Test Report

CHANGZHOU SUN PLUS LAMINATE CO., LTD

NO.16 WUQING ROAD, WEIXING INDUSTRY, HENGLIN TOWN, CHANGZHOU, CHINA

Sample Description: SUNPLUS HIGH PRESSURE LAMINATE HPL

Thickness: 0.7mm

Style/Item No.: /

The above sample(s) was / were submitted and identified on behalf of the client. SGS is not responsible for the authenticity, integrity and results of the data and information and / or the validity of the conclusion arising therefrom. Results apply to the sample as received.

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Test Requested:

EN 45545-2:2020 Railway applications—Fire protection on railway vehicles Part 2: Requirements for fire behavior of materials and components, and testing according to Table 5 — Material requirement sets (R1).

Test Results: -- See attached sheet --

Test Period:

Sample Receiving Date : DEC.16, 2024

Test Performing Date : DEC.16, 2024 TO DEC.20, 2024

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

Echo Li
Approved Signatory

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I. Description of Test specimens

Sample description	High pressure laminate HPL
Color	Grey and White
Thickness	0.7mm
Exposed (test) surface	Striped surface
Size of specimens	T02 ISO 5658-2: 800mm×155mm
	T03.01 ISO 5660-1: 100mm×100mm
	T10.01/T10.02 EN ISO 5659-2: 75mm×75mm
	T11.01 EN 17084 Method 1: 75mm×75mm

II. Summary of test results

Requirement set (used for)	Test method reference	Parameter and Unit	Test results *
R1	T02 ISO 5658-2	CFE kW/m^2	50.0
	T03.01 ISO 5660-1: 50 kW/m^2	MARHE kW/m^2	79.4
	T10.01 EN ISO 5659-2: 50 kW/m^2	*Ds*(4) dimensionless	59.5
	T10.02 EN ISO 5659-2: 50 kW/m^2	VOF_4 min	212.3
	T11.01 EN 17084 Method 1: 50 kW/m^2	CIT_G dimensionless	0.183

***** For the test details, please see the appendix of this test report.

III. Conclusion

According to the test results, the submitted sample **meets** the requirements of R1 (detailed in Table 5 of EN 45545-2:2020) for **HL2** Hazard Level Classification.

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Test Criteria, EN 45545-2:2020, Table 5, Material requirement sets, R1

Requirement set (used for)	Test method reference	Parameter and unit	Maximum or Minimum	HL1	HL2	HL3
R1 (IN1A; IN1B; IN1D; IN1E; IN4; IN5; IN6A; IN7; IN8; IN9B; IN11; IN12A; IN12B; IN14; EX4A; F5)	T02 ISO 5658-2	*CFE* kWm^{-2}	Minimum	20 [a]	20 [a]	20 [a]
	T03.01 ISO 5660-1: 50 kWm^{-2}	*MARHE* kWm^{-2}	Maximum	--	90	60
	T10.01 EN ISO 5659-2: 50 kWm^{-2}	$D_s(4)$ dimensionless	Maximum	600	300	150
	T10.02 EN ISO 5659-2: 50 kWm^{-2}	VOF_4 min	Maximum	1200	600	300
	T11.01 EN 17084 Method 1: 50 kWm^{-2}	CIT_G dimensionless	Maximum	1.2	0.9	0.75

[a] If flaming droplets / particles are reported according to 5.3.8 during the test ISO 5658-2, or for the special case of materials which do not ignite in ISO 5658-2 and are additionally reported as unclassifiable, the following requirements shall be added:

Test to the requirements of T05 (EN ISO 11925-2 with 30 s flame application).

The acceptance requirements are:

--- flame spread ⩽ 150 mm within 60 s.

--- no burning droplets / particles.

Statements:

This declaration of conformity is only based on the result of this laboratory activity, the impact of the uncertainty of the results was not included.

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 hazard of the product in use.

APPENDIX 1: T02 ISO 5658-2:2006 Reaction to fire tests — Spread of flame — Part 2: Lateral spread on building and transport products in vertical configuration

1. Conditioning

T: 23±2°C, R.H: 50±5%, until the test sample was conditioned to constant mass.

2. Test results

Specimen No.:	1		Heat for Sustained Burning (MJ/m^2)	2		Heat for Sustained Burning (MJ/m^2)	3		Heat for Sustained Burning (MJ/m^2)
Weight (g)	150.6			151.8			148.7		
Time to Ignition: (min: sec)	0:21			0:14			0:17		
Time to Travel	min	sec		min	sec		min	sec	
50 mm	0	23	-	0	21	-	0	20	-
100 mm	-	-	-	-	-	-	-	-	-
150 mm	-	-	-	-	-	-	-	-	-
200 mm	-	-	-	-	-	-	-	-	-
250 mm	-	-	-	-	-	-	-	-	-
300 mm	-	-	-	-	-	-	-	-	-
350 mm	-	-	-	-	-	-	-	-	-
400 mm	-	-	-	-	-	-	-	-	-
450 mm	-	-	-	-	-	-	-	-	-
500 mm	-	-	-	-	-	-	-	-	-
550 mm	-	-	-	-	-	-	-	-	-
600 mm	-	-	-	-	-	-	-	-	-
650 mm	-	-	-	-	-	-	-	-	-
700 mm	-	-	-	-	-	-	-	-	-
750 mm	-	-	-	-	-	-	-	-	-
Duration of Test (min: sec)	12:51			12:22			12:31		
Final Travel (mm)	50			50			50		
CFE (kW/m^2)	50.0			50.0			50.0		

Observations during test: None.

Calculated from the data in above table for each specimen for each of the parameters

PARAMETER	Specimen No.			Average
	1	2	3	
Average Heat for Sustained Burning (Qsb) (MJ/m^2)	--	--	--	--
Critical Heat Flux at Extinguishment (CFE) (kW/m^2)	50.0	50.0	50.0	50.0

Remark: "-" indicates the flame did not spread to 150mm.

APPENDIX 2: T03.01 ISO 5660-1:2015 Reaction-to-fire tests — Heat release, smoke production and mass loss rate — Part 1: Heat release rate (cone calorimeter method) and smoke production rate (dynamic measurement), Heat flux: 50 kW/m²

1. Conditioning

T: 23 ± 2°C, R.H: 50 ± 5%, until the test sample was conditioned to constant mass.

2. Test result

Test orientation	Horizontal			
The exposed surface area of the test specimen / m^2	0.0088			
Irradiance / (kW/m^2)	50			
Distance between the cone base plate and the upper specimen surface / (mm)	25			
Specimen No.	1	2	3	Average
Initial mass / g	12.1	12.2	12.0	12.1
Mass at sustained flaming / g	11.7	11.6	11.8	11.7
Remained mass / g	5.4	5.7	5.7	5.6
Sample Mass Loss / g/m^2	750.0	720.0	700.0	723.3
Average Mass Loss Rate $\dot{m}$ / ($g \cdot m^{-2} \cdot s^{-1}$)	0.6	0.6	0.6	0.6
Average rate of specimen mass loss per unit area $\dot{m}_{A,10-90}$ / ($g \cdot m^{-2} \cdot s^{-1}$)	1.8	2.0	1.8	1.9
Flashing or transitory flaming time at / s	—	—	—	---
Time to sustained flaming / s	15.0	22.0	14.0	17.0
Whether re-insert the spark igniter [1)]	No	No	No	---
Maximum heat release rate per unit area / (kW/m^2)	201.5	201.6	202.7	201.9
Average heat release rate per unit area for 180s after ignition / (kW/m^2) [2)]	62.6	58.7	60.4	60.6
Average heat release rate per unit area for 300s after ignition / (kW/m^2)	48.9	45.5	46.8	47.1
Total heat release / (MJ/m^2)	17.7	16.8	17.5	17.3
Average effective heat of combustion / (MJ/kg)	24.7	25.5	25.2	25.1
Total smoke production per unit area over the non-flaming phase ($S_{A,1}$) / m^2m^{-2}	7.0	8.3	6.5	7.3
Total smoke production per unit area over the flaming phase ($S_{A,2}$) / m^2m^{-2}	116.6	232.4	108.2	152.4
Total smoke production per unit area ($S_A=S_{A,1}+S_{A,2}$)/m^2m^{-2}	123.6	240.7	114.7	159.7
Test duration / s [3)]	1200.0	1200.0	1200.0	1200.0
Maximum value of average rate of heat emission (MARHE) / KW/m^2	81.8	75.1	81.3	79.4
Additional observations [4)]	Warping			
Special mounting procedures [5)]	c			

Remark:

1) If the flame extinguishes in less than 60 s after turning off the spark, re-insert the spark igniter and turn on the spark within 5 s, do not remove the spark until the entire test is completed.

2) The 180 s mean heat release readings shall be compared for the three specimens. If any of these mean readings differ by more than 10 % from the arithmetic mean of the three readings, then a further set of three specimens shall be tested unless the mean value is less than 10 kW m^{-2}.

3) Collect all data until:
   - ☐ a. 32 min after the time to sustained flaming (the 32 min consist of a 30 min test period, and an additional 2 min post-test period to collect data that will be time-shifted). Data are processed to the time to sustained flaming plus 30 min.
   - ☐ b. 30 min have elapsed and the specimen has not ignited.
   - ☐ c. XO_2 returns to a value greater than the pre-test value minus 100 µl/l of oxygen concentration for 10 min. The end of test is the beginning of the 10 min period.
   - ☐ d. The mass of the specimen is less than 0.1 g for 60 s. The end of test is the beginning of the 60 s period.
   - ☑ e. 20min (specified in EN 45545-2:2020, T03.01 ISO 5660-1).

4) Observe and record physical changes to the sample such as melting, swelling, and cracking.

5) Special mounting procedures that were used:
   - ☐ a. Samples that intumesce or deform so that they contact the spark plug prior to ignition, or the underside of the cone heater after ignition, shall be tested with the separation of 60 mm between the base plate of the cone heater and the upper surface of the specimen.
   - ☐ b. Other dimensionally unstable products, for example products that warp or shrink during testing, shall be restrained against excessive movement. This shall be accomplished with 4 tie wires. A tie wire is then looped around the sample holder and retainer frame assembly, so that it is parallel to and approximately 20 mm away from one of the 4 sides of the assembly. The ends of the wire are twisted together such that the wire is pulled firmly against the retainer frame. Excess wire is trimmed from the twisted section before testing. The 3 remaining wires shall be fitted around the specimen holder and retainer frame assembly in a similar manner, parallel to the three remaining sides.
   - ☐ c. Materials that distort so extensively that they cannot be held by 4 wires should be tested using the fine wire grid made of (0,8 ± 0,1) mm with wire spacing of (20 ± 2) mm.
   - ☐ d. Materials that intumesce in a fluid phase such that molten materials overflow the edge frame or seep between the edge frame and the specimen holder invalidate the test. Therefore, such materials should be tested without the edge frame and should be housed in 0,1 mm thick aluminum tray wrappings which extends 10mm above the top edge of the test specimen.
   - ☐ e. Materials, such as fibres, which need to be both physically restrained or compressed to be tested at installed densities should be tested in a wire cage structure made of (1,0 ± 0,1) mm steel wire with (9 ± 1) mm spacing which provides appropriate artificial boundaries to enable the materials to be tested.
   - ☐ f. No special mounting procedures that were used.

6) Heat release rate (per unit area), expressed in kilowatts per square metre curve of specimens is given in figure 1.

7) The orifice constant is 0.039 $m^{1/2}$ $g^{1/2}$ $K^{1/2}$; the exhaust flow rate is 0.024±0.002 m^3/s.

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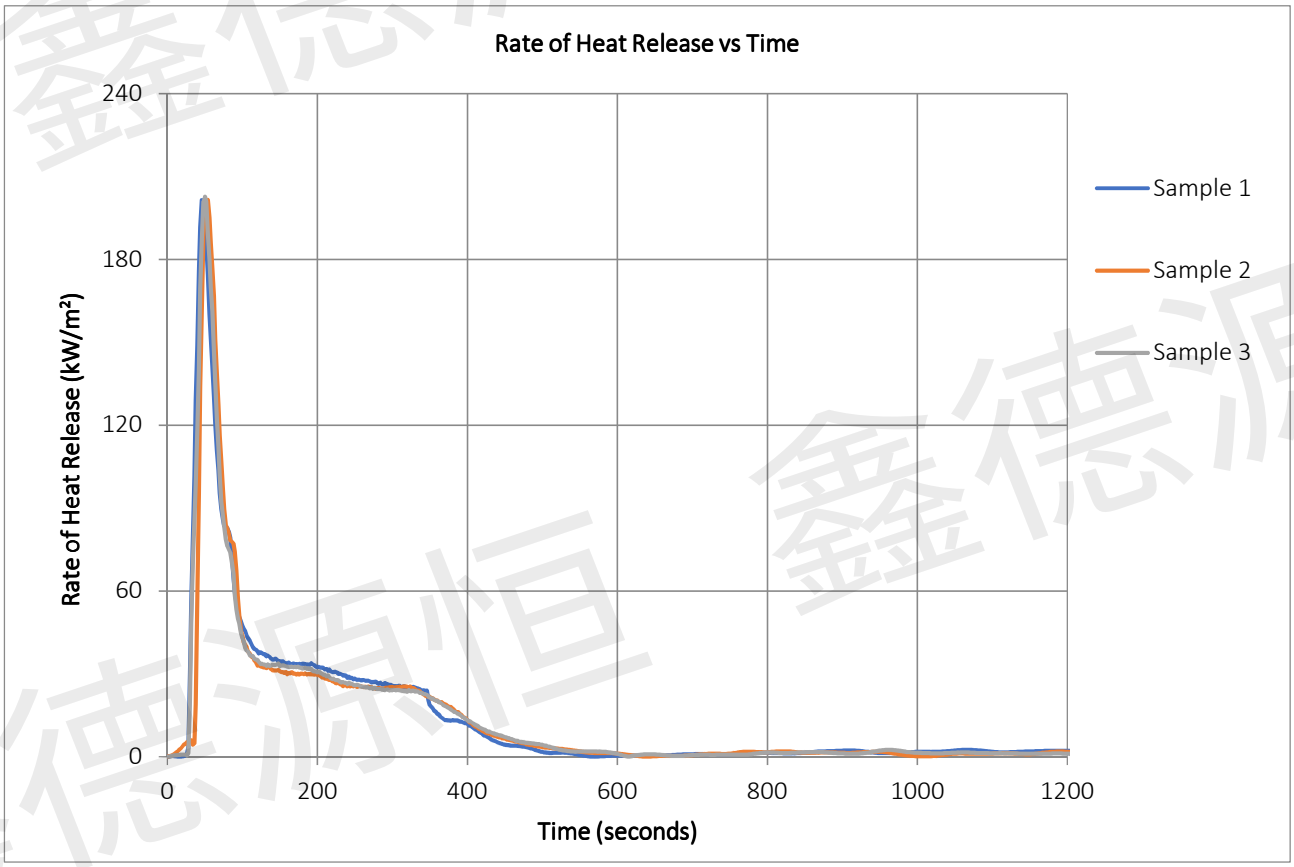
Curves:



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APPENDIX 3: T10.01&T10.02 EN ISO 5659-2:2017 Plastics—Smoke generation — Part 2: Determination of optical density by a single- chamber test. Heat flux 50 kW/m² without pilot flame, test duration is 10min

1. Conditioning

T: 23±2 ºC, R.H: 50±5%, until the test sample was conditioned to constant mass.

2. Test Results

Parameters	1	2	3	Average
Weight (g)	6.9	7.0	7.0	7.0
$D_{s\ (1.5)}$	57.8	49.7	71.8	59.8
$D_{s\ (4)}$	61.1	50.7	66.7	59.5
$D_{s\ max}$	66.3	52.9	76.8	65.3
T ($D_{s\ max}$) s	155	74	61	/
$D_{s\ (10)}$	43.2	42.3	51.0	45.5
VOF_4 min	206.8	180.7	249.5	212.3

NOTE:

$D_{s\ (n)}$ is the specific optical density at n^{th} min.

VOF_4 is the cumulative value of specific optical densities in the first 4 min of the test.

$D_{s\ max}$ is the maximum optical density in the test chamber.

APPENDIX 4: T11.01 EN 17084:2018 Railway applications – Fire protection on railway vehicles – Toxicity test of materials and components. Method 1, Smoke chamber + FTIR. Heat flux 50kW/m² without pilot flame, test duration is 10min.

1. Conditioning

T: 23±2°C and R.H 50±5%, until the test sample was conditioned to constant mass.

2. Test results

1) 4 min after the test start

Gas	1	2	3	Average
Carbon Dioxide (CO_2)	8706.5	10353.5	9939.3	9666.4
Carbon Monoxide (CO)	307.3	281.2	220.3	269.6
Hydrogen Fluoride (HF)	ND	ND	ND	---
Hydrogen Chloride (HCl)	ND	ND	ND	---
Hydrogen Bromide (HBr)	8.2	9.6	12.5	10.1
Hydrogen Cyanide (HCN)	18.6	21.7	22.7	21.0
Nitrogen Oxides (NO_x)	45.6	48.4	55.5	49.9
Sulphur Dioxide (SO_2)	ND	ND	ND	---

2) 8 min after the test start

Gas	1	2	3	Average
Carbon Dioxide (CO_2)	7877.8	8882.5	8713.4	8491.2
Carbon Monoxide (CO)	422.2	358.7	381.2	387.4
Hydrogen Fluoride (HF)	ND	ND	ND	---
Hydrogen Chloride (HCl)	ND	ND	ND	---
Hydrogen Bromide (HBr)	ND	ND	ND	---
Hydrogen Cyanide (HCN)	17.7	21.3	21.9	20.3
Nitrogen Oxides (NO_x)	56.4	55.4	60.2	57.3
Sulphur Dioxide (SO_2)	ND	ND	ND	---

Where, ND indicates Non-detected.

Note: All values given are in mg/m^3.

3) Calculation of CIT_G

Gas component	Reference concentration; mg/m³
Carbon Dioxide (CO_2)	72 000
Carbon Monoxide (CO)	1 380
Hydrogen Bromide (HBr)	99
Hydrogen Chloride (HCl)	75
Hydrogen Cyanide (HCN)	55
Hydrogen Fluoride (HF)	25
Nitrogen Oxides (NO_x)	38
Sulphur Dioxide (SO_2)	262

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

Where,

CIT_G – Conventional Index of toxicity.

c_i – Concentration of the ith gas.

C_i – Reference concentration of the ith gas.

PARAMETER	1	2	3	Average
CIT_G (4 min)	0.158	0.170	0.185	0.171
CIT_G (8 min)	0.179	0.179	0.192	0.183

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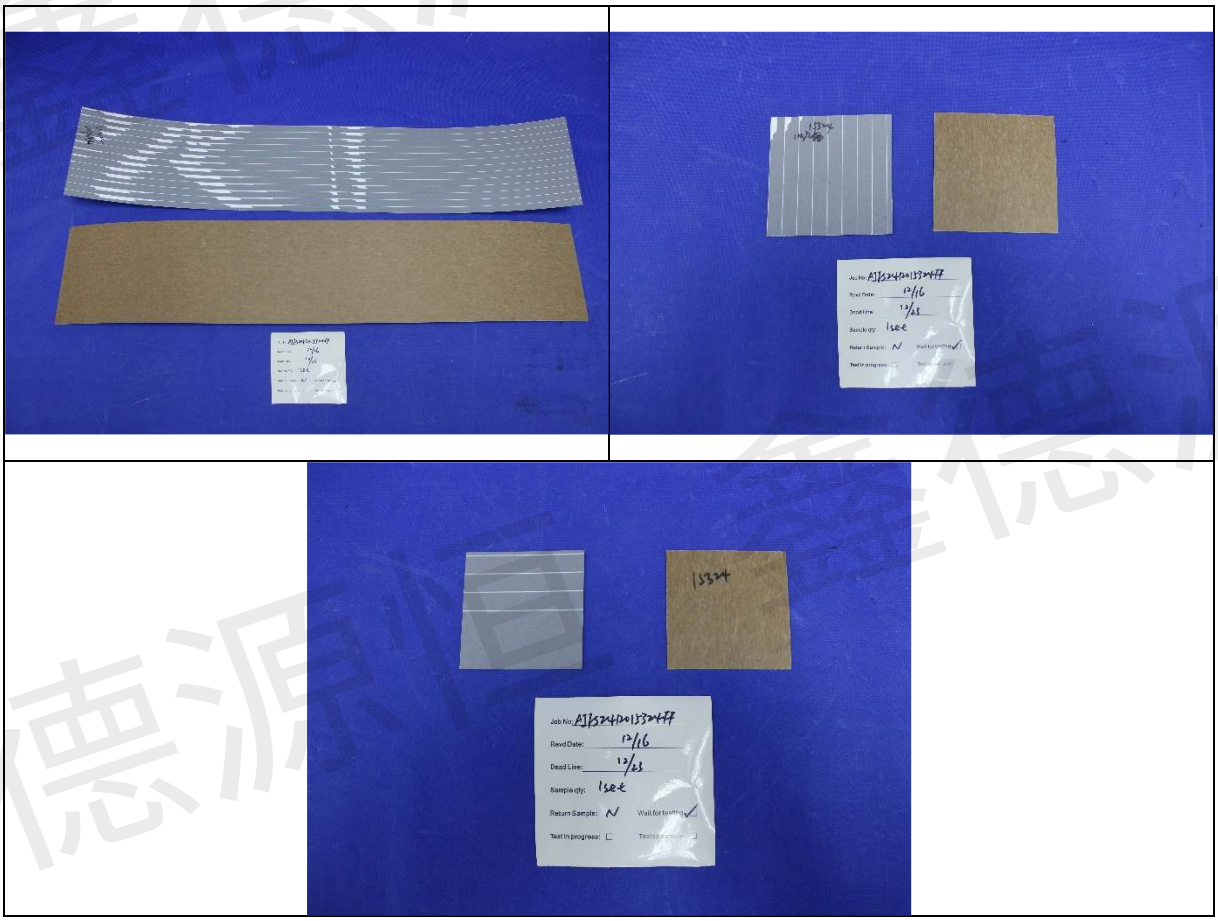
Photo Appendix:



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End of Report

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