

BRE Global Test Report

IMO 2010 FTP Code Part 2 - Smoke and Toxicity Test on High Temperature Carbon Fibre Composite

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BRE Global Ltd
Watford, Herts
WD25 9XX

Customer Services 0333 321 8811

From outside the UK:
T + 44 (0) 1923 664000
F + 44 (0) 1923 664010
E enquiries@bre.co.uk
www.bre.co.uk

Prepared for:
Carbon Fibre Preforms
Regus Building
Central Boulevard
Blythe Valley Business Park
Solihull
B90 8AG





Prepared by

Name Michael Walford

Position Chemist

Date

A handwritten signature in black ink, appearing to read 'M Walford', is written over the date field.

Authorised by

Name J Hunter

Position Section Leader, Reaction to Fire

Date 29 September 2016

Signature

A handwritten signature in black ink, appearing to read 'J Hunter', is written over the signature field.

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1 Objective

To determine the smoke and toxicity characteristics of the sample described in Section 2 in accordance with the test method and criteria for bulkhead, wall and ceiling linings, floor coverings and primary deck coverings, specified in the IMO 2010 FTP Code Part 2 – Smoke and Toxicity Test. MSC.307(88)1.

2 Sample Description

2.1 Traceability

The test samples were supplied by the test sponsor. BRE Global were not involved in the sample selection process and therefore cannot comment upon the relationship between samples supplied for test and the product supplied to market.

2.2 Description of sample and test format.

Unless otherwise stated all measurements are nominal.

Test Sponsor	Carbon Fibre Preforms, Regus Building, Central Boulevard, Blythe Valley Business Park, Solihull, B90 8AG
Manufacturer of sample	As above
Sample name/reference	High Temperature Carbon Fibre Composite
Sample description (as provided by test sponsor/manufacturer)	40.40.10
Description of sample (as received)	Black Plaques
Sample face tested	Both faces the same
Sample dimensions (mm)	75 x 75
Sample weight per surface area (kg/m ²) (measured)	11.57
Sample thickness (mm) (measured)	10.299
Sample receipt date	15 August 2016
Date of test	12 September 2016



3 Conditioning

The specimens were conditioned as required by the Standard.

4 Test conditions

Three specimens of material were tested in accordance with the following schedule:

Mode 1: Irradiance 25 kW/m², no pilot flame

Mode 2: Irradiance 25 kW/m², with pilot flame

Mode 3: Irradiance 50 kW/m², no pilot flame

5 Test results

Table 1 Summary of smoke test results

Test condition	Specimen 1 Ds (max)	Specimen 2 Ds (max)	Specimen 3 Ds (max)	Average specific Optical Density
25kW/m ² with pilot flame	14.5	4.7	9.2	9
25kW/m ² no pilot flame	3.6	5.9	7.6	6
50kW/m ² no pilot flame	21.7	15.7	13.2	17

5.1 FTIR Test Parameters

Data regarding test apparatus

Sampling Response Period (SRP) = 15 seconds

Inner volume of gas cell = 0.375 L

Inner volume and length of gas sampling line = 0.00001884 m³ and 1.5 m

The capacity of the gas sampling pump = 1.5 L/min

In Tables 2, 3 and 4 below

C = maximum gas concentration (ppm) (concentration of each Gas measured by FTIR for each test run)

C_{ca} = gas concentration correction, if applicable (ppm) (concentration of acid gases absorbed by filters, determined by IC)

C+C_{ca} = corrected maximum gas concentration (ppm) (maximum gas concentration plus acid gas corrections)

**Table 2 Summary of toxicity results - irradiance 25 kW/m², with pilot flame**

Maximum smoke density sampling time (DmST) = 1175 sec

Gas	C (ppm)		Cca (ppm)		C+Cca (ppm)		Average (ppm)
	Run 2	Run 3	Run 2	Run 3	Run 2	Run 3	
Hydrogen chloride	0.0	0.0	1.0	1.6	1.0	1.6	1
Hydrogen cyanide	0.0	0.0	n/a	n/a	0.0	0.0	0
Hydrogen bromide	0.0	0.0	0.0	0.0	0.0	0.0	0
Hydrogen fluoride	0.0	0.0	0.3	0.3	0.3	0.3	0
Sulphur dioxide	0.0	0.0	0.6	0.7	0.6	0.7	1
Nitrogen oxides	0.0	0.0	n/a	n/a	0.0	0.0	0
Carbon monoxide	0.0	0.0	n/a	n/a	0.0	0.0	0

Table 3 Summary of toxicity results - irradiance 25 kW/m², no pilot flame

Maximum smoke density sampling time (DmST) = 1175 sec

Gas	C (ppm)		Cca (ppm)		C+Cca (ppm)		Average (ppm)
	Run 2	Run 3	Run 2	Run 3	Run 2	Run 3	
Hydrogen chloride	0.0	0.0	1.2	1.2	1.2	1.2	1
Hydrogen cyanide	0.0	0.0	n/a	n/a	0.0	0.0	0
Hydrogen bromide	0.0	0.0	0.0	0.0	0.0	0.0	0
Hydrogen fluoride	0.0	0.0	0.3	0.3	0.3	0.3	0
Sulphur dioxide	0.0	0.0	0.7	0.7	0.7	0.7	1
Nitrogen oxides	0.0	0.0	n/a	n/a	0.0	0.0	0
Carbon monoxide	0.0	0.0	n/a	n/a	0.0	0.0	0

Table 4 Summary of toxicity results - irradiance 50 kW/m², no pilot flame

Maximum smoke density sampling time (DmST) = 1059 sec

Gas	C (ppm)		Cca (ppm)		C+Cca (ppm)		Average (ppm)
	Run 2	Run 3	Run 2	Run 3	Run 2	Run 3	
Hydrogen chloride	0.0	0.0	1.6	1.8	1.6	1.8	2
Hydrogen cyanide	0.0	0.0	n/a	n/a	0.0	0.0	0
Hydrogen bromide	0.0	0.0	0.0	0.0	0.0	0.0	0
Hydrogen fluoride	0.0	0.0	0.3	0.3	0.3	0.3	0
Sulphur dioxide	0.0	0.0	2.1	1.6	2.1	1.6	2
Nitrogen oxides	0.0	0.0	n/a	n/a	0.0	0.0	0
Carbon monoxide	307.3	226.3	n/a	n/a	0.0	0.0	267

**Table 5: Observations**

Test Mode	Observation
Mode 1: Irradiance 25 kW/m ² no pilot flame	No flaming
Mode 2: Irradiance 25 kW/m ² with pilot flame	No flaming
Mode 3: Irradiance 50 kW/m ² no pilot flame	No flaming

6 Classification

In accordance with the IMO 2010 FTP Code - Part 2 Clause 2.4, where a material is required not to be capable of producing excessive quantities of smoke and toxic products or not to give rise to toxic hazards at elevated temperature, it is required to meet the following classification criteria:

Smoke

An average (D_m) of the maximum specific optical density of smoke ($D_s \text{ max}$) of three tests at each test condition shall be calculated:

- .1 for materials used as surface of bulkheads, linings or ceilings, the D_m shall not exceed 200 in any test condition;
- .2 for materials used as primary deck coverings, the D_m shall not exceed 400 in any test condition;
- .3 for materials used as floor coverings, the D_m shall not exceed 500 in any test condition; and
- .4 for plastic pipes, the D_m shall not exceed 400 in any test condition.

Toxicity

The average value of the maximum value of the gas concentration measured at each test condition (see 4 above) shall not exceed the following limits:

CO	1,450 ppm	HBr	600 ppm
HCl	600 ppm	HCN	140 ppm
HF	600 ppm	SO ₂	120 ppm (200 ppm for floor coverings)
NO _x	350 ppm		



7 Conclusions

Smoke

The sample described in Section 2 of this report, when subjected to the tests required by IMO 2010 FTP Code Part 2 for Smoke satisfied the criteria for:

bulkheads, linings or ceilings

primary deck coverings

floor coverings

plastic pipes

Toxicity

The sample described in Section 2 of this report, when subjected to the tests required by IMO 2010 FTP Code Part 2 satisfied the criteria for Toxicity.

8 Validity

The test results relate only to behaviour of the test specimens of the product under the particular conditions of test, they are not intended to be the sole criteria for assessing the potential fire hazard of the product in use.

The specification and interpretation of fire test methods are the subject of on-going development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over 5 years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

9 Reference

- 1 Resolution MSC.307(88) Adoption of the International Code for application of fire test procedures 2010, Annex 1, Part 5 Test for surface flammability: Test for surface materials and primary deck coverings. International Maritime Organisation: London 2010.