
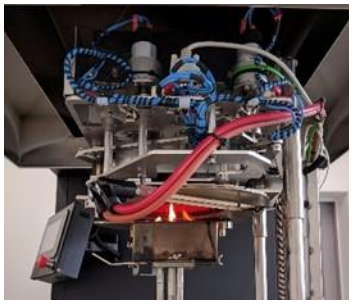
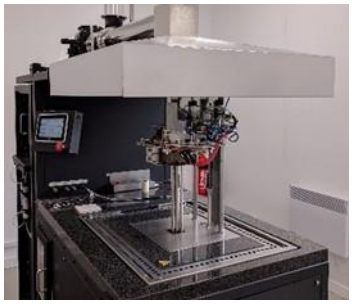

BRANZ Type Test

FH10913-1

CONE CALORIMETER TEST AND NZBC ACCEPTABLE SOLUTIONS SECTION 5.8.1 PERFORMANCE OF ALUCOBOND A2

CLIENT
Alucobond (Far East) Pte Ltd
6 Shenton Way
#40-05 OUE Downtown 1
Singapore 068809

All tests and procedures reported herein, unless indicated, have been performed in accordance with the laboratory's scope of accreditation

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TEST SUMMARY

Objective

To conduct cone calorimeter testing and reduce the data in accordance with ISO 5660 (2002) as specified in New Zealand Building Code (NZBC) Acceptable Solutions Appendix C 7.1, on client supplied specimens for the purposes of determination of the Exterior Surface Finishes performance in accordance with

- NZBC Acceptable Solutions Section 5.8.1. a) and b)

Test sponsor

Alucobond (Far East) Pte Ltd
6 Shenton Way
#40-05 OUE Downtown 1
Singapore 068809

Description of test specimen

The product as described by the client as **Alucobond A2**

Date of tests

13 November 2018 and 8 February 2019

Test results

For the purposes of compliance with the relevant building code documents, the following classification is considered applicable to the tested samples as described in Section 1.

Building Code Document		**Performance**
NZBC Acceptable Solutions Section 5.8.1	a)	Satisfied
	b)	Satisfied

LIMITATION

The results reported here relate only to the item/s tested.

TERMS AND CONDITIONS

This report is issued in accordance with the Terms and Conditions as detailed and agreed in the BRANZ Services Agreement for this work.

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DOCUMENT REVISION STATUS

ISSUE NO.	DATE ISSUED	EXPIRY DATE	DESCRIPTION
1	4/04/2019	4/04/2024	Initial Issue

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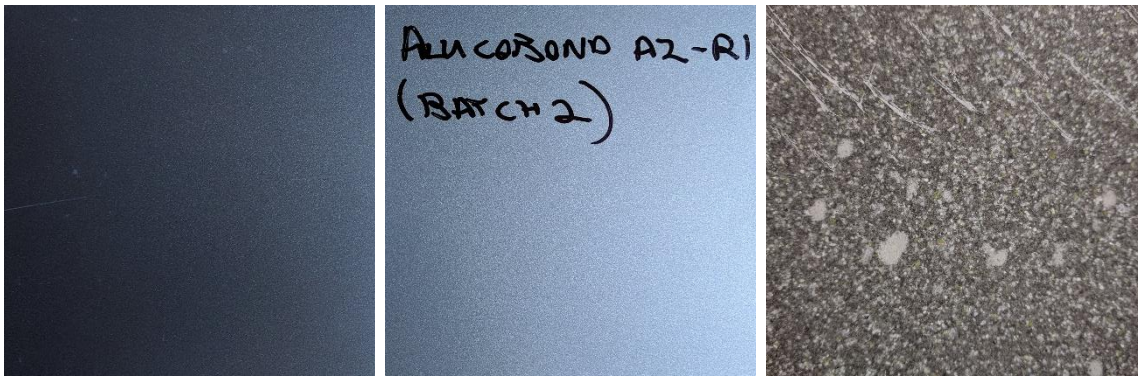
1. GENERAL

The product submitted by the client for testing was identified by the client as **Alucobond A2**, a nominally 4.0mm thick, composite panel comprising two layers EN-AW5005 grade 0.5mm thick aluminium layers covering a 3.0mm mineral filled core with less than 10% combustible binder content. The front facing metallic silver painted aluminium skin was removed prior to testing. Figure 1 illustrates representative specimens of that tested.

Figure 1: Representative specimens (front face left, back face centre, core right)



1.1 Sample measurements

The following physical parameters were measured for each specimen prior to testing.

Table 1: Physical parameters

Specimen ID	Initial properties		Overall apparent density (kg/m³)	Colour
	Mass (g)	Mean thickness (mm)		
FH10913-2-50-1	68.9	3.3	2088	Silver
FH10913-2-50-2	71.0	3.3	2152	Silver
FH10913-2-50-3	73.3	3.3	2221	Silver
FH10913-2-50-4	67.6	3.2	2113	Silver
FH10913-2-50-5	67.9	3.2	2122	Silver
FH10913-2-50-6	68.9	3.2	2153	Silver

Note: All measurements exclude front facing aluminium skin

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2. EXPERIMENTAL PROCEDURE

2.1 Test standard

The tests were carried out and data reduced according to the test procedures described in ISO 5660: (2002), Reaction-to-fire tests – Heat release, smoke production and mass loss – Part 1: Heat release rate, and Part 2: Smoke production rate. The sample preparation and test procedure are as described in 2.4 and 2.5.

2.2 Test date

The tests were conducted on the 13 November 2018 and 8 February 2019 by Mr James Quilter and Mr Lukas Hersche at BRANZ Limited laboratories, Judgeford, New Zealand.

2.3 Specimen conditioning

All specimens were conditioned to moisture equilibrium (constant weight), at a temperature of 23 ± 2°C and a relative humidity of 50 ± 5% immediately prior to testing.

2.4 Special weathering

According to Acceptable Solutions Appendix C 7.1.3, timber claddings which have a fire-retardant treatment incorporated in or applied to them are required to be subjected to the regime of accelerated weathering described in ASTM D 2898 Method B with the water flow rate from Method A before testing. The tested specimens were not timber claddings and therefore were not subjected to the accelerated weathering.

2.5 Specimen wrapping and preparation

All tests were conducted, and the specimens prepared in accordance with the test standard. The spark igniter and the stainless-steel retainer frame were used during testing. All specimens were wrapped in a single layer of aluminium foil, covering the unexposed surfaces. Prior to testing all samples had the front facing aluminium skin removed.

2.6 Test programme

The test programme consisted of six replicate specimens as identified in the Table 1, tested at an irradiance level of 50 kW/m². All tests were carried out with the specimen horizontal, and with a nominal duct flow rate of 0.024 m³/s.

2.7 Specimen selection

BRANZ was not involved in the selection of the materials submitted for testing. The test materials used were supplied to the laboratory by the client.

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3. TEST RESULTS AND REDUCED DATA

3.1 Test results and reduced data – NZBC Acceptable Solutions Appendix C7.1

Table 2: Test results and reduced data for three replicate samples

Material		Test specimens as described in Section 1 (in accordance with ISO 5660)			Mean
Specimen test number		FH10913-2-50-1	FH10913-2-50-2	FH10913-2-50-3	
Test Date		13/11/2018	8/02/2019	8/02/2019	
Time to sustained flaming	s	186	186	230	201
Observations[a]		-	-	-	
Test duration[b]	s	900*	900*	900*	900
Mass remaining, m_f	g	51.0	55.0	56.8	54.2
Mass pyrolyzed	%	26.0%	22.6%	22.6%	23.7%
Specimen mass loss[c]	kg/m^2	1.3	1.1	0.9	1.1
Specimen mass loss rate[c]	g/m^2 .s	4.2	3.0	2.5	3.2
Heat release rate					
peak, $\dot{q}''_{max}$	kW/m^2	73.6	88.0	78.3	80.0
average, $\dot{q}''_{avg}$					
Over 60 s from ignition	kW/m^2	23.6	46.6	55.3	41.8
Over 180 s from ignition	kW/m^2	40.7	63.5	60.1	54.8
Over 300 s from ignition	kW/m^2	43.0	53.2	48.9	48.4
Total heat released	MJ/m^2	15.8	17.9	17.4	17.1
Average Specific Extinction Area	m^2/kg	22.8	71.6	71.8	55.4
Effective heat of combustion[d], $\Delta h_{c,eff}$	MJ/kg	7.8	9.9	9.3	9.0

Notes:

[a] no significant observations were recorded

[b] determined by * test duration of 15 minutes as specified in NZBC Acceptable Solutions Appendix C 7.1.2

[c] from ignition to end of test;

[d] from the start of the test

[+] value calculated using data beyond the official end of test time according to the test standard.

NR not recorded

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4. SUMMARY

The test standard requires that the mean heat release rate (HRR) readings over the first 180 s from ignition for the three specimens should differ by no more than 10% of the arithmetic mean of the three readings. In the event of this criterion not being met, a further three specimens are required to be tested.

Table 3: Heat release rate

Specimen ID	Average HRR over 180 s from ignition	Arithmetic mean	% difference from the arithmetic mean
FH10913-2-50-1	40.7	54.8	-25.7%
FH10913-2-50-2	63.5		16.0%
FH10913-2-50-3	60.1		9.8%

Table 3 identifies two specimens exposed to 50 kW/m² irradiance exceeded the acceptance criteria. A further set of three tests, as required by the test standard were undertaken and results are provided in Table 4 below.

Table 4: Heat release rate

Specimen ID	Average HRR over 180 s from ignition	Arithmetic mean	% difference from the arithmetic mean
FH10913-2-50-1	40.7	52.7	-22.9
FH10913-2-50-2	63.5		20.5
FH10913-2-50-3	60.1		14.1
FH10913-2-50-4	41.8		-20.7
FH10913-2-50-5	58.7		11.3
FH10913-2-50-6	51.5		-2.3

Table 5: Report summary for six replicate specimens

Mean Specimen thickness (mm)	Irradiance (kW/m^2)	Mean Time to Ignition (s)	Mean Peak Heat Release Rate (kW/m^2)	Mean Total Heat Released (MJ/ m^2)
3.3	50	214	75.4	15.6

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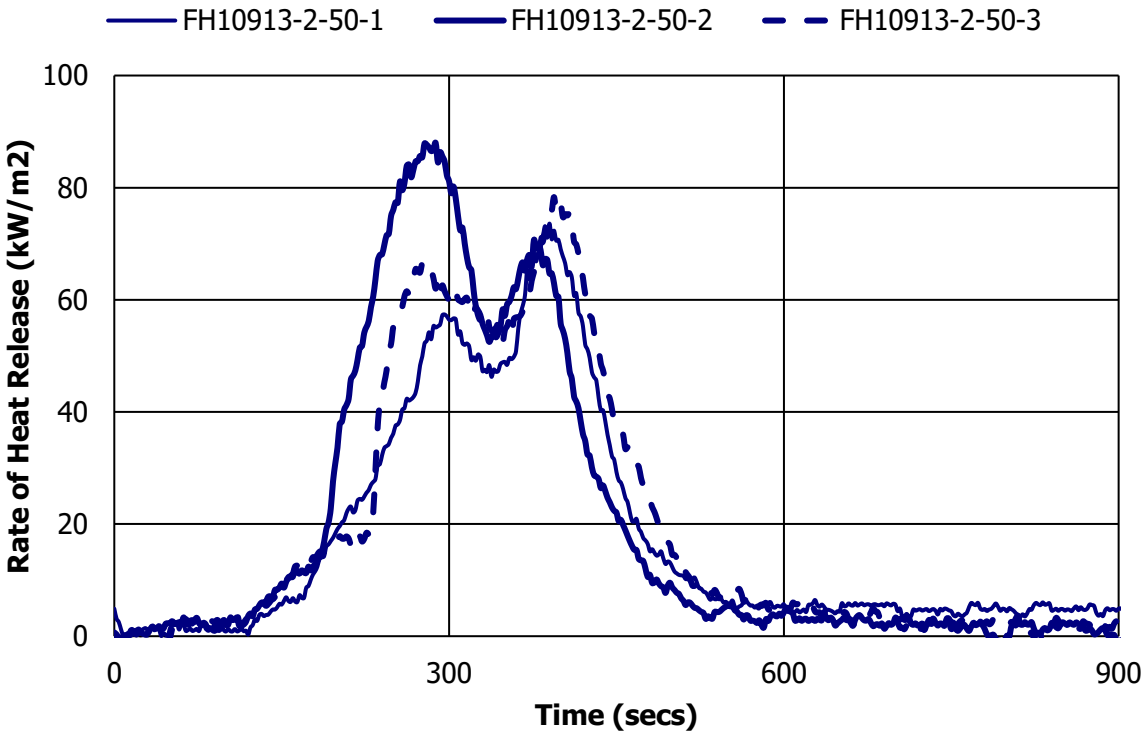
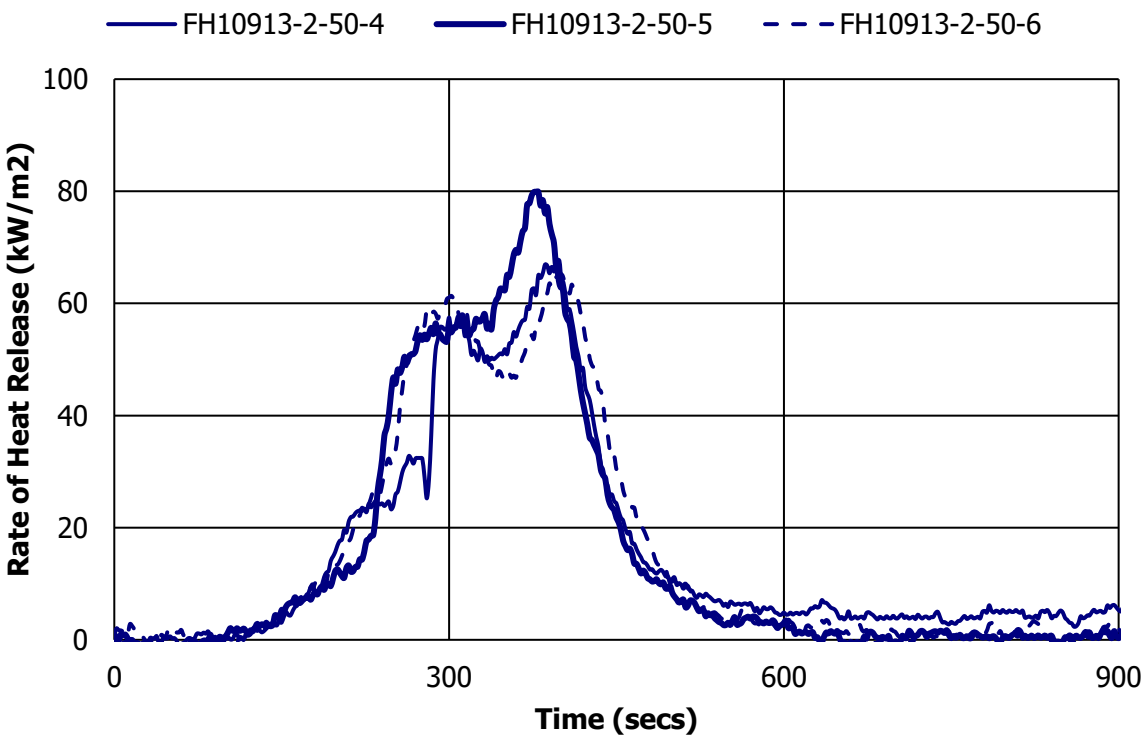
Figure 2: Rate of heat release versus time





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5. RESULTS FOR NZBC ACCEPTABLE SOLUTIONS SECTION 5.8.1

In accordance with NZBC Acceptable Solutions Section 5.8.1 a) and b) for external walls the mean test results must not exceed the Peak Heat Release rate and Total Heat Release shown in Table 5.

Table 6: NZBC Acceptable Solutions Section 5.8.1 a) and b) requirements

	NZBC Acceptable Solutions Section 5.8.1 Requirement – values shall not exceed	
	(a)	(b)
Peak Heat Release rate (kW/m²)	100	150
Total Heat Release (MJ/m²)	25	50

The samples as described in Section 1 had the following results when reduced over the 15-minute (900 s) period as specified in Appendix C 7.1.2 as shown in Table 6.

Table 7: NZBC Acceptable Solutions Section 5.8.1 a) and b) requirements

	Sample 1	**Sample 2**	**Sample 3**	**Performance**
Peak Heat Release rate (kW/m²)	73.6	88.0	78.3	Meets a) and b)
Total Heat Release (MJ/m²)	15.8	17.9	17.4	Meets a) and b)
	Sample 4	**Sample 5**	**Sample 6**	**Performance**
Peak Heat Release rate (kW/m²)	66.9	79.9	65.3	Meets a) and b)
Total Heat Release (MJ/m²)	14.1	13.9	14.2	Meets a) and b)

The tested samples recorded a mean Peak Heat Release of 75.3 KW/m^2 and a mean Total Heat Release of 15.6 MJ/m^2 and it is therefore considered to satisfy the requirements of NZBC Acceptable Solutions Section 5.8.1 a) and b).

6. NZBC CONCLUSION

For the purposes of compliance with the relevant building code documents, the following classification is considered applicable to the tested sample as described in Section 1.

Building Code Document		**Performance**
NZBC Acceptable Solutions Section 5.8.1	a)	Satisfied
	b)	Satisfied

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7. APPENDIX

Table 8: Test results and reduced data for six replicate samples

Material		Test specimens as described in Section 1 (in accordance with ISO 5660)						Mean
Specimen test number		FH10913-2-50-1	FH10913-2-50-2	FH10913-2-50-3	FH10913-2-50-4	FH10913-2-50-5	FH10913-2-50-6	
Test Date		13/11/2018	8/02/2019	8/02/2019	8/02/2019	8/02/2019	8/02/2019	
Time to sustained flaming	s	186	186	230	203	250	230	214
Test duration[b]	s	900	900	900	900	900	900	900
Mass remaining, m_f	g	51.0	55.0	56.8	49.3	49.6	50.4	52.0
Mass pyrolyzed	%	26.0%	22.6%	22.6%	27.1%	26.9%	26.8%	25.3%
Specimen mass loss[c]	kg/m^2	1.3	1.1	0.9	1.3	1.0	1.1	1.1
Specimen mass loss rate[c]	g/m^2 .s	4.2	3.0	2.5	3.2	2.5	2.9	3.1
HRR peak, $\dot{q}''_{max}$	kW/m^2	73.6	88.0	78.3	66.9	79.9	65.3	75.3
HRR average, $\dot{q}''_{avg}$								
HRR Over 60 s from ignition	kW/m^2	23.6	46.6	55.3	24.3	52.8	43.7	41.1
HRR Over 180 s from ignition	kW/m^2	40.7	63.5	60.1	41.8	58.7	51.5	52.7
HRR Over 300 s from ignition	kW/m^2	43.0	53.2	48.9	38.4	40.1	41.3	44.2
Total heat released	MJ/m^2	15.8	17.9	17.4	14.1	13.9	14.2	15.6
Average Specific Extinction Area	m^2/kg	22.8	71.6	71.8	52.9	38.5	12.9	45.1
Effective heat of combustion[d], $\Delta h_{c,eff}$	MJ/kg	7.8	9.9	9.3	6.8	6.7	6.8	7.9

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FH10913-1
NZBC CLASSIFICATION

This is to certify that the specimen described below was tested by BRANZ in accordance with ISO 5660 Parts 1 and 2.

Test Sponsor

Alucobond (Far East) Pte Ltd
6 Shenton Way
#40-05 OUE Downtown 1
Singapore 068809

Date of tests

13 November 2018 and 8 February 2019

Reference BRANZ Test Report

FH10913-1 – issued 4/04/2019

Test specimen as described by the client

Alucobond A2, a nominally 4.0mm thick, composite panel comprising two layers EN-AW5005 grade 0.5mm thick aluminium layers covering a 3.0mm mineral filled core with less than 10% combustible binder content. Front and rear facing surfaces painted metallic silver.

Specimen ID	Mean parameters			Colour
	Mass (g)	Thickness (mm)	Apparent Density (kg/m³)	
FH10913-2-50-1, 2, 3, 4, 5, 6	69.6	3.3	2142	Silver

Note: Mean parameters exclude front facing aluminium layer

Classification in accordance with the New Zealand Building Code

Calculations were carried out according to NZBC Verification Method C/VM2 Appendix A. The classification for the sample as described above is given in the table below.

Building Code Document		Performance
NZBC Acceptable Solutions Section 5.8.1	a)	Satisfied
	b)	Satisfied

Issued by

L. F. Hersche
Fire Testing Engineer
BRANZ

Reviewed by

P. C. R. Collier
Senior Fire Testing Engineer
IANZ Approved Signatory

Regulatory authorities are advised to examine test reports before approving any product.

All tests and procedures reported herein, unless indicated, have been performed in accordance with the laboratory's scope of accreditation

Issue Date
4/04/2019

Expiry Date
4/04/2024