

Test report no.: 74190/06

Customer: LG Chem Europe GmbH
Lyoner Str. 15
ATRICOM C6
60528 Frankfurt am Main
GERMANY

Order: Testing of colour fastness after artificial weathering of window profiles made of PVC-U, laminated with several foils. Artificial weathering according to EN 513, procedure 1 (simulation of a moderate climatic zone M) up to an irradiation dose of up to 8 GJ/m² in the wave length range of 300 nm to 800 nm.

Orally ordered: 2006-12-04 **by:** Mr Carlos Shin

Test samples received on: 2006-12-04

Test period: 2006-12-08 to 2007-06-05

The test report comprises 6 pages.

Würzburg, 2007-07-04
Mü/ste

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1. Order

The company LG Chem Europe GmbH, Lyoner Straße 15, ATRICOM C6, 60528 Frankfurt am Main, GERMANY, instructed the SKZ - TeConA GmbH by Mr Carlos Shin to test the colour fastness after artificial weathering of window profiles made of PVC-U, laminated with foil. The artificial weathering to be carried out according to EN 513, procedure 1 (simulation of a moderate climatic zone M) up to an irradiation dose of up to 8 GJ/m² in the wave length range of 300 nm to 800 nm.

2. Test material

On December 4, 2006 SKZ - TeConA GmbH received following test material:

14 x 0.3 m window profile sections laminated with several foils.

Producer of base profile: DIMEX, Nehren, GERMANY
 Designation of base profile: Frame 210100
 Marking of profile: DIMEX 18 210100 02 06 13 11  223

Assignment and designation of the individual foils:

sample no.	colour- and design number
1	BER 50 - S9
2	GAN 80 - S9
3	GAP 19 - S9
4	KAAM 6 - S9
5	KD 649 - S9
6	KDA 34 - S9
7	M 5339 - S9
8	M 6342 - S9
9	M 6343 - S9
10	M 6344 - S9
11	M 6341 - S9
12	MH 314 - S9
13	U 9301 - S9
14	YEL 41 - S9



3. Test procedure

Following tests were carried out following the quality and test specifications "Plastic windows, quality assurance, RAL-GZ 716/1, section I, plastic window profiles", test methods and requirements, part 7, window profiles made of PVC-U, laminated with foils.

The stated requirements were borrowed from the mentioned quality and test specification.

Unless otherwise noted testing was performed at a standard atmosphere of 23/50-2 in accordance with DIN EN ISO 291.

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.

3.1 Testing of weathering fastness

The procedure of artificial weathering is based on the requirements according to DIN EN 513, procedure 1, simulation of a moderate climate zone (M).

Laminated outside surface was irradiated.

Parameters of the weathering device:

Type:	Xenon test device 1200 CPS
Radiation source:	Xenon arc radiation
Filter system:	outdoor sun light simulation
Black standard temp.:	60 ± 3 °C
White standard temp.:	40 - 45 °C
Relative humidity:	65 ± 5 %
Spray cycle:	18 min. water spray, 102 min. dry period
Irradiation energy E_{UV} (300 - 400) nm:	60 ± 2 W/m ²
Irradiation dose (300 - 800) nm:	8 GJ/m ²
Exposure period:	4060 h
Start:	2006-12-08
End:	2007-06-05



3.1.1 Visual assessment

Visual assessment was carried out according to ISO 105-A03 by using the grey scale for assessing staining.

Requirement:

Upon termination of artificial weathering, the colour change must not be greater than allowed by grade 4 of the grey scale according to ISO 105-A03. Changes must not bring about stains, bubbles, streaks or cracks. There must not be any cracks and flake-off in the polyacrylate protective layer. A peel-off of the coating between the polyacrylate protective layer and the base foil as well as between the base foil and the PVC-U-profile must not occur.

In addition the visual assessment was carried out by using the grey scale for assessing change in colour according to ISO 105-A02.

Requirement (according to RAL-GZ 716/1 section I, part 7, draft January 2007):

Upon termination of artificial weathering, the colour change must not be greater than allowed by grade 3 of the grey scale according to ISO 105-A02.

3.1.2 Colourimetric assessment

The sample colour was measured by means of a spectrophotometer of a wave length area of 380 - 720 nm, standard light type D65, gloss inclusion, 10° normal inspection. It was determined the colour distance ΔE^*_{ab} according to ISO 7724-3.

Each sample was measured before and after artificial weathering at the same measuring position on the sample, upon identical sample placement. Due to that, also in case of the not single-coloured foils with surface texture, a guide value for colour change can be determined in terms of colourimetry.



4. Test results

4.1 Weathering fastness

4.1.1 Visual assessment

Sample no.	Colour / design-no.	Fastness grade acc. to ISO 105		Remark
		A02	A03	
1	BER 50 - S9	4 - 5	4 - 5	darker, more yellow
2	GAN 80 - S9	3	4 - 5	darker, more blue
3	GAP 19 - S9	4 - 5	4 - 5	darker, more blue
4	KAAM 6 - S9	4 - 5	4 - 5	darker, more yellow
5	KD 649 - S9	4	4 - 5	darker, more yellow
6	KDA 34 - S9	3 - 4	4 - 5	darker
7	M 5339 - S9	4 - 5	4 - 5	darker, more yellow
8	M 6342 - S9	4 - 5	4 - 5	darker, more yellow
9	M 6343 - S9	3	4	more red, more blue
10	M 6344 - S9	4 - 5	4 - 5	darker
11	M 6341 - S9	4	4 - 5	lighter
12	MH 314 - S9	5	5	---
13	U 9301 - S9	4 - 5	4 - 5	darker, more yellow
14	YEL 41 - S9	4	4 - 5	lighter, more green, more yellow

No stains, bubbles or streaks were found on any sample surface.

No crack formation or flake off was found on the polyacrylate protective layer of any sample. A peel-off of the base foil from PVC-U-profile did not occur.



4.1.2 Colourimetric assessment

Sample no.	Colour / design no.	Colour distance			
		ΔL^*	Δa^*	Δb^*	ΔE^*_{ab}
1	BER 50 - S9	-0.6	0.0	1.1	1.3
2	GAN 80 - S9	-0.9	0.6	-3.1	3.3
3	GAP 19 - S9	-0.3	0.1	-0.1	0.3
4	KAAM 6 - S9	-0.2	-0.3	0.6	0.7
5	KD 649 - S9	-0.8	0.0	0.5	0.9
6	KDA 34 - S9	-0.4	0.0	0.3	0.5
7	M 5339 - S9	-0.5	0.1	0.6	0.8
8	M 6342 - S9	0.2	-0.7	0.9	1.2
9	M 6343 - S9	0.1	-0.1	-3.8	3.8
10	M 6344 - S9	-0.8	0.1	0.5	0.9
11	M 6341 - S9	0.6	-0.6	-4.3	4.4
12	MH 314 - S9	0.0	0.0	0.6	0.6
13	U 9301 - S9	-0.3	0.0	0.6	0.6
14	YEL 41 - S9	0.7	-1.6	0.1	1.7

5. Assessment of the test results

With regard to the weathering fastness, the foils tested for the lamination of plastic window profiles comply with the requirements stipulated in the quality and test specifications RAL-GZ 716/1 section I, part 7, issued October 1998.

