

Test Report

No. SDHL1611021504FB

Date: Nov.16, 2016

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DONGSUNG CHEMICAL CO.,LTD.
472, SHINPYUNG-DONG, SAHA-GU, BUSAN, KOREA

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

Sample Description : VIXUM
 Type No. : VIXUM IGN 380-AL
 Thickness : 10MM
 Composition : MELAMINE FOAM,ALUMINUM FOIL,ADHESIVE
 Color : SILVER GREY
 Sample Receiving Date : Nov.04, 2016
 Test Performing Date : Nov.04, 2016 to Nov.16, 2016

Test Result Summary

No.	Test(s) Requested	Result(s)	Comments
1	DIN 5510-2:2009 Preventive fire protection in railway vehicles Part 2: Fire behaviour and fire side effects of materials and parts	Flammability Class: S4 Smoke generation Class: SR2 Droplet formation Class: ST2	/
2	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 behavior and fire side effects of materials and parts; Classification, requirements and test methods	PASS	/

For further details, please refer to the following page(s)

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



Kevin Pan
Approved signatory



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Test Conducted:

This test is specified in DIN 5510-2:2009-05 Specification for materials and components for railed vehicles, and the test methods as following:

DIN 54837: 2007 --- Testing of materials, small components and component sections for rail vehicles – Determination of burning behaviour using a gas burner.

Annex C (normative) of DIN 5510-2:2009 --- To determine of the FED (Fractional effective dose) of toxic fume.

I. Sample description & conditioning:

Sample Description	VIXUM
Materials	Aluminum foil + Adhesive + Foam + Metal plate(substrate)
Color	Front: Sliver; Substrate: Sliver
Thickness	About 12mm
Exposed face	Aluminum foil surface
Precondition	Prior to testing, the sample was conditioned, to constant mass at temperatures of 23±2°C and at a relative humidity of 50±5%

II. Test Requirements:

1. Classification according DIN 5510-2: 2009

Flammability Class	Smoke generation Class	Droplet formation Class
S1 - Test according DIN 53438 required	SR1 Not achieved - Int. >100% min	ST1 - Burning dripping or burning falling drops, and afterflame of drops > 20s ST2 - No dripping and burning, or afterflame of drops ≤ 20s
S2 - Damaged length≤30 cm	SR1 - Int. ≤100% min	
S3 - Damaged length≤25cm, afterflame≤100 s (No individual value ≥ 120s)	SR2 - Int. ≤50% min	
S4 - Damaged length≤20cm, afterflame≤10s		
S5 - Damaged length=0cm, afterflame = 0s		

2. Requirements of Annex C (normative) of DIN 5510-2:2009 --- To determine of the FED (Fractional effective dose) of toxic fume: **FED ≤ 1**



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III. Test Result:

1. According to DIN 54837:2007

Parameter		Specimen No. & Value					Average
		1	2	3	4	5	
Flaming at (s)		2	2	2	1	2	---
Afterflame (s)		0	0	0	0	0	0
Glowing	Occur (Yes / No)	No	No	No	No	No	---
	Afterglow (s)	0	0	0	0	0	0
Flame height	Maximum (cm)	26	32	24	27	26	---
Drop away of parts	Drop away (Yes / No)	No	No	No	No	No	---
	Burning. Burntime (s)	0	0	0	0	0	0
Smoke density	Maximum (%)	1.02	1.32	0.43	2.74	1.76	---
	At time (s)	9	11	9	9	9	---
	Integral (%·min)	1.02	1.32	0.43	2.74	1.76	1.45
Charred Length (cm)		20	20	17	17	17	18
Burn through (Yes / No)		No	No	No	No	No	---
Melting (Yes / No)		No	No	No	No	No	

Sub-Conclusion:

---	Burning Class	Smoke generation Class	Droplet formation Class
Classification	S4	SR2	ST2

2. 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.



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1) 4 min after the test start

Gas	Specimen 1	Specimen 2	Specimen 3	Average
Carbon Dioxide (CO ₂)	2727	2818	2818	2788
Carbon Monoxide (CO)	9	8	8	8
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)	ND	1	ND	0.3
Sulphur Dioxide (SO ₂)	8	5	7	7

2) 8 min after the test start

Gas	Specimen 1	Specimen 2	Specimen 3	Average
Carbon Dioxide (CO ₂)	3091	3273	3273	3212
Carbon Monoxide (CO)	12	10	10	11
Hydrogen Fluoride (HF)	ND	ND	ND	--
Hydrogen Chloride (HCl)	ND	ND	ND	--
Hydrogen Bromide (HBr)	ND	ND	ND	--
Hydrogen Cyanide (HCN)	1	ND	1	0.6
Nitrogen Oxides (NO ₂)	3	2	2	2
Sulphur Dioxide (SO ₂)	11	8	9	9

Where, ND indicates Non-detected.

Note: All values given are in mg/m³.



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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.3.3 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.

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

Where,

CIT₄, *CIT₈* – 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}* = 30min Then, **FED=0.011**

t_{zul} = 15min Then, **FED=0.005**

Sub-Conclusion: The smoke-gas toxicity of the submitted sample **meets** the requirements specified in DIN 5510-2:2009.



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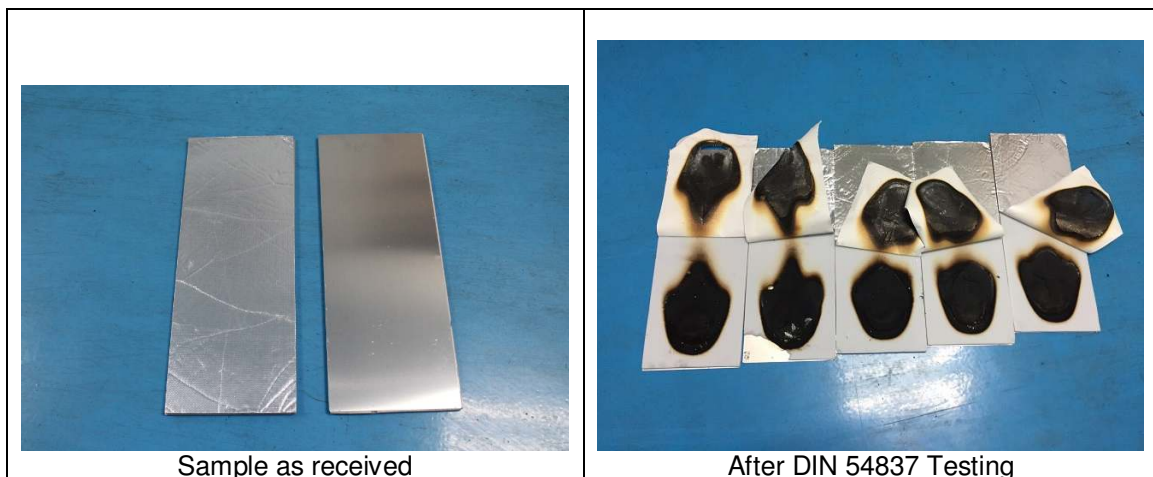
Statements:

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 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 Shunde Branch was not involved in any selection or sampling procedure.

Photo Appendix:



End of Report



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