

Test Report

No. AJFS1708006441RS

Date: SEP.04, 2017

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ASHLAND CHINA HOLDINGS CO., LTD

18F, #1089, ZHONGSHAN 2ND ROAD(S), XUHUI DISTRICT, SHANGHAI

The following sample(s) was / were submitted and identified on behalf of the client as:

Sample Description: UP FRP

RESIN: MODAR 102F

GELCOAT: MAXGUARD FR S

Test Requested:

1. To determine the performance of the sample when it is subjected to the conditions of test specified in DIN 54837:2007 Testing of materials, small components and component sections for rail vehicles – Determination of burning behaviour using a gas burner
Classification according to DIN 5510-2:2009 Preventive fire protection in railway vehicles Part 2: Fire behaviour and fire side effects of materials and parts; Classification, requirements and test methods
2. To determine of the FED (Fractional effective dose) of toxic fume, as described in Annex C (normative) of DIN 5510-2:2009 Preventive fire protection in railway vehicles Part 2: Fire behaviour and fire side effects of materials and parts; Classification, requirements and test methods

Test Results: -- See attached sheet --

Test Period:

Sample Receiving Date : AUG.21, 2017

Test Performing Date : AUG.21, 2017 TO AUG.29, 2017

Signed for and on behalf of
SGS-CSTC Co., Ltd. Anji Branch



Allen Zou
Technical Manager



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Sample details

Sample description	UP FRP
Color	Beige
Thickness	About 3.7 mm

1. DIN 54837:2007 Fire behaviour

I. Test conducted

This test was conducted in accordance with the procedure specified in DIN 54837:2007 Testing of materials, small components and component sections for rail vehicles – Determination of burning behaviour using a gas burner.

II. Test details

Conditioning:

Prior to testing, the sample was conditioned,

to constant mass at a temperature of 23 ± 2 °C, and a relative humidity of 50 ± 6 %, and maintained in this condition until required for testing.

Exposed Face: Gelcoat surface

Size of specimen: 500mm×190mm

III. Test results

		Specimen No.					Average
		1	2	3	4	5	
Flaming at (s)		19	23	24	22	25	22.6
Afterflame (s)		0	0	0	0	0	0
Glowing	Occur (s)	-	-	-	-	-	-
	Afterglow (s)	-	-	-	-	-	-
Flame Height	Maximum (cm)	33	35	34	31	32	33.0
	Reached at (s)	145	152	147	140	146	146.0
Drop away of parts	Drop Away (Yes/No)	No	No	No	No	No	-
	Burning time (s)	-	-	-	-	-	-
Smoke Density	Maximum (%)	3	4	4	5	3	3.8
	At Time (s)	102	137	142	129	163	134.6
	Integral (%×min)	12	14	15	17	11	13.8
Length of destroyed area (cm)		16	16	18	15	17	16.4
Extinguished (s)		-	-	-	-	-	-
Burn through (Yes/No)		No	No	No	No	No	-
Melting (Yes/No)		No	No	No	No	No	-

To be continued...



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Remark: “-“Not applicable

Observations during test: None

The classification requirements specified in DIN 5510-2:2009 are given in Appendix 1.

Appendix 1 Classification according to DIN 5510-2:2009

Burning Class		Smoke class		Dripping Class	
Class	Requirements	Class	Requirements	Class	Requirements
S-1	Test according to DIN 53438-2/3 required	--	--	--	--
S-2	Length of destroyed area ≤ 30 cm	Not reached SR-1	Int. > 100 %×min	ST-1	Burning / falling drops, afterflame of drops>20 s
S-3	Length of destroyed area ≤ 25 cm, Afterflame≤100 s (No individual value ≥ 120s)	SR-1	Int. ≤ 100 %×min	ST-2	No dripping / No falling drops, afterflame of drops<20 s
S-4	Length of destroyed area ≤ 20cm, afterflame≤10s	SR-2	Int. ≤ 50 %×min		
S-5	Length of destroyed area = 0cm Afterflame = 0s				

Classification: In accordance with the class definitions given in DIN 5510-2:2009, the tested sample is classified as following:

Burning Class: S4

Smoke Class: SR2

Dripping Class: ST2

To be continued....



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2. DIN 5510-2:2009 Annex C

I. Test conducted

This test was conducted in accordance with the procedure specified in DIN 5510-2:2009 Preventive fire protection in railway vehicles Part 2: Fire behaviour and fire side effects of materials and parts; Classification, requirements and test methods, Annex C (normative), Examination of the toxic of the smoke and Annex D (informative), Analysis methods of gaseous toxic.

This standard recommends that the test is carried out using the apparatus detailed in DIN EN ISO 5659-2 and that the quantitative determination of the gases emitted should be carried out in accordance with the procedure specified in Annex D (informative), Analysis methods of gaseous toxic of DIN 5510-2:2009.

II. Test details

Conditioning

Prior to testing, the sample was conditioned,

To constant mass at temperatures of $23 \pm 2^\circ\text{C}$ and at a relative humidity of $50 \pm 5\%$

At time to testing, Temperature between $15^\circ\text{C} \sim 35^\circ\text{C}$ and Relative humidity between $20\% \sim 80\%$

Exposed Face: Gelcoat Surface

Size of specimen: 76mm×76mm

III. Test results

1) 4 min after the test start

Gas	Sample 1	Sample 2	Sample 3	Average
Carbon Dioxide (CO ₂)	16917.50	17448.15	17384.59	17250.08
Carbon Monoxide (CO)	124.14	169.40	161.0	151.51
Hydrogen Fluoride (HF)	ND	ND	ND	-
Hydrogen Chloride (HCl)	ND	ND	ND	-
Hydrogen Bromide (HBr)	ND	ND	ND	-
Hydrogen Cyanide (HCN)	ND	ND	ND	-
Nitrogen Oxides (NO ₂)	20.62	18.96	17.49	19.02
Sulphur Dioxide (SO ₂)	ND	ND	ND	-

To be continued....



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2) 8 min after the test start

Gas	Sample 1	Sample 2	Sample 3	Average
Carbon Dioxide (CO ₂)	27199.27	28041.90	27837.67	27692.95
Carbon Monoxide (CO)	298.47	327.60	319.65	315.24
Hydrogen Fluoride (HF)	ND	ND	ND	-
Hydrogen Chloride (HCl)	ND	ND	ND	-
Hydrogen Bromide (HBr)	ND	ND	ND	-
Hydrogen Cyanide (HCN)	ND	ND	ND	-
Nitrogen Oxides (NO ₂)	30.74	27.98	25.22	27.98
Sulphur Dioxide (SO ₂)	ND	ND	ND	-

Where, ND indicates Non-detected.

Note: All values given are in mg/m³.

Calculate the Fractional effective dose *FED*

The test results obtained for toxicity measurements were used to calculate the *FED*, as described in DIN 5510-2:2009, clause C.3.4 and the reference values for gases is showed in following table.

Gas	Reference concentration; mg/m ³
Carbon Dioxide (CO ₂)	72000
Carbon Monoxide (CO)	1380
Hydrogen Fluoride (HF)	25
Hydrogen Chloride (HCl)	75
Hydrogen Bromide (HBr)	99
Hydrogen Cyanide (HCN)	55
Nitrogen Oxides (NO ₂)	38
Sulphur Dioxide (SO ₂)	262

$$CIT = 0.0805 \cdot \sum_{i=1}^{i=8} \frac{C_i}{C_i}$$

Where,

CIT — Conventional Index of Toxicity;

c_i — Concentration of the *i*th gas;

C_i — Reference concentration of the *i*th gas.

To be continued...



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$$FED(t_{zul}) = \frac{(CIT_4 + 0.5CIT_8) \times 4\text{min} + CIT_8 \times (t_{zul} - 8\text{min})}{30\text{min}}$$

Where,

CIT_4 , CIT_8 — the value of CIT 4 min or 8 min after the test started;

t_{zul} — Allowed exposure duration in vehicle refer to Table C.2 of DIN 5510-2:2009.

According to the Table C.2, $t_{zul} = 15$ min, $FED(t_{zul} = 15\text{ min}) = 0.04$

$t_{zul} = 30$ min, $FED(t_{zul} = 30\text{ min}) = 0.10$

Requirement: $FED \leq 1$

Sub-Conclusion: According to test results, the smoke-gas toxicity of the submitted sample **meets** the requirements specified in DIN 5510-2:2009.

STATEMENTS:

The test results relate to the behaviour of the test specimens of a product under the particular conditions of the test. They are not intended to be the sole criterion for assessing the potential fire, smoke and toxicity hazard of the product in use.

The test results relate only to the specimens of the product in the form in which were tested. Small differences in the composition or thickness of the product may significantly affect the performance during the test and may therefore invalidate the test results. Care should be taken to ensure that any product, which is supplied or used, is fully represented by the specimens, which were tested.

The specimen was supplied by the sponsor and SGS-CSTC ANJI Branch was not involved in any selection or sampling procedure.

To be continued....



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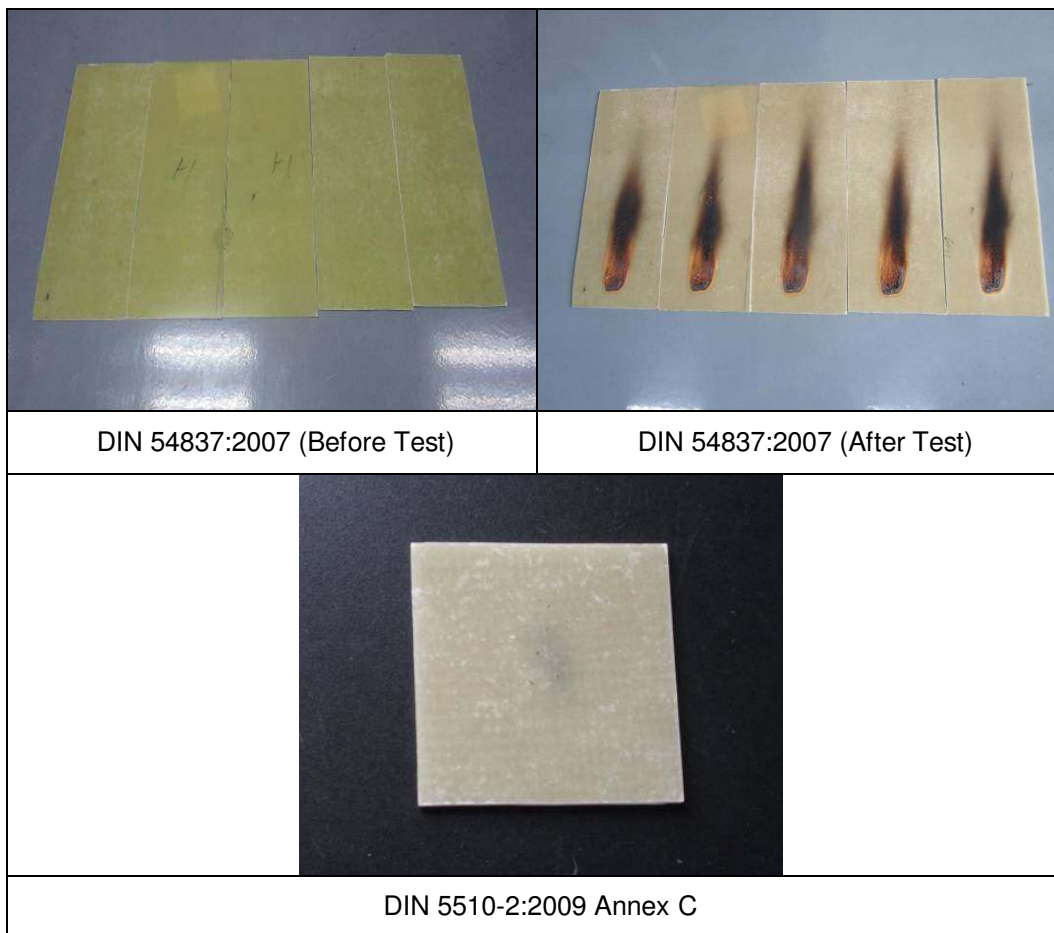
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Photo Appendix:



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