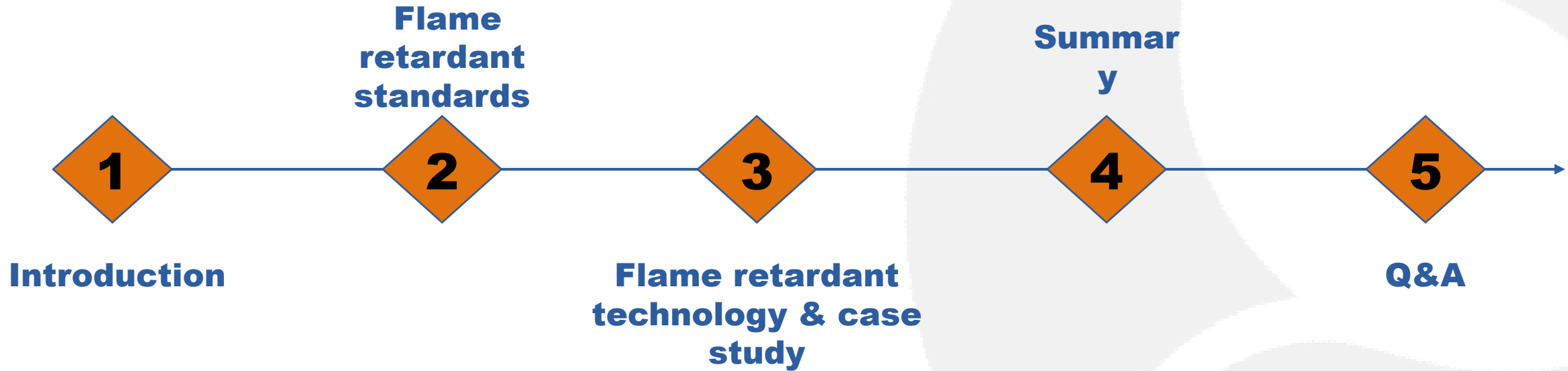


Experts In Rotomoulding Materials



Innovating Flame-Retardant Solutions for the Future of Rotomoulding

Agenda



Introduction

The usage of polymers in Rotomoulding

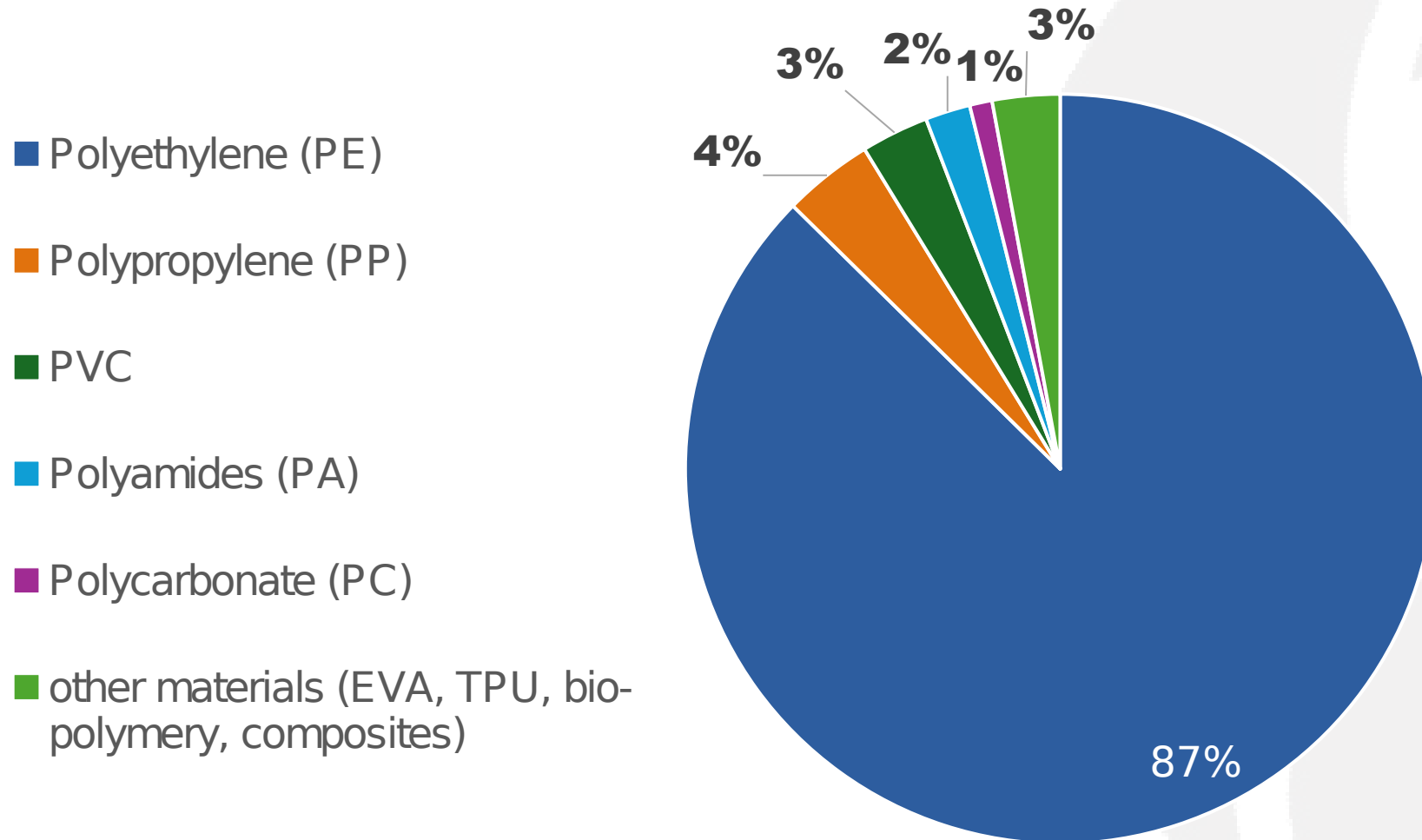


Figure 1. The usage of different polymers in Rotomoulding.

Introduction

Heat Release Rate (HRR)

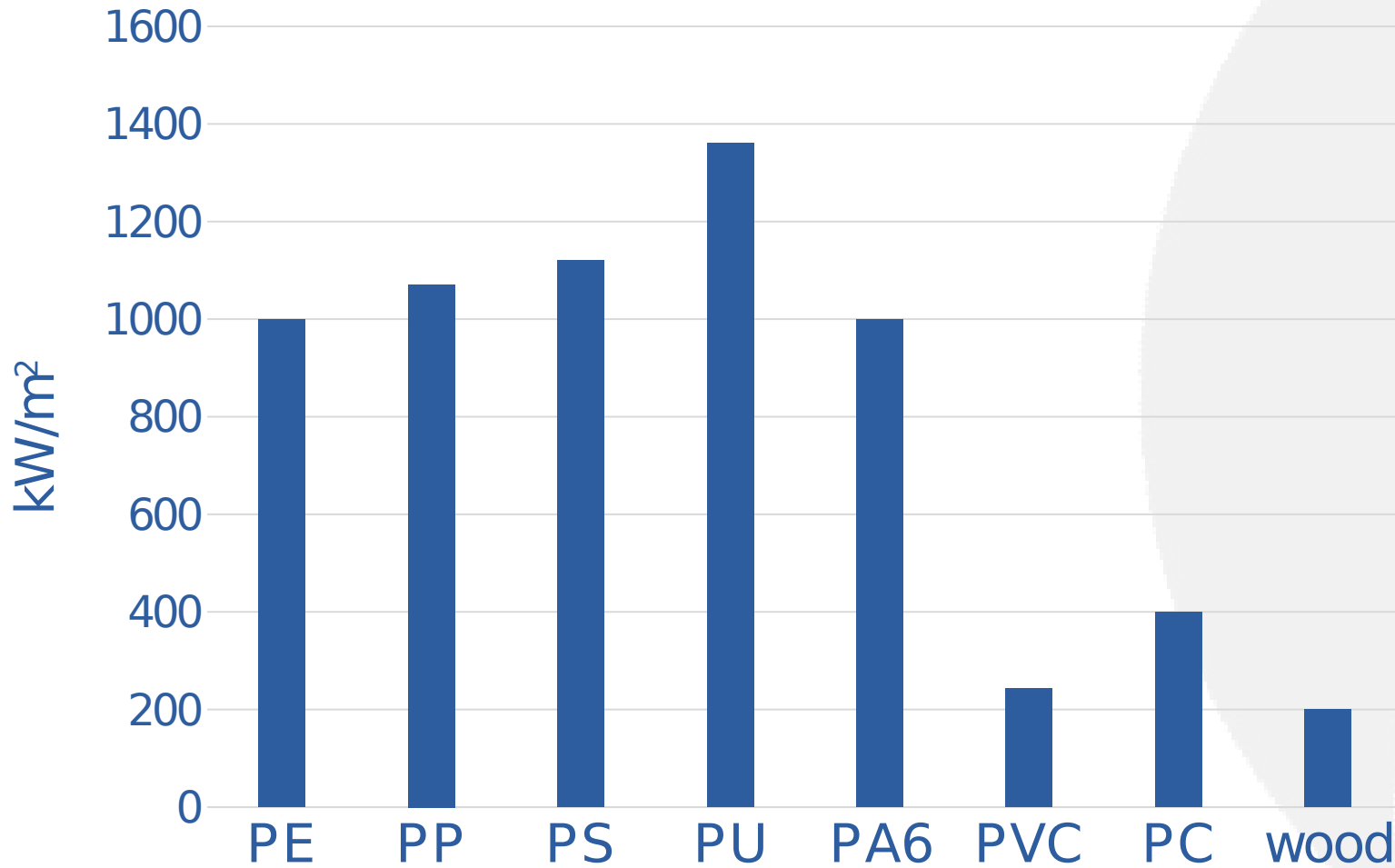


Figure 2. The usage of different polymers in Rotomoulding.

$$HRR = E \times \dot{m}_{O_2} \quad [kW/m^2]$$

Energy per unit
of oxygen
consumed

Oxygen
consumption
rate

The HRR value allows to:

1. Assess the rate at which a fire spreads.
2. Predict when flashover (the sudden ignition of the entire room) will occur.
3. Design fire safety measures.
4. Compare building materials.

Polymer combustion

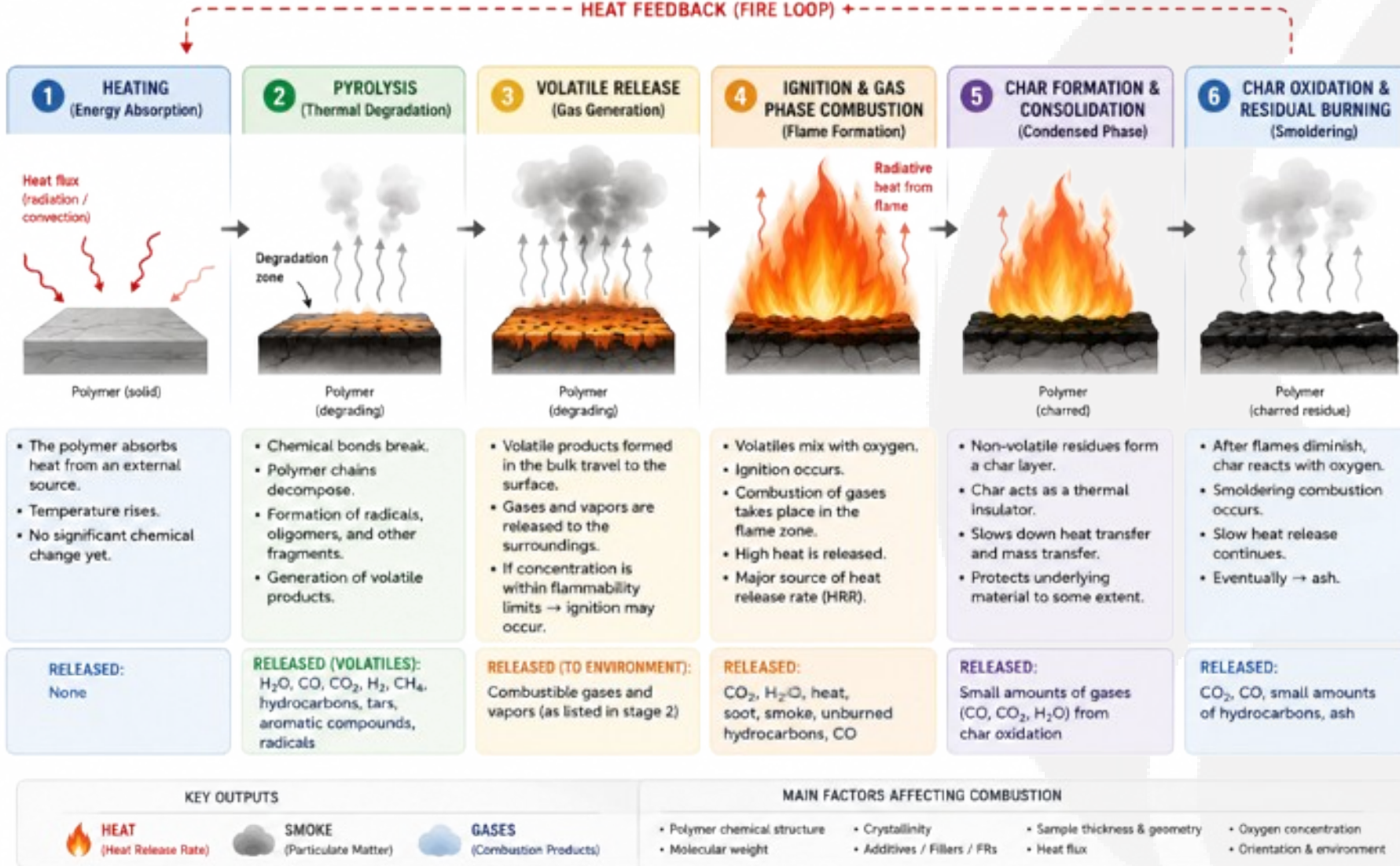


Figure 3. The mechanism of polymer combustion.

Flame retardants

Material standards

Key Features

- Standards used to classify flammability:
 - **UL94**
 - **EN ISO 11925-2** ignitability test
 - **EN 45545** flame resistance test for the railway sector
 - **EN13823** heat release and smoke production test
 - **EN ISO 1716** bomb calorimeter test
 - **EN ISO 1182** non combustibility test
 - **EN 13501-1** classification standard
- Protects occupants from fire effects;
- Protects escapes routes.



Usage Considerations

- All places where there is a risk of fire.

Flame retardants

Product standards

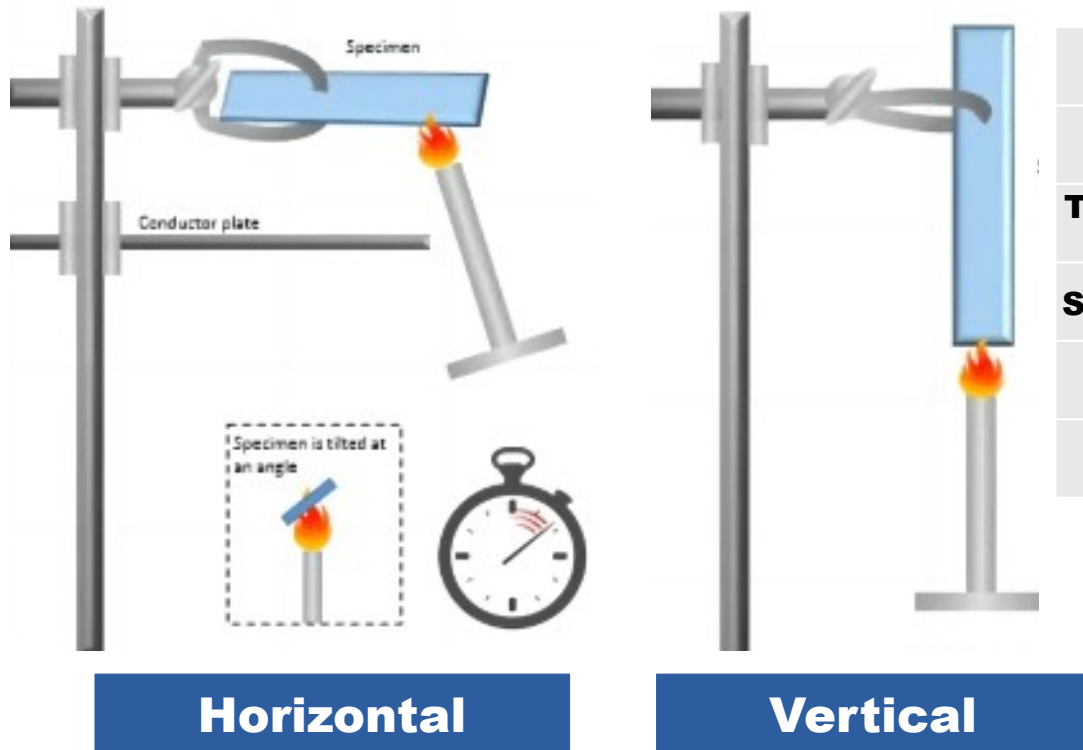
- **FMVSS 302** – Major focus on passenger car, truck, and bus interior materials
- **IS 15061** – Indian BIS standard with a focus on automotive interior flammability
- **ISO 3795** – Focus on road vehicles, tractors, and agricultural machinery
- **ECE R118** – Focus on interior materials used in buses and coaches



UL 94 Standard

- **UL94 (Underwriters Laboratories)** standard deals with the flammability rating of plastics used for consumer devices and appliances.
- Key reference for the rotomoulding industry globally accepted
- Used also as baseline for further tests in specific applications
- The standard provides Horizontal & Vertical test

Flame retardants – UL94



	94V-0	94V-1	94V-2	Not classifiable
Flaming combustion, any specimen	≤10s	≤30s	≤30s	>30s
Total burning time, burns 1-10	≤50s	≤250s	≤250s	>250s
Specimen fully burns to clip	No	No	No	Yes
Glowing combustion, any specimen	≤30s	≤60s	≤60s	>60s
Flaming drips ignite wool	No	No	Yes	Yes

Figure 4. UL94 Standard

UL94 – Yellow Card

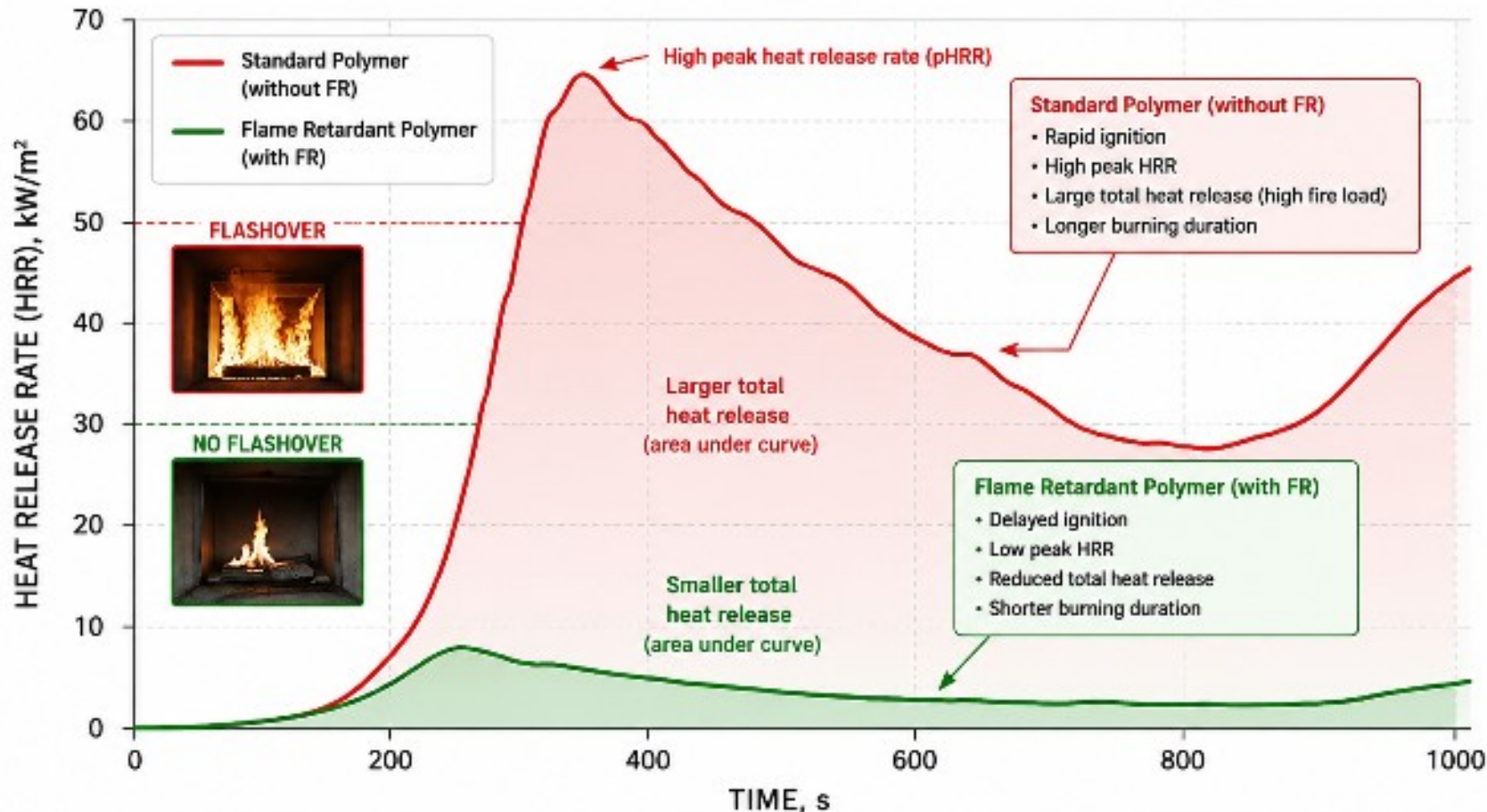
Definition

- **A UL Yellow Card (now UL Solutions Yellow Card)** is a digital product information sheet detailing safety and performance data for a specific plastic material
- Proof that UL has tested it to relevant standards
- Support manufactures to speed up certification for end-products by showing their materials meet established criteria for applications like flammability, electrical properties, and mechanical strength
- Accessible online via UL databases



Figure 5. UL94 Yellow Card

Flame retardant technology



HRR (Heat Release Rate) is the rate at which energy is released during combustion. Lower and delayed HRR means better fire performance and reduced fire hazard.

Flame retardant materials inhibit or reduce the combustion process interfering with one or several stages of the combustion cycle heating, decomposition, ignition, flame spread, smoke process.

Figure 6. Compare of standard polymer and flame-retardant technology

Flame-Retardant technology

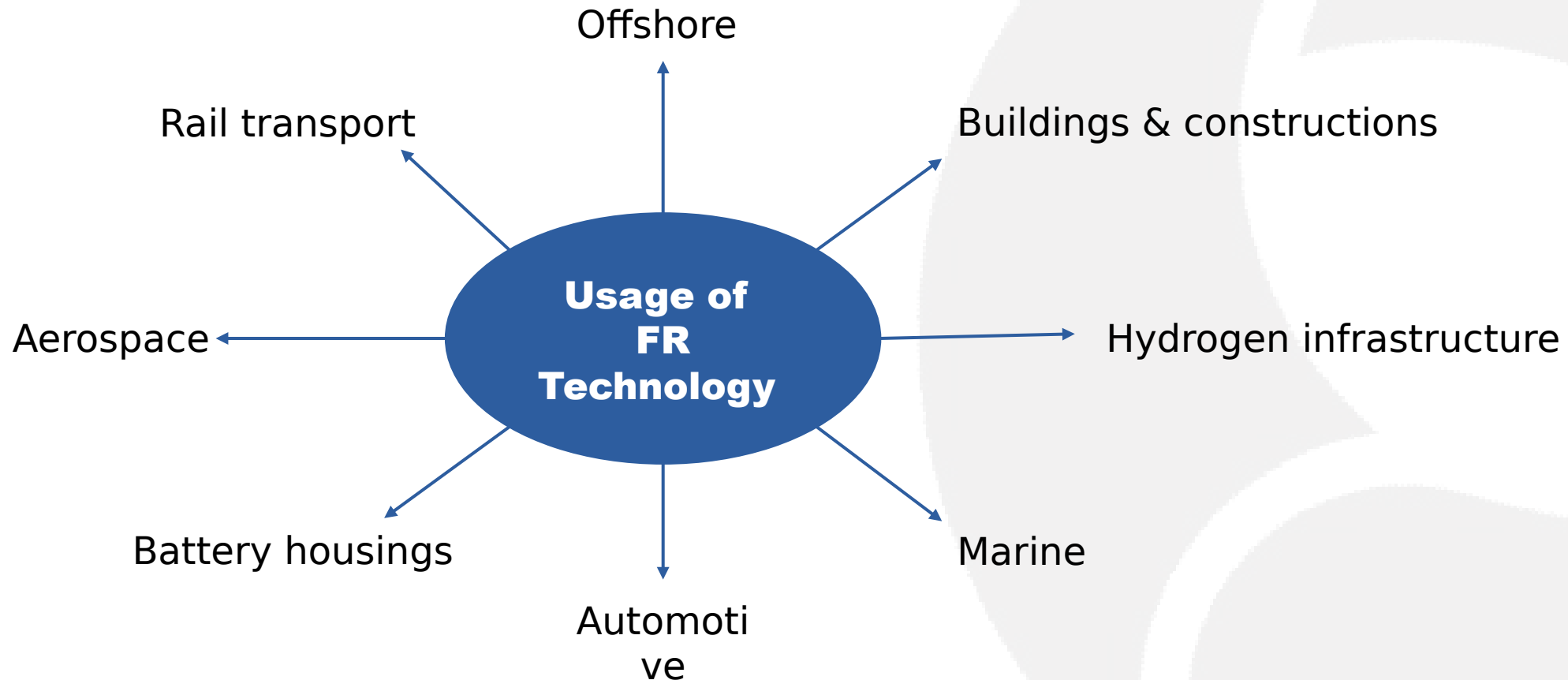


Figure 7. Most common FR Technology applications.

Flame-Retardant Solutions

Materials available in Europe and Asia in powder form

- Multiple PE & PP materials with advanced flame-retardant technologies meeting V0 at 3 mm criteria.
- New PP material to meet the most smoke stringent criteria for the rail industry at 3 mm thickness

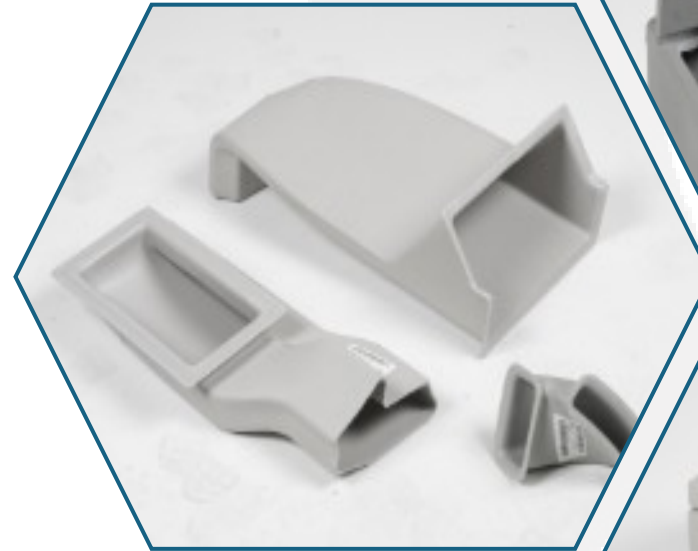


Figure 8. Images courtesy of Floteks.

Case Study

Floteks - cabinet

- Daimler product manufactured by Floteks
- Storage Box on Daimler Bus
- The idea was to substitute metal with a lighter and cost-effective solution without compromising design



Figure 9. Storage Box on Daimler Bus.

Polypropylene F/R

Advanced Technologies

- **PP 45 F/R** – V0 at 3 mm thickness
 - High Flow & very easy to mould
 - Good Impact Resistance
 - Stiff
 - Service temperature from 0 to 90 °C



Figure 10. Air-pipe used in hood for industrial kitchen in hotel and big restaurant.

Polypropylene F/R

Advanced Technologies

➤ PP 85 F/R

- Developed for the rail industry
- Limit smoke development
- Different standard criteria from UL94
 - EN ISO 45545-2
- Rigid structure



Figure 11. Structural product for vacuum cleaner.

Observations

Mouldability & Influence on material properties

Flame-Retardant Technologies can influence

- Mouldability
- Material Properties such as Impact Strength & Tensile
- UV stability

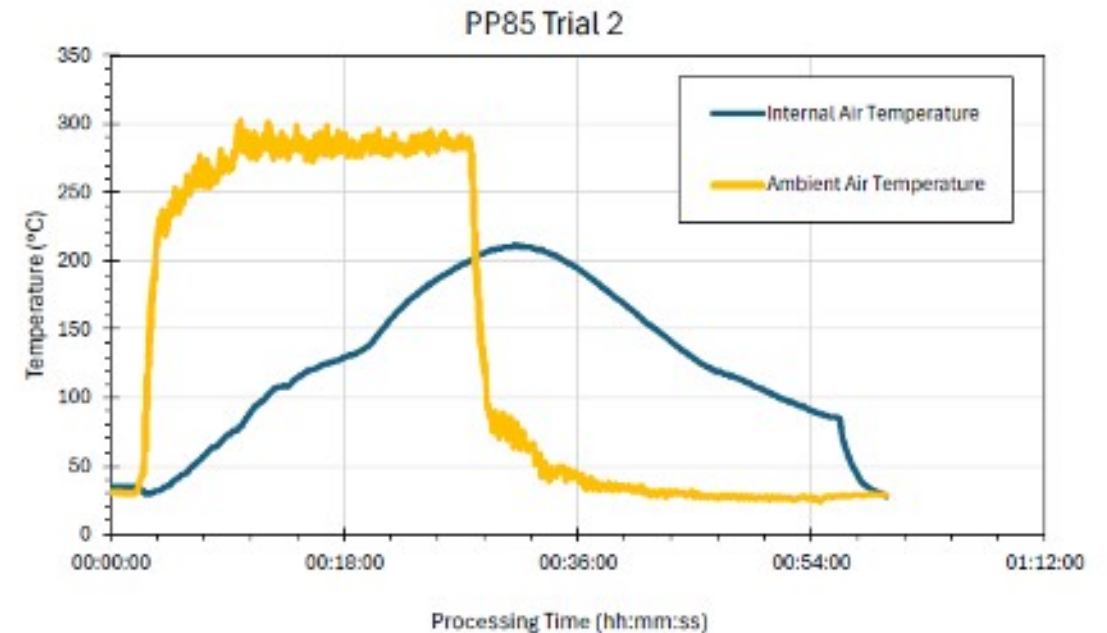


Figure 12. IAT traces during field trials at customer premises

Summary

- 1. FR technologies significantly improve the fire safety of polymer materials** by reducing the heat release rate (HRR), delaying ignition, and limiting flame spread.
- 2. The mechanism of FR technologies may involve both gas-phase and condensed-phase actions**, including radical quenching, char layer formation, material cooling, and dilution of combustible gases.
- 3. Highly flammable polymers such as PE, PP, and PS often require FR technologies**, because they are characterized by high HRR, low char-forming ability, and rapid-fire development.
- 4. Modern development of FR technologies is focused on environmentally friendly solutions**, in accordance with environmental requirements and REACH/RoHS regulations.
- 5. Polymeric materials containing FR additives are essential in modern industries**, such as electromobility, public transportation, aerospace, offshore, energy, and construction, where low flammability, reduced smoke emission, and high fire resistance are required.

Summary



- We have extensive knowledge compounded by multiple decades of field experience on various advanced technologies to meet your product criteria and end user specification.
- We advise to involve your material supplier from day one to design the most suitable material for your intended application.

Thank You



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