

FIRE SAFETY FOR ROLLING STOCK

Fire Safety Workshop
17th – 18th March 2004
Cologne - Germany



A TRAIN ON FIRE



A TRAIN ON FIRE



London Underground



High Speed Train



ICE-3



SOME TYPICAL MATERIALS

Glass Reinforced Plastics

Pre-coated Metals

Wood

Lighting

Seating/Upholstery

Flooring

Cables

Paint

Sandwich Structures

Polyester, Epoxy, Phenolic,
Modified Acrylic

Coated aluminium,
Metal/Plastic laminates

Melamine-faced plywood,

Polycarbonate, Acrylic

Polyurethane foam, Synthetic fabric

Elastomers

Polyolefins, Ethylene vinyl acetate

Epoxy/polyurethane, Intumescent,

Foam cores, PEI, PVC, GRP skins

GLASS-REINFORCED COMPOSITE STRUCTURES

- ✚ Cab fronts, nose cones
- ✚ Driver control desks
- ✚ Interior wall panels
- ✚ Exterior cladding
- ✚ Window frames
- ✚ Seat shells and tables
- ✚ Handles and head supports
- ✚ Flooring and ceilings
- ✚ Ventilation ducting
- ✚ Fire Doors and Barriers

FIRE SAFETY FOR ROLLING STOCK

To ensure fire safety of passengers, the following are key factors which must be addressed and/or controlled:

- (o) flammability of materials
- (o) quantity of flammable materials on-board a train, configuration and proximity to other combustibles
- (o) products of combustion, smoke and gases
- (o) sources of ignition,
- (o) likelihood of occurrence,
- (o) consequences of occurrence,
- (o) means of escape to a place of safety and the time taken to reach the place of safety,
- (o) reliability of tests undertaken to demonstrate fire safety and adherence to existing fire standards.

FIRE REACTION and FIRE RESISTANCE

FIRE REACTION

The response of a material particularly in the early stages of a fire and its interactions with the environment.

Progress of a fire

time to ignition
spread of flame
peak of heat release
average heat release

Human survivability

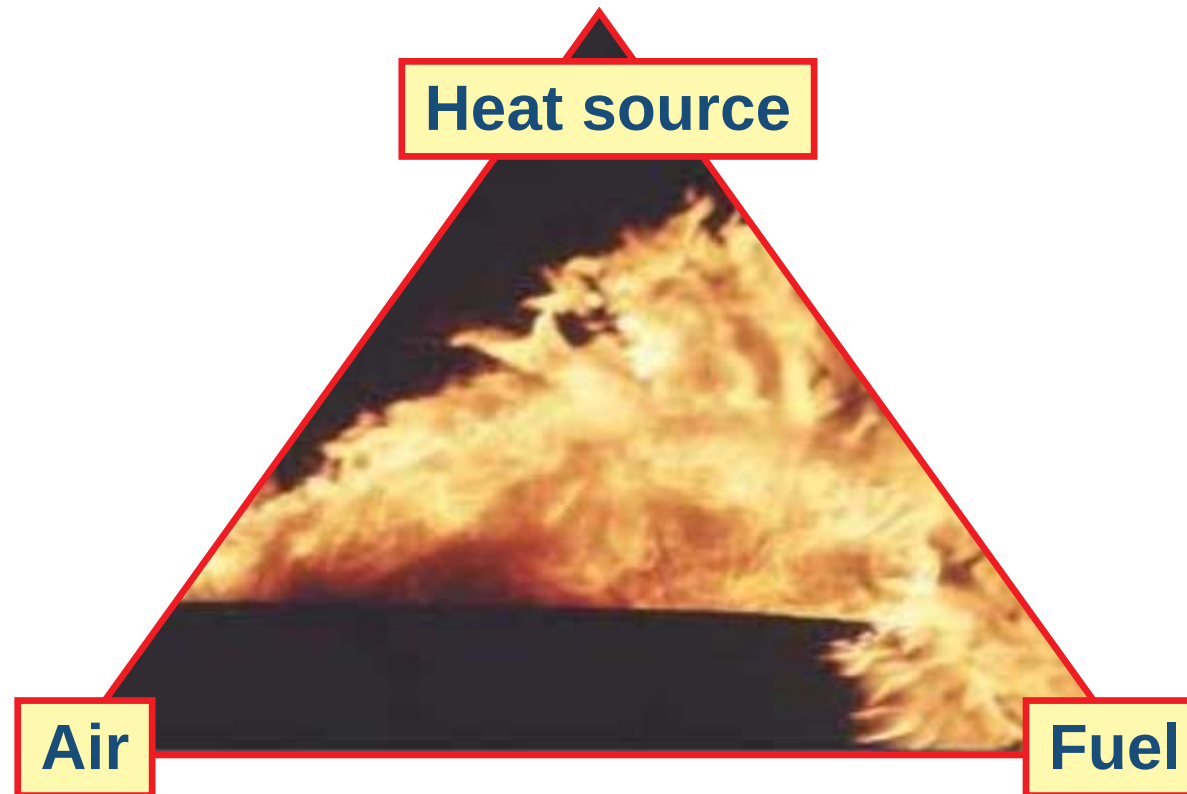
smoke generation
toxicity of gases

FIRE RESISTANCE

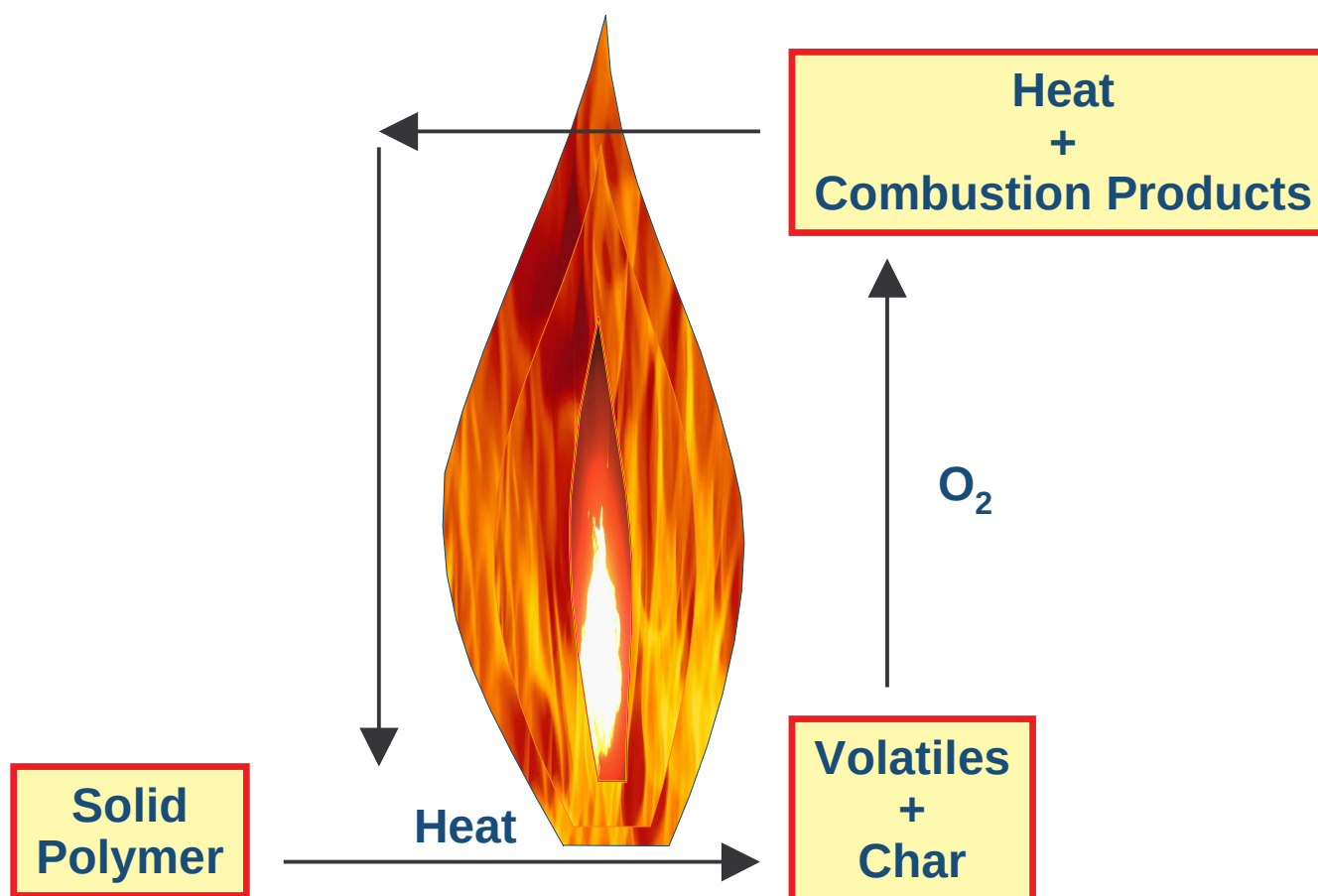
The ability of a structure to retain functionality during a fire.

The ability of a physical barrier such as a wall, a bulkhead or a protective coating to limit heat flux and prevent damage to material remote from the fire.

FIRE REQUIRES



POLYMER COMBUSTION



FIRE RETARDANTS

Brominated Compounds

TBBA (Tetrabromobisphenol A)
Decabromodiphenyl ether

Phosphorus Compounds

Red phosphorus
Organophosphorous

Nitrogen Compounds

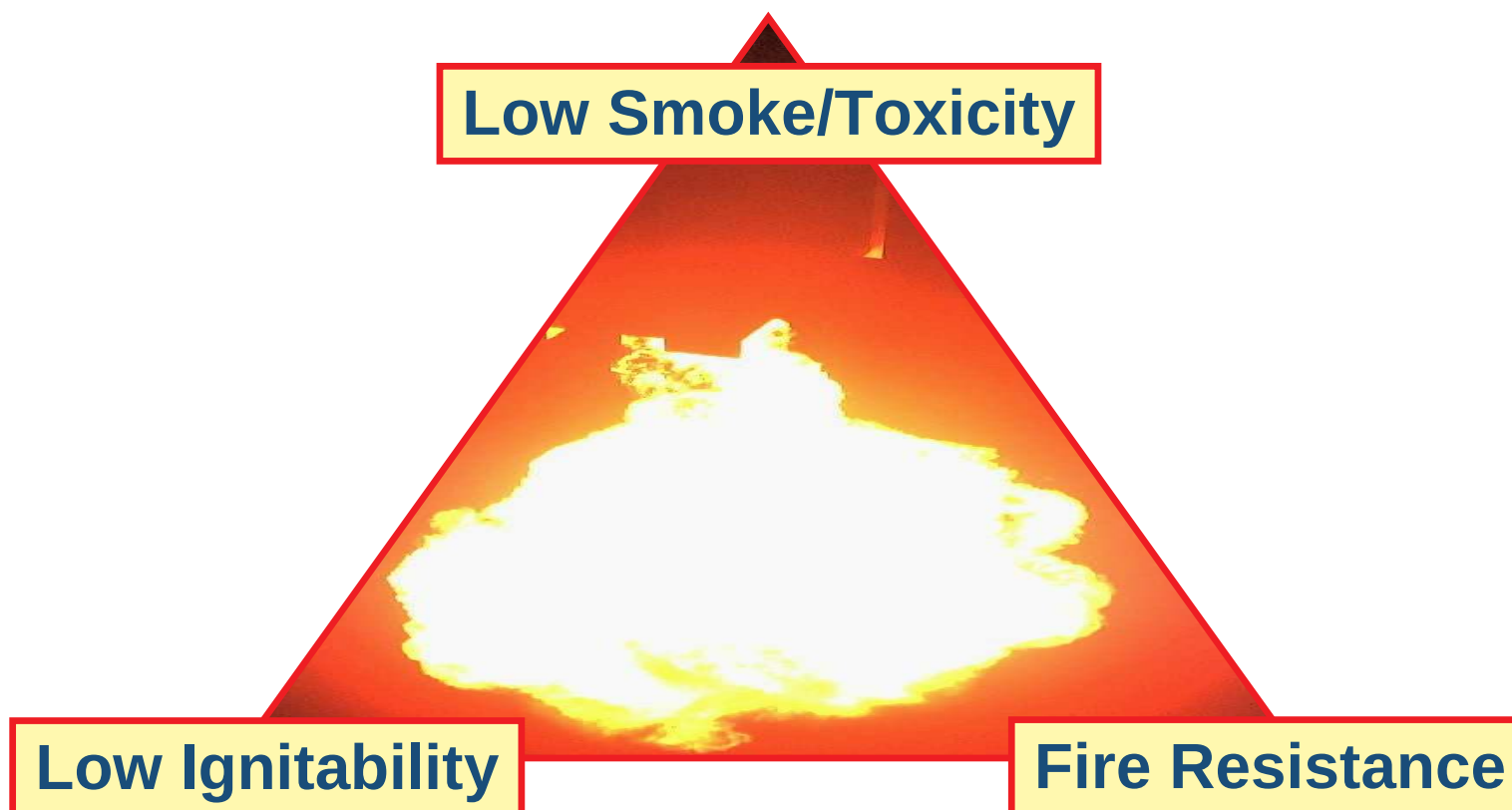
Melamine
Ammonium polyphosphate

Mineral fillers/additives

Aluminium Hydroxide
Magnesium Hydroxide
Boron compounds

Intumescent Coatings

FIRE PERFORMANCE



STATE OF THE ART

Structures for railway rolling stock can be manufactured from synthetic materials with the required fire reaction and fire resistance properties.

FIRE STANDARDS

National classification of materials for railways

France	NFF 16-101/2
Germany	DIN 5510
UK	BS 6853
Italy	UNIFER E 10.02.977
UIC	International Union of Railways

NEW EUROPEAN STANDARD EN 45545

THE FUTURE OF RAIL NEEDS RESEARCH AND TECHNOLOGY

