

# Fire Performance

## Overview

With the appropriate choice of resin, additive and fillers, Fibre Reinforced Polymer (FRP) materials can be used to make structures with clear fire performance benefits over many other materials. In addition, FRP composites generally are good thermal insulators, so they can significantly limit the heat of a fire spreading in the way that can occur with metals.

In addition, FRP composites generally are good thermal insulators, so they can significantly limit the heat of a fire spreading in the way that can occur with metals.



When considering fire issues, it is important to understand fire performance terminology:

## Fire Reaction

This is the **response** of a material to a fire, such as flame spread, flammability and release of fumes and smoke. These are specific characteristics for any material; for FRP composites these characteristics will vary considerably between different types of resins, reinforcements and other additives used. The smoke and perhaps fumes released during a fire event can be a concern, and so careful choices need to be made for internal applications.

## Fire Resistance

This is the ability of the material to **retain its functionality** during and after a fire, such as the ability to retain structural strength (e.g. for a supporting beam) or to provide fire protection (e.g. a bulkhead)

## Improving Fire Performance

The main method of improving fire performance is by the inclusion of additives in the resin at the time of manufacture. These work in different ways, but are effective in reducing flammability and flame spread for Polyester, Vinyl Ester, Epoxies and the like. Various types of additive are available, with improvements being made all the time to increase performance and reduce smoke and toxic emissions. Coatings can also be used on FRPs to delay ignition, lower

the rate of heat release, suppress lateral flame spread, and extend the duration of fire resistance.

Some intrinsically fire-resistant resins are also available, the most commonly used is Phenolic. Its high fire performance has some trade-offs in structural performance, but Phenolics are extensively used in mass transit and offshore engineering.

## Testing and Standards

Many tests exist to measure fire performance, but it is important to make sure that tests relevant to the application are being applied. The most commonly used for FRP materials in the UK is BS 476 Fire tests on building materials and structures, in particular Parts 6 and 7 of the standard which test for flammability and flame spread. Later parts of the same standard consider Fire Integrity under cellulosic fire conditions.

### BS 476-7: Surface Spread of Flame Test

This test measures the rate of spread of a flame front across a material surface, but does not consider emission of toxic smoke and gas. Class 1 is the highest classification, with the slowest rate of spread.

Classification	Spread of flame at 1.5 min		Final Spread of flame	
	Limited (mm)	Limit for one specimen in sample (mm)	Limit (mm)	Limit for one specimen in sample (mm)
1	165	25	165	25
2	215	25	455	45
3	265	25	710	75
4	Exceeding the limits for class 3			

## Contact

## Fire Performance

### BS 476-6: Fire Propagation Test

This test assesses the heat potential for a material or system.

Results are reported as an index of performance, that provides a comparative measure of the contribution made to the growth of the fire made by an essentially flat material.

The values obtained in the two tests (BS 476 part 6 and 7) can be used to classify materials as Class 0, Class 1 and Class 3. Class 0 materials perform well in fire situations and can be used without restriction within a building.

Other BS standards measure levels of smoke or toxicity; these are particularly relevant for enclosed spaces such as underground mass transit.

Similar tests are available in ISO, EN, ASTM and other well-known authorities.

## Summary

Fire performance is a key part of the design process of an FRP product or structure which should be considered early on alongside other considerations such as structural performance, environmental issues and the like. But there are many FRP materials with proven fire performance and case history evidence which are immediately available to meet most project requirements.

Composites UK and their members can be contacted for specific queries regarding fire performance of FRP materials.

## Contact

Email: [info@compositesuk.co.uk](mailto:info@compositesuk.co.uk)

Web: [compositesuk.co.uk/construction-sector-group](http://compositesuk.co.uk/construction-sector-group)