

Test report no.: 113877/14

Customer: HANWHA L&C
Hanwha Building 1
Janggyo-Dong Chung-Gu
100-797 SEOUL
KOREA

Order: Testing of the heating of laminated profile surfaces upon exposure to an artificial radiation source according to Technical appendix "Section II" to RAL-GZ 716, part II-a-3, appendix I "Testing of the heating of coloured profile surfaces upon exposure to an artificial radiation source", issue April 2014.

Email dated: 2014-11-17

Ref: Mr Park

Sample receipt: 2014-11-20

Test period: 2014-12-03 to 2015-01-12

This test report consists of 15 pages.

Würzburg, 2015-01-30
Rs/km

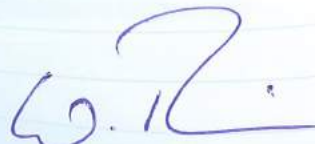
i. V.



Dr. Anton Zahn



i. A.



Wolfgang Ries

The original language of the report is German. In case of doubt, the German version is obligatory.

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1. Order

The Company HANWHA L&C, Hanwha Building 1, Janggyo-Dong Chung-Gu, 100-797 SEOUL, KOREA, instructed the SKZ - TeConA GmbH on 17 November 2014 to test the heating of laminated profile surfaces upon exposure to an artificial radiation source according to Technical appendix "Section II" to RAL-GZ 716, part II-a-3, appendix I "Testing of the heating of coloured profile surfaces upon exposure to an artificial radiation source", issue April 2014.

2. Test material

On 20 November 2014 SKZ - TeConA GmbH received following samples for testing:

3 DIN A4 sections of each décor.

Designation of the foils according to manufacturers data or suppliers data:

Sample no.	Designation of foil
1	XE-HF2GOL
2	XE-HF2GOK
3	XE-HF2MGK
4	XE-HF2DWK
5	XE-HF2GOM
6	XE-HF2GOP
7	SE-HM2GOL
8	SE-HM2GOK
9	SE-HM2MGK
10	SE-HM2DWK
11	SE-HM2GOM

Sample no.	Designation of foil
12	ME-HM2GOP
13	ME-HM2MGP
14	ME-HM2DWP
15	SE-HK2GOK
16	ME-HK2GOP
17	MP-HM2GOK
18	MP-HM2GOM
19	MP-HM2GOP
20	MP-HM2MGP
21	MP-HM2DWP

3. Test procedure

The tests described in the following have been performed in accordance with the Technical appendix "Section II" to RAL-GZ 716, part II- a-3, appendix I "Testing of the heating of coloured profile surfaces upon exposure to an artificial radiation source", issue April 2014. The test procedure was carried out according to standard climate 23/50, class 1 according to DIN EN ISO 291: 2008-08.

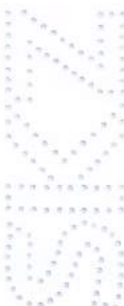
Usually we carry out tests according to standards for which we have an accreditation. The list of all standards for which we are accredited is shown on the homepage at www.skz.de.

The test was predominantly effected as double determination on black base body and as double determination on white base body.

Non-black pigmented PVC-U plates with $L^* > 92$ have been used as white base bodies and homogeneous black PVC-U plates with a carbon black content of 0.5 % +/- 0.1 % have been used as black base bodies.

The foils have been applied by means of a double-faced adhesive tape "HDK7408" of company Hohner-Industrietechnik without causing bubbles.

The radiation was implemented by means of a dim IR radiator Siccatherm "Sicca FR 250W HG".



4. Test results

Determination on black base body

XE-HF2GOL				
1	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.6	T black reference sample (prior to measuring)	73.6
	T black reference sample (after measuring)	74.5	T black reference sample (after measuring)	74.5
	T white reference sample	54.0	T white reference sample	54.0
	T room	23.0	T room	23.0
	ΔT	9.6	ΔT	9.2
	T sample	64.5	T sample	64.9

XE-HF2GOK				
2	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.2	T black reference sample (prior to measuring)	74.2
	T black reference sample (after measuring)	75.0	T black reference sample (after measuring)	75.0
	T white reference sample	54.2	T white reference sample	54.2
	T room	23.0	T room	23.0
	ΔT	10.8	ΔT	10.3
	T sample	63.8	T sample	64.3

XE-HF2MGK				
3	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.0	T black reference sample (prior to measuring)	74.0
	T black reference sample (after measuring)	73.9	T black reference sample (after measuring)	73.9
	T white reference sample	54.1	T white reference sample	54.1
	T room	22.8	T room	22.8
	ΔT	6.6	ΔT	6.3
	T sample	67.4	T sample	67.7

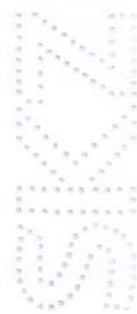
XE-HF2DWK				
4	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.2	T black reference sample (prior to measuring)	74.2
	T black reference sample (after measuring)	74.1	T black reference sample (after measuring)	74.1
	T white reference sample	54.3	T white reference sample	54.3
	T room	22.8	T room	22.8
	ΔT	8.6	ΔT	8.5
	T sample	65.6	T sample	65.7

XE-HF2GOM				
5	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.9	T black reference sample (prior to measuring)	73.9
	T black reference sample (after measuring)	74.2	T black reference sample (after measuring)	74.2
	T white reference sample	54.3	T white reference sample	54.3
	T room	22.8	T room	22.8
	ΔT	10.6	ΔT	10.8
	T sample	63.5	T sample	63.3

XE-HF2GOP				
6	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.1	T black reference sample (prior to measuring)	74.1
	T black reference sample (after measuring)	73.4	T black reference sample (after measuring)	73.4
	T white reference sample	54.3	T white reference sample	54.3
	T room	22.8	T room	22.8
	ΔT	10.6	ΔT	11.0
	T sample	63.2	T sample	62.8

SE-HM2GOL				
7	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.9	T black reference sample (prior to measuring)	74.1
	T black reference sample (after measuring)	73.6	T black reference sample (after measuring)	74.6
	T white reference sample	54.3	T white reference sample	54.5
	T room	23.0	T room	23.0
	ΔT	7.4	ΔT	8.0
	T sample	66.4	T sample	65.8

SE-HM2GOK				
8	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.8	T black reference sample (prior to measuring)	73.8
	T black reference sample (after measuring)	74.1	T black reference sample (after measuring)	74.1
	T white reference sample	54.5	T white reference sample	54.5
	T room	22.9	T room	22.9
	ΔT	9.7	ΔT	10.0
	T sample	64.3	T sample	64.0



SE-HM2MGK				
9	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.0	T black reference sample (prior to measuring)	74.0
	T black reference sample (after measuring)	73.4	T black reference sample (after measuring)	73.4
	T white reference sample	54.5	T white reference sample	54.5
	T room	22.9	T room	22.9
	ΔT	7.3	ΔT	7.1
	T sample	66.4	T sample	66.6

SE-HM2DWK				
10	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.2	T black reference sample (prior to measuring)	74.2
	T black reference sample (after measuring)	73.9	T black reference sample (after measuring)	73.9
	T white reference sample	54.3	T white reference sample	54.3
	T room	22.9	T room	22.9
	ΔT	8.5	ΔT	8.5
	T sample	65.6	T sample	65.6

SE-HM2GOM				
11	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.8	T black reference sample (prior to measuring)	73.8
	T black reference sample (after measuring)	73.9	T black reference sample (after measuring)	73.9
	T white reference sample	54.5	T white reference sample	54.5
	T room	22.9	T room	22.9
	ΔT	11.0	ΔT	11.2
	T sample	62.9	T sample	62.7

ME-HM2GOP				
12	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.8	T black reference sample (prior to measuring)	73.8
	T black reference sample (after measuring)	73.8	T black reference sample (after measuring)	73.8
	T white reference sample	54.6	T white reference sample	54.6
	T room	22.8	T room	22.8
	ΔT	10.6	ΔT	10.9
	T sample	63.2	T sample	62.9



ME-HM2MGP				
13	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.0	T black reference sample (prior to measuring)	74.0
	T black reference sample (after measuring)	74.3	T black reference sample (after measuring)	74.3
	T white reference sample	54.8	T white reference sample	54.8
	T room	22.8	T room	22.8
	ΔT	8.7	ΔT	9.0
	T sample	65.5	T sample	65.2

ME-HM2DWP				
14	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.3	T black reference sample (prior to measuring)	74.3
	T black reference sample (after measuring)	73.7	T black reference sample (after measuring)	73.7
	T white reference sample	54.4	T white reference sample	54.4
	T room	22.9	T room	22.9
	ΔT	9.2	ΔT	9.8
	T sample	64.8	T sample	64.2

SE-HK2GOK				
15	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.7	T black reference sample (prior to measuring)	73.7
	T black reference sample (after measuring)	74.0	T black reference sample (after measuring)	74.0
	T white reference sample	54.4	T white reference sample	54.4
	T room	22.9	T room	22.9
	ΔT	9.9	ΔT	10.7
	T sample	64.0	T sample	63.2

ME-HK2GOP				
16	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.9	T black reference sample (prior to measuring)	74.0
	T black reference sample (after measuring)	73.9	T black reference sample (after measuring)	73.9
	T white reference sample	54.7	T white reference sample	54.5
	T room	23.0	T room	23.0
	ΔT	10.8	ΔT	11.0
	T sample	63.1	T sample	63.0



MP-HM2GOK				
17	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.5	T black reference sample (prior to measuring)	73.5
	T black reference sample (after measuring)	73.3	T black reference sample (after measuring)	73.3
	T white reference sample	53.9	T white reference sample	53.9
	T room	22.9	T room	22.9
	ΔT	11.0	ΔT	10.8
	T sample	62.4	T sample	62.6

MP-HM2GOM				
18	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.1	T black reference sample (prior to measuring)	74.1
	T black reference sample (after measuring)	73.5	T black reference sample (after measuring)	73.5
	T white reference sample	54.0	T white reference sample	54.0
	T room	22.9	T room	22.9
	ΔT	8.7	ΔT	8.7
	T sample	65.1	T sample	65.1

MP-HM2GOP				
19	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.3	T black reference sample (prior to measuring)	74.3
	T black reference sample (after measuring)	74.1	T black reference sample (after measuring)	74.1
	T white reference sample	54.3	T white reference sample	54.3
	T room	22.9	T room	22.9
	ΔT	10.6	ΔT	11.6
	T sample	63.6	T sample	62.6

MP-HM2MGP				
20	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.8	T black reference sample (prior to measuring)	73.8
	T black reference sample (after measuring)	74.0	T black reference sample (after measuring)	74.0
	T white reference sample	54.5	T white reference sample	54.5
	T room	22.9	T room	22.9
	ΔT	8.6	ΔT	8.9
	T sample	65.3	T sample	65.0



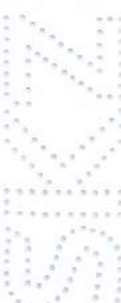
MP-HM2DWP				
21	Sample 1	°C	Sample 2	°C
	T _{black reference sample (prior to measuring)}	74.0	T _{black reference sample (prior to measuring)}	74.0
	T _{black reference sample (after measuring)}	74.2	T _{black reference sample (after measuring)}	74.2
	T _{white reference sample}	54.6	T _{white reference sample}	54.6
	T _{room}	22.8	T _{room}	22.8
	Δ T	9.2	Δ T	9.4
	T _{sample}	64.9	T _{sample}	64.7

Determination on white base body

XE-HF2GOL				
1	Sample 1	°C	Sample 2	°C
	T _{black reference sample (prior to measuring)}	73.6	T _{black reference sample (prior to measuring)}	73.6
	T _{black reference sample (after measuring)}	74.5	T _{black reference sample (after measuring)}	74.5
	T _{white reference sample}	54.0	T _{white reference sample}	54.0
	T _{room}	23.0	T _{room}	23.0
	Δ T	10.7	Δ T	11.3
	T _{sample}	63.4	T _{sample}	62.8

XE-HF2GOK				
2	Sample 1	°C	Sample 2	°C
	T _{black reference sample (prior to measuring)}	74.2	T _{black reference sample (prior to measuring)}	74.2
	T _{black reference sample (after measuring)}	75.0	T _{black reference sample (after measuring)}	75.0
	T _{white reference sample}	54.2	T _{white reference sample}	54.2
	T _{room}	23.0	T _{room}	23.0
	Δ T	14.6	Δ T	13.9
	T _{sample}	60.0	T _{sample}	60.7

XE-HF2MGK				
3	Sample 1	°C	Sample 2	°C
	T _{black reference sample (prior to measuring)}	74.0	T _{black reference sample (prior to measuring)}	74.0
	T _{black reference sample (after measuring)}	73.9	T _{black reference sample (after measuring)}	73.9
	T _{white reference sample}	54.1	T _{white reference sample}	54.1
	T _{room}	22.8	T _{room}	22.8
	Δ T	12.7	Δ T	12.3
	T _{sample}	61.3	T _{sample}	61.7



XE-HF2DWK				
4	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.2	T black reference sample (prior to measuring)	74.2
	T black reference sample (after measuring)	74.1	T black reference sample (after measuring)	74.1
	T white reference sample	54.3	T white reference sample	54.3
	T room	22.8	T room	22.8
	ΔT	13.6	ΔT	13.6
	T sample	60.6	T sample	60.6

XE-HF2GOM				
5	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.9	T black reference sample (prior to measuring)	73.9
	T black reference sample (after measuring)	74.2	T black reference sample (after measuring)	74.2
	T white reference sample	54.3	T white reference sample	54.3
	T room	22.8	T room	22.8
	ΔT	14.5	ΔT	13.8
	T sample	59.6	T sample	60.3

XE-HF2GOP				
6	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.1	T black reference sample (prior to measuring)	74.1
	T black reference sample (after measuring)	73.4	T black reference sample (after measuring)	73.4
	T white reference sample	54.3	T white reference sample	54.3
	T room	22.8	T room	22.8
	ΔT	14.5	ΔT	14.8
	T sample	59.3	T sample	59.0

SE-HM2GOL				
7	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.9	T black reference sample (prior to measuring)	74.1
	T black reference sample (after measuring)	73.6	T black reference sample (after measuring)	74.6
	T white reference sample	54.3	T white reference sample	54.5
	T room	23.0	T room	23.0
	ΔT	10.7	ΔT	10.3
	T sample	63.1	T sample	63.5



SE-HM2GOK

8	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.8	T black reference sample (prior to measuring)	73.8
	T black reference sample (after measuring)	74.1	T black reference sample (after measuring)	74.1
	T white reference sample	54.5	T white reference sample	54.5
	T room	22.9	T room	22.9
	ΔT	13.9	ΔT	14.3
	T sample	60.1	T sample	59.7

SE-HM2MGK

9	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.0	T black reference sample (prior to measuring)	74.0
	T black reference sample (after measuring)	73.4	T black reference sample (after measuring)	73.4
	T white reference sample	54.5	T white reference sample	54.5
	T room	22.9	T room	22.9
	ΔT	11.8	ΔT	12.0
	T sample	61.9	T sample	61.7

SE-HM2DWK

10	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.2	T black reference sample (prior to measuring)	74.2
	T black reference sample (after measuring)	73.9	T black reference sample (after measuring)	73.9
	T white reference sample	54.3	T white reference sample	54.3
	T room	22.9	T room	22.9
	ΔT	13.2	ΔT	13.7
	T sample	60.9	T sample	60.4

SE-HM2GOM

11	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.8	T black reference sample (prior to measuring)	73.8
	T black reference sample (after measuring)	73.9	T black reference sample (after measuring)	73.9
	T white reference sample	54.5	T white reference sample	54.5
	T room	22.9	T room	22.9
	ΔT	14.5	ΔT	14.4
	T sample	59.4	T sample	59.5



ME-HM2GOP				
12	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.8	T black reference sample (prior to measuring)	73.8
	T black reference sample (after measuring)	73.8	T black reference sample (after measuring)	73.8
	T white reference sample	54.6	T white reference sample	54.6
	T room	22.8	T room	22.8
	ΔT	14.1	ΔT	14.2
	T sample	59.7	T sample	59.6

ME-HM2MGP				
13	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.0	T black reference sample (prior to measuring)	74.0
	T black reference sample (after measuring)	74.3	T black reference sample (after measuring)	74.3
	T white reference sample	54.8	T white reference sample	54.8
	T room	22.8	T room	22.8
	ΔT	12.4	ΔT	12.8
	T sample	61.8	T sample	61.4

ME-HM2DWP				
14	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.3	T black reference sample (prior to measuring)	74.3
	T black reference sample (after measuring)	73.7	T black reference sample (after measuring)	73.7
	T white reference sample	54.4	T white reference sample	54.4
	T room	22.9	T room	22.9
	ΔT	13.1	ΔT	13.3
	T sample	60.9	T sample	60.7

SE-HK2GOK				
15	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.7	T black reference sample (prior to measuring)	73.7
	T black reference sample (after measuring)	74.0	T black reference sample (after measuring)	74.0
	T white reference sample	54.4	T white reference sample	54.4
	T room	22.9	T room	22.9
	ΔT	13.6	ΔT	14.0
	T sample	60.3	T sample	59.9

ME-HK2GOP				
16	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.9	T black reference sample (prior to measuring)	74.0
	T black reference sample (after measuring)	73.9	T black reference sample (after measuring)	73.9
	T white reference sample	54.7	T white reference sample	54.5
	T room	23.0	T room	23.0
	ΔT	13.8	ΔT	14.1
	T sample	60.1	T sample	59.9

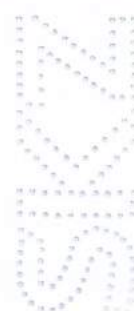
MP-HM2GOK				
17	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.5	T black reference sample (prior to measuring)	73.5
	T black reference sample (after measuring)	73.3	T black reference sample (after measuring)	73.3
	T white reference sample	53.9	T white reference sample	53.9
	T room	22.9	T room	22.9
	ΔT	14.2	ΔT	13.7
	T sample	59.2	T sample	59.7

MP-HM2GOM				
18	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.1	T black reference sample (prior to measuring)	74.1
	T black reference sample (after measuring)	73.5	T black reference sample (after measuring)	73.5
	T white reference sample	54.0	T white reference sample	54.0
	T room	22.9	T room	22.9
	ΔT	11.1	ΔT	10.7
	T sample	62.7	T sample	63.1

MP-HM2GOP				
19	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.3	T black reference sample (prior to measuring)	74.3
	T black reference sample (after measuring)	74.1	T black reference sample (after measuring)	74.1
	T white reference sample	54.3	T white reference sample	54.3
	T room	22.9	T room	22.9
	ΔT	14.2	ΔT	14.6
	T sample	60.0	T sample	59.6

MP-HM2MGP				
20	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	73.8	T black reference sample (prior to measuring)	73.8
	T black reference sample (after measuring)	74.0	T black reference sample (after measuring)	74.0
	T white reference sample	54.5	T white reference sample	54.5
	T room	22.9	T room	22.9
	ΔT	12.6	ΔT	12.6
	T sample	61.3	T sample	61.3

MP-HM2DWP				
21	Sample 1	°C	Sample 2	°C
	T black reference sample (prior to measuring)	74.0	T black reference sample (prior to measuring)	74.0
	T black reference sample (after measuring)	74.2	T black reference sample (after measuring)	74.2
	T white reference sample	54.6	T white reference sample	54.6
	T room	22.8	T room	22.8
	ΔT	13.1	ΔT	13.0
	T sample	61.0	T sample	61.1



Summary

Sample	T _{sample} on black	T _{sample} on white
XE-HF2GOL	65 °C	63 °C
XE-HF2GOK	64 °C	60 °C
XE-HF2MGK	<u>68 °C</u>	62 °C
XE-HF2DWK	66 °C	61 °C
XE-HF2GOM	63 °C	60 °C
XE-HF2GOP	63 °C	59 °C
SE-HM2GOL	66 °C	63 °C
SE-HM2GOK	64 °C	60 °C
SE-HM2MGK	<u>67 °C</u>	62 °C
SE-HM2DWK	66 °C	61 °C
SE-HM2GOM	63 °C	59 °C
ME-HM2GOP	63 °C	60 °C
ME-HM2MGP	65 °C	62 °C
ME-HM2DWP	65 °C	61 °C
SE-HK2GOK	64 °C	60 °C
ME-HK2GOP	63 °C	60 °C
MP-HM2GOK	63 °C	59 °C
MP-HM2GOM	65 °C	63 °C
MP-HM2GOP	63 °C	60 °C
MP-HM2MGP	65 °C	61 °C
MP-HM2DWP	65 °C	61 °C

