Technical Report

QUV Accelerated Weather Testing

TR-0002302 | QUV Accelerated Weathering Performance Testing	**Date:** 21 December 2023
Assessment of Liquimix Products	**Document Number:** TR-0002302

Technical Report

QUV Accelerated Weather Testing

Executive Summary

The colour change is tabulated below for all products tested after 1000 hours.

Tabulated data for the series

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)	Visual Comment
GC450 / S30 White (24 Hrs)	1000 Hrs	-0.15	0.03	0.37	0.4	No colour change Visually
GC450 / S30 White (3 Days)	1000 Hrs	-0.29	0	0.38	0.48	No colour change Visually
Opalon-S30 Yellow	1000 Hrs	-0.27	0.14	-0.4	0.5	No colour change Visually
Opalon-S30 Blue	1000 Hrs	0.03	-0.3	0.97	1.01	No colour change Visually
Opalon-S30 Green	1000 Hrs	-1.14	4.24	-0.82	4.47	No colour change Visually
Opalon-S30 Red	1000 Hrs	-0.14	-1.63	0.78	1.81	No colour change Visually
F45 / F45 Mid Grey (24 Hrs)	1000 Hrs	-0.34	-0.05	0	0.34	No colour change Visually
F45 Mid Grey / F45 Clear	1000 Hrs	0.09	-0.81	2.39	2.52	Slight Yellowing of Clear
PU75 White	1000 Hrs	-0.34	-0.14	1.05	1.11	No colour change Visually
Opalon-W45 Mid Grey	1000 Hrs	-0.83	0	-0.06	0.83	No colour change Visually
Roofproof	1000 Hrs	-1.17	0.11	0.67	1.36	No colour change Visually
FL170 / FL170 Mid Grey (24 Hrs)	1000 Hrs	-1.32	0.24	16.36	16.41	Yellowing
Metalox-GC450	1000 Hrs	-7.77	5.65	3.61	10.26	Darker, yellower, redder
Colourtuff-A90	1000 Hrs	-0.83	0.03	-0.21	0.85	No colour change Visually
Colourtuff-C85	1000 Hrs	-7.54	0.15	2.57	7.96	Darker
P2 / W80 White (24 Hrs)	1000 Hrs	-15.16	11.63	30.77	36.22	Darker, Redder, Yellower
Tufflon-P80 White	1000 Hrs	-13.86	9.92	26.58	31.57	Darker, Redder, Yellower
Polytuff-21 White	1000 Hrs	-19.16	15.4	18.85	30.98	Darker, Redder, Yellower
Tufflon-P90 Mid Grey	1000 Hrs	-3.49	0.36	18.42	18.75	Yellowing and s. darker
Hybron-H90 Yellow	1000 Hrs	-8.29	6.06	-1.9	10.45	Darker and redder
Hybron-W90 Black	1000 Hrs	-7.03	-0.12	2.81	7.57	Darker
Tufflon-D60 Black	1000 Hrs	0.52	0.1	0.54	0.75	No colour change.

The following conclusion is drawn from the results.

- All aromatic polyurea, hybrid and polyurethane will change colour. The lighter the colour, the greater the yellowing. Yellow and black have significantly less colour change.
- All aromatic polyurea, hybrid and polyurethane will lose their gloss and chalk. The low gloss is consistent and looks good.
- All our epoxies will turn yellow on exposure to sunlight.
- Opalon-S30, Opalon-F45, Opalon-W45 and PU75 all had no visual change in colour or gloss
- Different colours of Opalon-S30 will have different performances due to the pigments used.
- Colourtuff-A90 and C85 both perform well for colour fastness. Aliphatic polyurea does not perform as well as aliphatic polyaspartic and polyurethane.
- The Opalon-S30 has a 3-day recoat window when applied over Metalox-GC450 and is not exposed to UV.
- None of the samples experienced high levels of DFT loss.

Technical Report

QUV Accelerated Weather Testing

Introduction

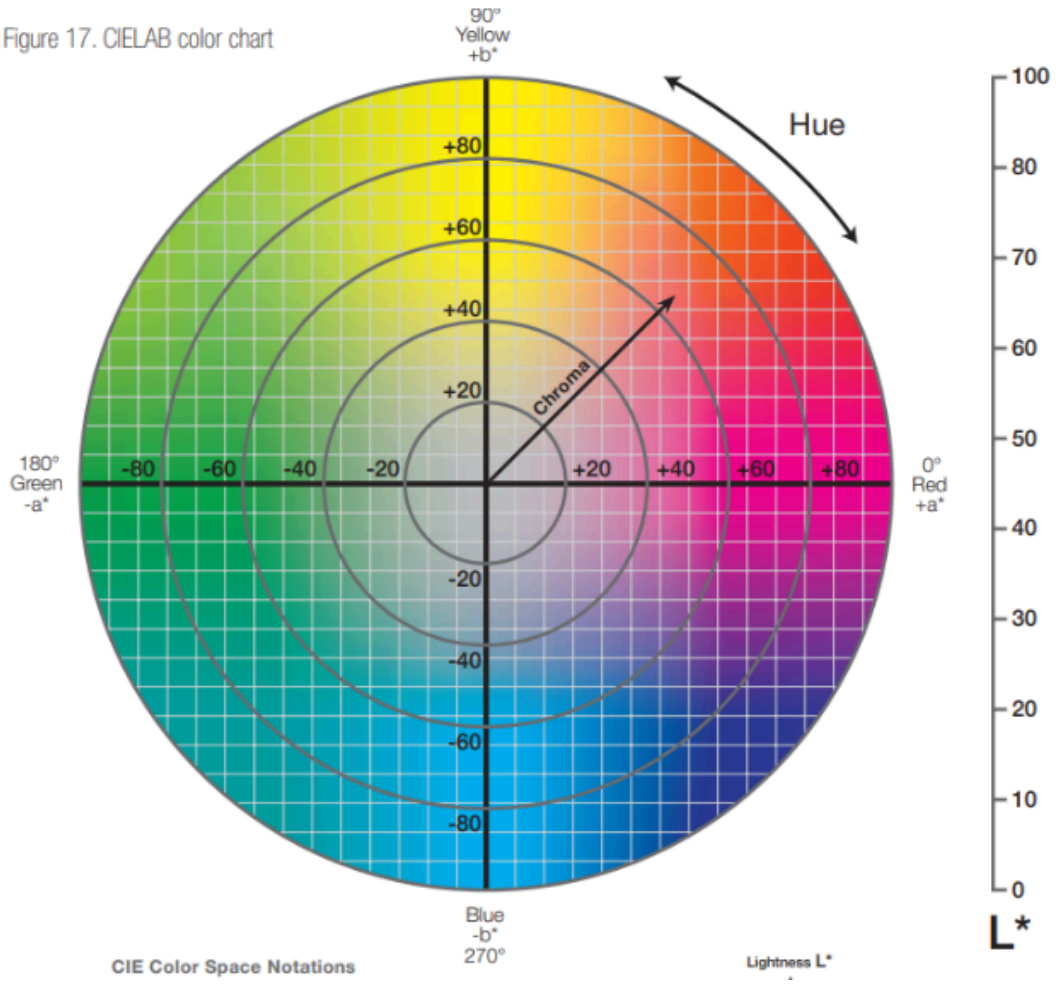
This technical report assesses the colour change, gloss change, and DFT loss after 1000 hours of accelerated weathering to ASTM D154 Cycle 1. The list of test panels in the series is tabulated in panel preparation

Assessment

Colour

The colour will be assessed using a spectrophotometer (Konica Minolta). Any colour data will be supported by a visual assessment of a colour matcher.

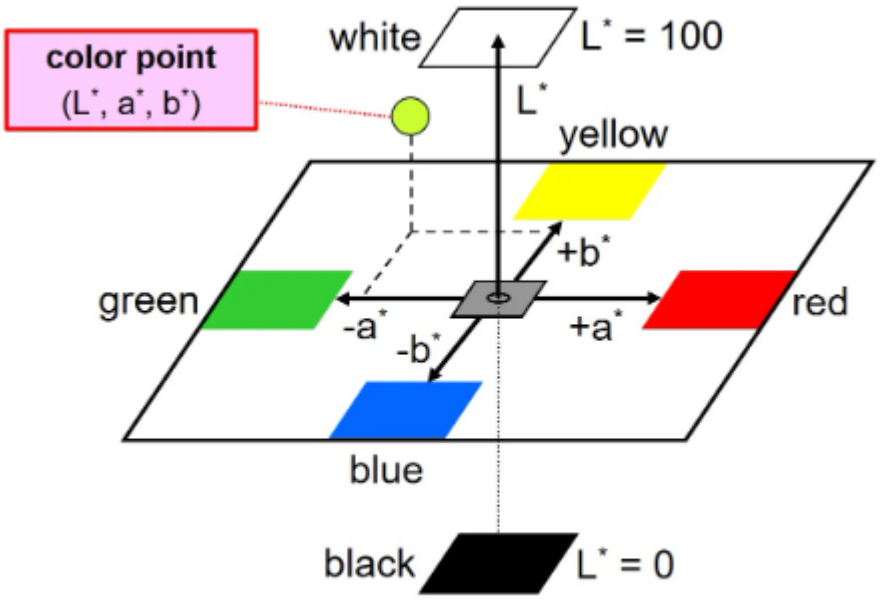
Figure 17. CIELAB color chart



Technical Report

QUV Accelerated Weather Testing

CIELAB is a three-dimensional system that triangulates and precisely defines any colour point. The initial colours of all the samples are scanned to create the standard reference. The samples are rescanned after weathering (250, 500, 750, and 1000 Hours of weathering in the QUV) to determine the changes in colour.



The 3-dimensional CIELAB color space.

CIE Colour Space Notations

dL*(D65)	difference in lightness / darkness value	"+" = lighter "-" darker
da*(D65)	difference on the red / green axis	"+" = redder "-" = greener
db*(D65)	difference on the yellow / blue axis	"+" = yellower "-" = bluer
dE*(D65)	total colour difference value	

The d or delta describes the change in colour rather than an actual colour. The dL number indicates a change in light or dark colour. The da number indicates a change in green or red, and the db indicates a change in blue or yellow. The delta (dL, da and db) numbers indicate how the colour has changed from the original colour scan. DE is the visual difference between the two colours.

Gloss

Laboratory gloss metre used to test gloss.

Technical Report

QUV Accelerated Weather Testing

Panel Preparation

System 0001/01 (GC450/S30/24 Hours)

Metalox-GC450 White	250µm DFT	24 Hour recoat
Opalon-S30 - White	75µm DFT	

System 0001/02 (GC450/S30/3 Days)

Metalox-GC450 White	250µm DFT	3 Days recoat
Opalon-S30 - White	75µm DFT	

System 0002/01 (S30 Yellow)

Opalon-S30 - Yellow	75µm DFT	

System 0002/02 (S30 Blue)

Opalon-S30 - Blue	75µm DFT	

System 0002/03 (S30 Green)

Opalon-S30 - Green	75µm DFT	

System 0002/04 (S30 Red)

Opalon-S30 - Red	75µm DFT	

System 0003/01 (F45/F45 Mid Grey/24 Hours)

Opalon-F45 Mid Grey	90µm DFT	24 Hour recoat
Opalon-F45 Mid Grey	90µm DFT	

System 0004/01 (F45/F45 Clear/24 Hours)

Opalon-F45 Mid Grey	90µm DFT	24 Hour recoat
Opalon-F45 Clear	90µm DFT	

System 0005/01 (PU75 White)

PU75 White	50µm DFT	

System 0006/01 (Opalon W45)

Opalon-W45	100µm DFT	

Technical Report

QUV Accelerated Weather Testing

System 0009/01 (RoofProof)

RoofProof	500µm DFT	

System 00010/01 (FL170/FL170/24 Hours)

Aralox-FL170 Mid Grey	100µm DFT	24 Hour recoat
Aralox-FL170 Mid Grey	100µm DFT	

System 00011/01 (GC450)

Metalox-GC450 White	250µm DFT	

System 00012/01 (A90)

Colourtuff-A90 Mid Grey	3000µm DFT	

System 00013/01 (C85)

Colourtuff-C85 White	3000µm DFT	

System 00014/01 (P2/W80/24 Hours)

Elaston-W80 White	3000µm DFT	

System 00015/01 (P80)

Tufflon-P80 White	3000µm DFT	

System 00016/01 (PT21)

Polytuff-21 White	3000µm DFT	

System 00017/01 (P90)

Tufflon-P90 Mid Grey	3000µm DFT	

System 00018/01 (H90)

Hybron-H90 - Yellow	3000µm DFT	

System 00019/01 (W90)

Hybron-W90 Black	3000µm DFT	

System 00020/10 (D60)

Tufflon-D60 Black	3000µm DFT	

Technical Report

QUV Accelerated Weather Testing

Results

Metalox-GC450 / Opalon-S30 - 24 Hour Recoat

System 0001/01 (GC450/S30/24 Hours)

Opalon-S30 White has not visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The dry film thickness has not changed.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Metalox-GC450 / Opalon-S30 White (Recoat 24 Hrs)	0 Hrs	0.00	0.00	-0.01	0.01
	250 Hrs	0.09	0.02	0.32	0.33
	500 Hrs	-0.03	-0.03	0.47	0.48
	750 Hrs	0.03	-0.02	0.34	0.35
	1000 Hrs	-0.15	0.03	0.37	0.40

System	QUV Hours	Gloss	DFT
Metalox-GC450 / Opalon-S30 White (Recoat 24 Hrs)	0 Hrs	66.6	270 µm
	1000 Hrs	68.1	270 µm

Technical Report

QUV Accelerated Weather Testing

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Metalox-GC450 / Opalon-S30 - 3 Days

System 0001/02 (GC450/S30/3 Days)

Opalon-S30 White has not visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The dry film thickness has not changed.
The recoat window for Opalon-S30 over Metalox-GC450 not exposed to UV is 3 Days.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Metalox-GC450 / Opalon-S30 White (Recoat 3 Days)	0 Hrs	0.01	0.00	0.01	0.01
	250 Hrs	-0.19	0.01	0.32	0.38
	500 Hrs	-0.30	-0.06	0.61	0.68
	750 Hrs	-0.11	-0.03	0.42	0.43
	1000 Hrs	-0.29	0.00	0.38	0.48

System	QUV Hours	Gloss	DFT
Metalox-GC450 / Opalon-S30 White (Recoat 3 Days)	0 Hrs	67.3	260 µm
	1000 Hrs	66.7	260 µm

Technical Report

QUV Accelerated Weather Testing

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Opalon-S30 - Yellow

System 0002/01 (S30 Yellow)

Opalon-S30 yellow has not visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The dry film thickness has not changed.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Opalon-S30 Yellow	0 Hrs	0.01	-0.03	0.01	0.03
	250 Hrs	-0.17	0.11	-0.33	0.39
	500 Hrs	-0.17	0.13	-0.32	0.38
	750 Hrs	-0.20	0.14	-0.33	0.40
	1000 Hrs	-0.27	0.14	-0.40	0.50

System	QUV Hours	Gloss	DFT
Opalon-S30 Yellow	0 Hrs	74.3	85 µm
	1000 Hrs	73.1	85 µm

Technical Report

QUV Accelerated Weather Testing

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Opalon-S30 - Blue

System 0002/02 (S30 Blue)

Opalon-S30 Blue has not visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Spectrophotometer has detected a yellowing of the colour however, at this point, it can not be detected visually. The yellow shift indicates that the colour is slightly less blue. This tone change would be hard to detect visually by eye. The dry film thickness has not changed.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Opalon-S30 Blue	0 Hrs	0.00	0.01	-0.01	0.02
	250 Hrs	0.07	-0.06	0.50	0.51
	500 Hrs	0.01	-0.20	0.81	0.83
	750 Hrs	0.05	-0.27	0.80	0.84
	1000 Hrs	0.03	-0.3	0.97	1.01

Technical Report

QUV Accelerated Weather Testing

System	QUV Hours	Gloss	DFT
Opalon-S30 Blue	0 Hrs	73.8	85 µm
	1000 Hrs	74.1	85 µm

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Opalon-S30 - Green

System 0002/03 (S30 Green)

The Opalon-S30 Green has slightly changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The green colour has visually darkened slightly. The spectrophotometer detected the colour changing to darker, redder and yellower. The significant red shift in the colour indicates the colour became less green rather than looking red. The Opalon-S30 Green has performed excellently even though it has darkened a little. The dry film thickness has not changed.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Opalon-S30 Green	0 Hrs	0.01	-0.02	0.01	0.02
	250 Hrs	-0.95	3.14	-0.55	3.33
	500 Hrs	-1.00	3.54	-0.58	3.72
	750 Hrs	-0.96	3.59	-0.61	3.77

Technical Report

QUV Accelerated Weather Testing

	1000 Hrs	-1.14	4.24	-0.82	4.47

System	QUV Hours	Gloss	DFT
Opalon-S30 Green	0 Hrs	78.2	75 µm
	1000 Hrs	78.0	75 µm

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Opalon-S30 - Red

System 0002/04 (S30 Red)

Opalon-S30 Red has not visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Spectrophotometer has detected a greening of the colour however, at this point, it can not be detected visually. The green shift indicates that the colour is slightly less red. This tone change would be hard to detect visually by eye. The dry film thickness has not changed.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Opalon-S30 Red	0 Hrs	0.00	0.00	-0.01	0.01
	250 Hrs	-0.02	-0.87	0.78	1.17

	500 Hrs	-0.12	-1.31	0.83	1.56
	750 Hrs	-0.15	-1.62	0.77	1.80
	1000 Hrs	-0.14	-1.63	0.78	1.81

System	QUV Hours	Gloss	DFT
Opalon-S30 Red	0 Hrs	78.6	80 µm
	1000 Hrs	76.1	80 µm

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Opalon-F45 Mid Grey / Opalon-F45 Mid Grey - 24 Hours Recoat

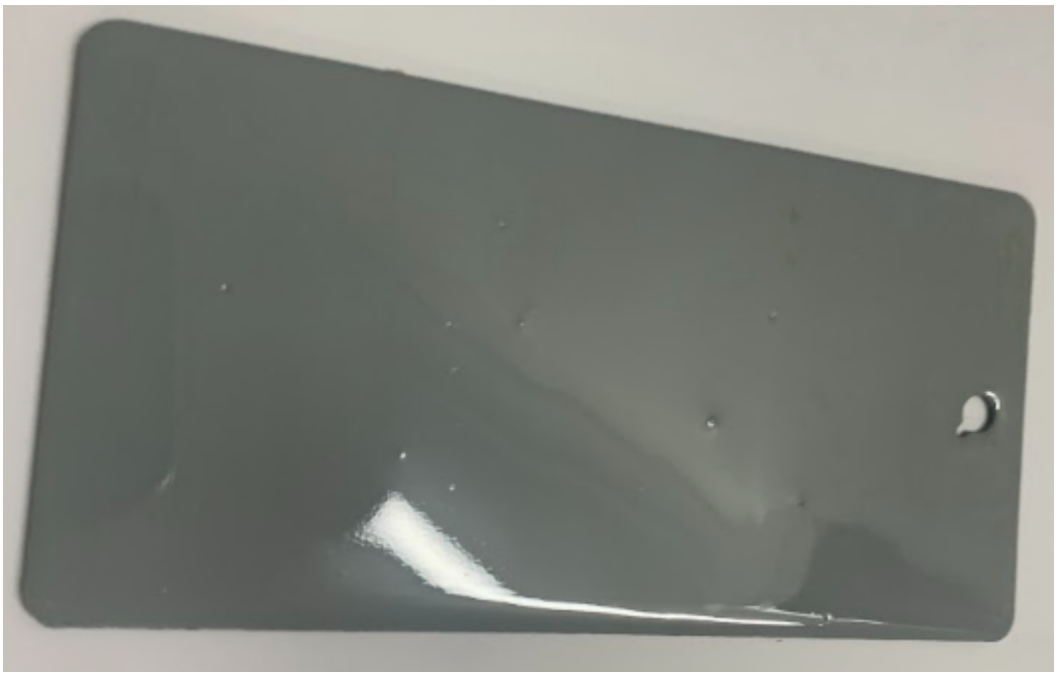
System 0003/01 (F45/F45 Mid Grey/24 Hours)

Opalon-F45 Mid Grey has not visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). It has been the best performer of the series. The dry film thickness has not changed.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Opalon-F45 Mid grey / Opalon-F45 Mid Grey (Recoat 24 Hrs)	0 Hrs	0.00	-0.01	0.00	0.01
	250 Hrs	-0.20	-0.03	0.06	0.21

	500 Hrs	-0.33	-0.06	0.04	0.34
	750 Hrs	-0.29	-0.08	0.00	0.30
	1000 Hrs	-0.34	-0.05	0.00	0.34

System	QUV Hours	Gloss	DFT
Opalon-F45 Mid grey / Opalon-F45 Mid Grey	0 Hrs	100.0	190 µm
	1000 Hrs	97.6	190 µm



https://liquimix.com/opalon-f45

Opalon-F45 Mid Grey / Opalon-F45 Clear - 24 Hours Recoat

System 0004/01 (F45/F45 Clear/24 Hours)

Opalon-F45 Mid Grey / Opalon-F45 Clear has yellowed visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Opalon-F45 Clear has started to yellow slightly. The green can not be detected visually. The dry film thickness has not changed.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)

Opalon-F45 Mid grey / Opalon-F45 Clear (Recoat 24 Hrs)	0 Hrs	0.02	-0.05	0.03	0.06
	250 Hrs	0.21	-0.74	1.99	2.13
	500 Hrs	0.18	-1.08	3.00	3.20
	750 Hrs	0.24	-0.92	2.64	2.81
	1000 Hrs	0.09	-0.81	2.39	2.52

System	QUV Hours	Gloss	DFT
Opalon-F45 Mid grey / Opalon-F45 Clear	0 Hrs	93.4	185 µm
	1000 Hrs	92.8	185 µm

https://liquimix.com/opalon-f45

PU75 White

System 0005/01 (PU75 White)

PU75 White has not visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Spectrophotometer has detected a yellowing of the colour however, at this point, it can not be detected visually. The dry film thickness has not changed.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)

Technical Report

QUV Accelerated Weather Testing

PU75 White	0 Hrs	-0.02	0.00	-0.01	0.02
	250 Hrs	-0.26	-0.08	0.51	0.58
	500 Hrs	-0.24	-0.37	1.62	1.68
	750 Hrs	-0.27	-0.23	1.27	1.32
	1000 Hrs	-0.34	-0.14	1.05	1.11

System	QUV Hours	Gloss	DFT
PU75 White	0 Hrs	93.2	50 µm
	1000 Hrs	93.5	50 µm

Opalon-W45 Mid Grey

System 0006/01 (Opalon-W45)

Opalon-W45 Mid Grey has not visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Spectrophotometer has detected a darkening of the colour however, at this point, it can not be detected visually. The dry film thickness has not changed.

Technical Report

QUV Accelerated Weather Testing

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Opalon-W45 Mid Grey	0 Hrs	0.00	-0.01	0.00	0.01
	250 Hrs	-0.41	0.01	0.02	0.41
	500 Hrs	-0.55	-0.07	-0.03	0.55
	750 Hrs	-0.54	-0.02	-0.06	0.55
	1000 Hrs	-0.83	0.00	-0.06	0.83

System	QUV Hours	Gloss	DFT
Opalon-W45 Mid Grey	0 Hrs	95.8	85 µm
	1000 Hrs	95.2	85 µm

https://liquimix.com/opalon-w45

RoofProof

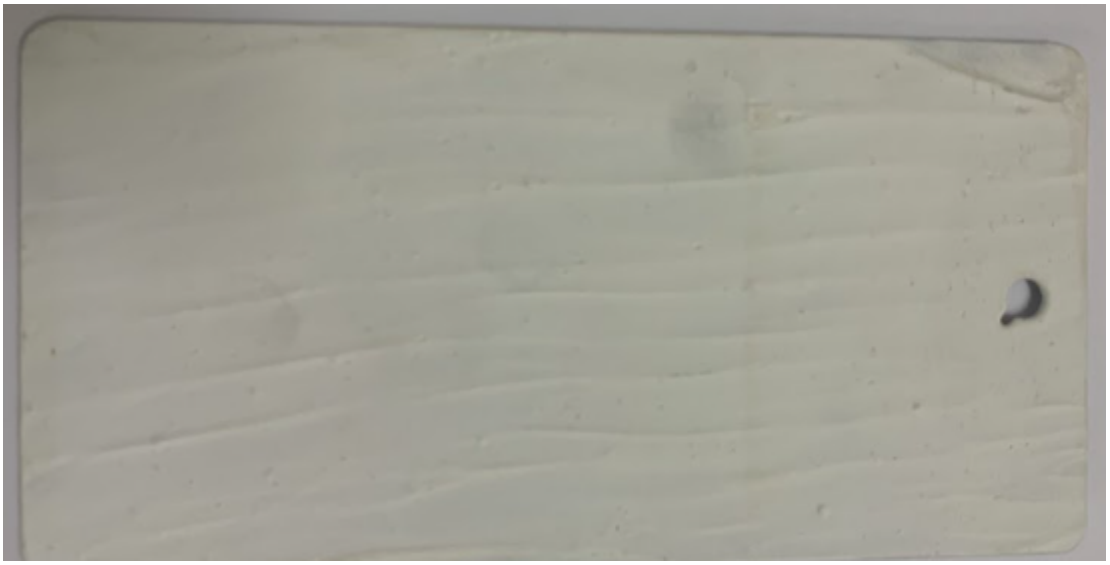
System 0009/01 (RoofProof)

RoofProof has not visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Spectrophotometer has detected a darkening of the colour; however, at this point, it can not be detected visually. Roofproof appears to be chalking and picking up dirt. The dry film thickness has not changed.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)

RoofProof	0 Hrs	0.00	0.00	0.00	0.00
	250 Hrs	-1.32	0.11	0.85	1.58
	500 Hrs	-1.07	0.06	0.58	1.22
	750 Hrs	-1.13	0.09	0.61	1.29
	1000 Hrs	-1.17	0.11	0.67	1.36

System	QUV Hours	Gloss	DFT
RoofProof	0 Hrs	2.0	245 µm
	1000 Hrs	1.9	245 µm



https://liquimix.com/roofproof/

Aralox-FL170 Mid Grey / Aralox-FL170 Mid Grey - 24 Hours Recoat

System 00010/01 (FL170/FL170/24 Hours)

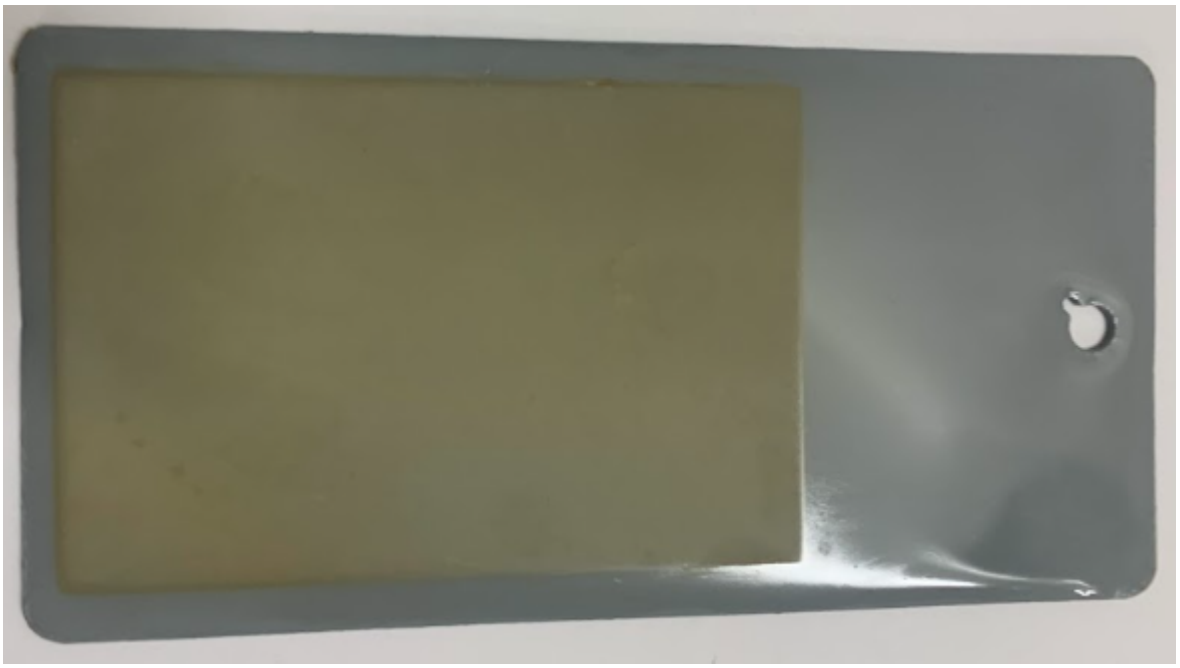
The Aralox-FL170 Mid Grey has significantly changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The colour has yellowed visually. The spectrophotometer detected the colour changing to yellow. The significant shift to a yellow colour occurred within the first 500 hours and then became a more stable colour. The gloss has dropped off to a matt level.

Technical Report

QUV Accelerated Weather Testing

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Aralox-FL170 Mid Grey / Aralox-FL170 Mid Grey (Recoat 24 Hrs)	0 Hrs	0.00	0.01	-0.01	0.02
	250 Hrs	-1.75	-0.91	8.66	8.88
	500 Hrs	-3.38	-0.11	16.95	17.28
	750 Hrs	-1.84	0.19	16.73	16.83
	1000 Hrs	-1.32	0.24	16.36	16.41

System	QUV Hours	Gloss	DFT
Aralox-FL170 Mid Grey / Aralox-FL170 Mid Grey	0 Hrs	106.0	185 µm
	1000 Hrs	1.4	185 µm



https://liquimix.com/Aralox

Metalox-GC450

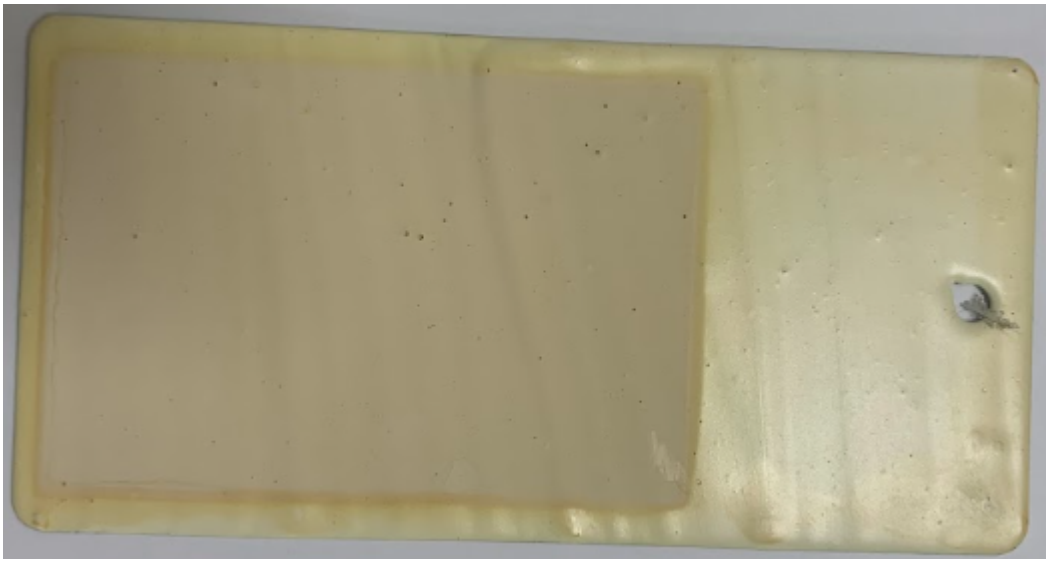
System 00011/01 (GC450)

The Metalox-GC450 White has significantly changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Metalox-GC450 White colour has darkened and yellowed visually. The spectrophotometer detected the colour changing to a

darker yellow colour. The significant shift to a beige colour occurred within the first 250 hours and then became a more stable colour. The gloss has dropped off to matte level.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Metalox-GC450	0 Hrs	0.00	-0.01	-0.01	0.01
	250 Hrs	-7.94	4.96	11.51	14.84
	500 Hrs	-7.57	5.50	6.31	11.29
	750 Hrs	-7.60	5.54	4.93	10.62
	1000 Hrs	-7.77	5.65	3.61	10.26

System	QUV Hours	Gloss	DFT
Metalox-GC450	0 Hrs	15.8	245 µm
	1000 Hrs	1.6	245 µm



Technical Report

QUV Accelerated Weather Testing

Colourtuff-A90

System 00012/01 (A90)

Colourtuff-A90 has not visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Spectrophotometer has detected a darkening of the colour however, at this point, it can not be detected visually. The dry film thickness has not changed.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Colourtuff-A90	0 Hrs	0.00	0.00	-0.01	0.01
	250 Hrs	-0.02	-0.01	0.07	0.08
	500 Hrs	-0.52	-0.05	-0.06	0.53
	750 Hrs	-0.69	0.00	-0.13	0.71
	1000 Hrs	-0.83	0.03	-0.21	0.85

System	QUV Hours	Gloss	DFT
Colourtuff-A90	0 Hrs	65.4	2875 µm
	1000 Hrs	63.9	2875 µm

Technical Report

QUV Accelerated Weather Testing

Colourtuff-C85

System 00013/01 (C85)

Colourtuff-C85 has visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Spectrophotometer has detected a darkening of the colour. The colour change is nowhere as noticeable as standard pure polyurea. The dry film thickness has not changed.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Colourtuff-C85	0 Hrs	0.00	0.00	-0.01	0.01
	250 Hrs	-1.88	0.34	4.38	4.78
	500 Hrs	-2.55	0.23	4.67	5.32
	750 Hrs	-4.78	0.15	3.81	6.11
	1000 Hrs	-7.54	0.15	2.57	7.96

System	QUV Hours	Gloss	DFT
Colourtuff-C85	0 Hrs	64.1	3120 µm
	1000 Hrs	62.3	3120 µm

Metalox-P2 / Elaston-W80 White - 24 Hours Recoat

System 00014/01 (P2/W80/24Hrs)

The Elaston-W80 has significantly changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Elaston-W80 colour has gotten darker, yellower and redder visually. The significant shift in colour mainly occurred within the first 250 hours and then became a more stable colour. The gloss has dropped off to matt level.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Metalox-P2 / Elaston-W80 White (24 Hours)	0 Hrs	-0.01	0.00	-0.01	0.01
	250 Hrs	-12.89	9.18	34.52	37.97
	500 Hrs	-14.74	11.28	33.4	38.21
	750 Hrs	-15.23	11.62	33.84	38.88
	1000 Hrs	-15.16	11.63	30.77	36.22

System	QUV Hours	Gloss	DFT
Metalox-P2 / Elaston-W80 White	0 Hrs	100.0	3290 µm
	1000 Hrs	0.7	3290 µm

Tufflon-P80 White

System 00015/01 (P80)

The Tufflon-P80 has significantly changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Tufflon-P80 colour has gotten darker, yellower and redder visually. The significant shift in colour mainly occurred within the first 250 hours and then became a more stable colour. The gloss has dropped off to matt level.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Tufflon-P80 White	0 Hrs	0.00	0.00	0.00	0.01
	250 Hrs	-10.93	7.25	32.61	35.15
	500 Hrs	-12.97	9.51	31.69	35.54
	750 Hrs	-13.19	9.75	29.88	34.08
	1000 Hrs	-13.86	9.92	26.58	31.57

System	QUV Hours	Gloss	DFT
Tufflon-P80 White	0 Hrs	102	3410 µm
	1000 Hrs	0.1	3410 µm

Polytuff-21 White

System 00016/01 (PT21)

The Polytuff-21 has significantly changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Polytuff-21 colour has gotten darker, yellower and redder visually. The significant shift in colour mainly occurred within the first 250 hours and then became a more stable colour. The gloss has dropped off to matt level.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Polytuff-21 White	0 Hrs	0.00	0.00	0.00	0.01
	250 Hrs	-16.56	13.90	28.81	36.02
	500 Hrs	-19.13	16.23	25.47	35.75
	750 Hrs	-18.60	15.72	22.52	33.17
	1000 Hrs	-19.16	15.40	18.85	30.98

System	QUV Hours	Gloss	DFT
Polytuff-21 White	0 Hrs	27.5	1585 µm
	1000 Hrs	1.9	1585 µm

Technical Report

QUV Accelerated Weather Testing

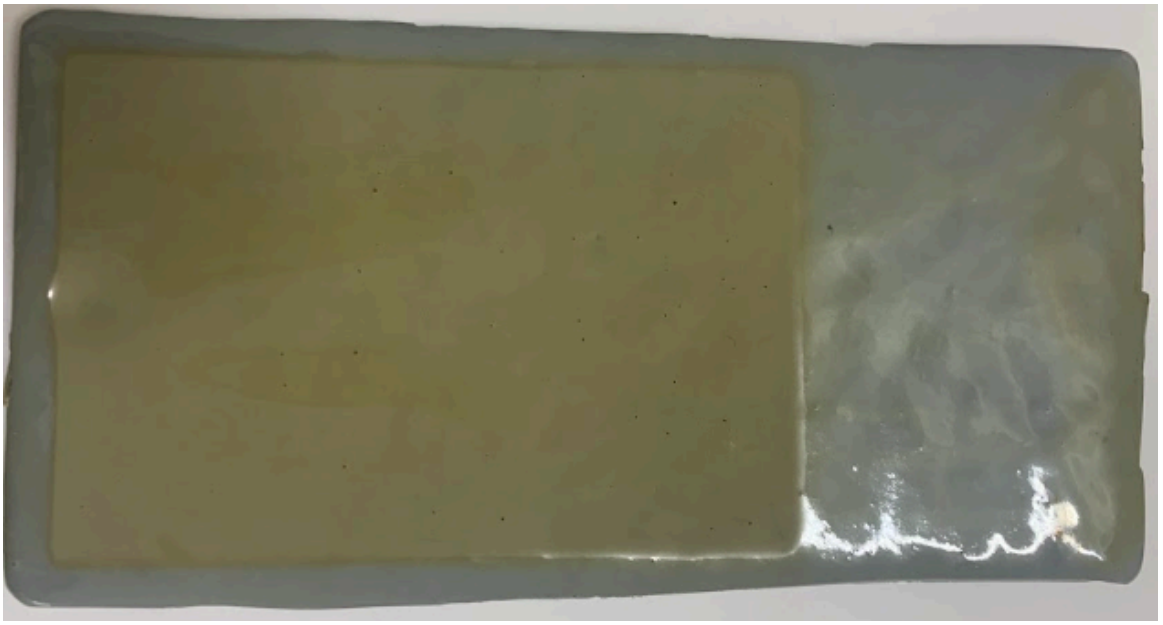
Tufflon-P90 Mid Grey

System 00017/01 (P90)

The Tufflon-P90 has significantly changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Tufflon-P90 colour has gotten darker and yellower visually. The significant shift in colour mainly occurred within the first 250 hours and then became a more stable colour. The gloss has dropped off to matt level.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Tufflon-P90 Mid Grey	0 Hrs	0.00	0.01	0.00	0.01
	250 Hrs	-2.97	-0.83	17.42	17.69
	500 Hrs	-3.71	0.00	19.89	20.23
	750 Hrs	-3.66	0.14	19.25	19.59
	1000 Hrs	-3.49	0.36	18.42	18.75

System	QUV Hours	Gloss	DFT
Tufflon-P90 Mid Grey	0 Hrs	85.9	3170 µm
	1000 Hrs	0.4	3170 µm



Technical Report

QUV Accelerated Weather Testing

Hybron-H90 Yellow

System 00018/01 (H90)

The Hybron-H90 has changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Hybron-H90 colour has gotten darker visually (Not a huge colour change for an aromatic hybrid). The shift in colour mainly occurred within the first 250 hours and then became a more stable colour. The gloss has dropped off to matte level.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Hybron-H90 Yellow	0 Hrs	-0.01	0.00	-0.02	0.02
	250 Hrs	-6.15	5.25	2.00	8.33
	500 Hrs	-7.00	5.39	-7.30	11.46
	750 Hrs	-8.29	6.07	-1.90	10.45
	1000 Hrs	-8.29	6.06	-1.90	10.45

System	QUV Hours	Gloss	DFT
Hybron-H90 Yellow	0 Hrs	78.0	2905 µm
	1000 Hrs	1.0	2905 µm

Technical Report

QUV Accelerated Weather Testing

Hybron-W90 Black

System 00019/01 (W90)

Hybron-W90 has not visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). However, the spectrophotometer has detected a darkening of the Hybron-W90 colour. The shift in colour can not be detected visually, but the loss of gloss is very noticeable. The gloss has dropped to a matte level.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Hybron-W90 Black	0 Hrs	0.01	-0.03	-0.02	0.04
	250 Hrs	-0.02	0.04	1.27	1.27
	500 Hrs	-1.24	-0.09	1.12	1.67
	750 Hrs	-3.84	-0.19	1.10	4.00
	1000 Hrs	-7.03	-0.12	2.81	7.57

System	QUV Hours	Gloss	DFT
Hybron-W90 Black	0 Hrs	35.3	4260 µm
	1000 Hrs	1.0	4260 µm

Technical Report

QUV Accelerated Weather Testing

Tufflon-D60 Black

System 00020/01 (D60)

Tufflon-D60 has not visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). However, the spectrophotometer has detected a darkening of the Tufflon-D60 colour. The shift in colour can not be detected visually, but the loss of gloss is very noticeable. The gloss has dropped to a matt level.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Tufflon-D60 Black	0 Hrs	0.02	-0.01	-0.02	0.04
	250 Hrs	1.72	-0.06	0.36	1.75
	500 Hrs	1.85	0.10	0.63	1.96
	750 Hrs	1.02	0.14	0.61	1.20
	1000 Hrs	0.52	0.10	0.54	0.75

System	QUV Hours	Gloss	DFT
Tufflon-D60	0 Hrs	95	3860 µm
	1000 Hrs	10.5	3860 µm

Technical Report

QUV Accelerated Weather Testing

Conclusion

The following conclusions are drawn from the above results.

- All aromatic polyurea, hybrid and polyurethane will change colour. The lighter the colour, the greater the yellowing. Yellow and black have significantly less colour change.
- All aromatic polyurea, hybrid and polyurethane will lose their gloss and chalk. The low gloss is consistent and looks good.
- All our epoxies will turn yellow on exposure to sunlight.
- Opalon-S30, Opalon-F45, Opalon-W45 and PU75 all had no visual change in colour or gloss
- Different colours of Opalon-S30 will have different performances due to the pigments used.
- Colourtuff-A90 and C85 both perform well for colour fastness. Aliphatic polyurea does not perform as well as aliphatic polyaspartic and polyurethane.
- The Opalon-S30 has a 3-day recoat window when applied over Metalox-GC450 and is not exposed to UV.
- None of the samples experienced high levels of DFT loss.

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