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ToughGuard Xenon 2000 hrs. Testing Report

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Nomenclature

Acronym	Description
ASTM	American Society for Testing and Materials
CIE	Commission Internationale de l'Elclairage
DI	Deionized
ΔE^*_{ab}	Change in color after exposure



1 Introduction

Sample were provide for Xenon Exposure from Tough Guard no replicates. Samples were cleaned with aerospace wipes before starting the test. Minor scratches and paint defects were observed on the sample coating system. Single panel for each coating type were provided with no replicates.

Equipment used:-

1. Xenon Test Chamber Atlas Ci3000+ Weather-Ometer.
2. BYK Spectro Guide Sphere Gloss for color measurement.
3. BYK micro-TRI-gloss 20°, 60°, 85° for gloss measurement.

Standards

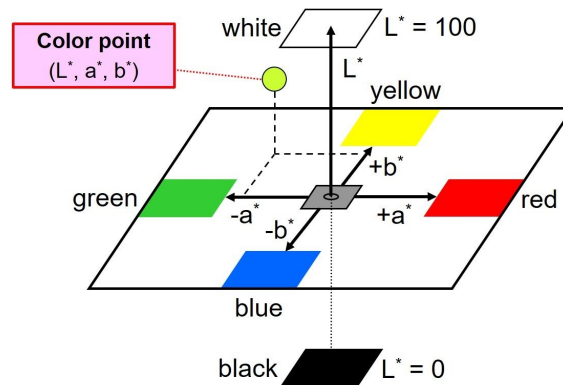
ASTM	Description
D7869-17	Standard Practice for Xenon Arc Exposure Test with Enhanced Light and Water Exposure for Transportation Coatings
D2244-21	Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
D523-14	Standard Test Method for Specular Gloss

2 Xenon Testing Results

Xenon testing was performed according to ASTM D7869. The test was performed for 2000 hrs. And the color and gloss were evaluated as per the standards ASTM D2244 – 6.2 CIE 1976 and ASTM D523, for the samples at Initial, 500, 1000, 1500 and 2000 hrs. The samples were only dabbed with an Aerospace wipe before evaluating at 500, 1000, 1500 and 2000 hrs. The data represent the testing of single panel without any replicates.

Table 1 Color Change ΔE^*ab at Every 500 hrs.

Sample Name		Initial	500 Hrs.	1000 Hrs.	1500 Hrs.	2000 Hrs.
TG Resin 1 Coat	ΔE^*ab		0.45	0.41	0.41	0.52
TG Resin 2 Coats	ΔE^*ab		0.75	0.78	0.77	0.84
TG Resin 3 Coats	ΔE^*ab		0.95	0.92	0.89	0.92
Speed Guard SGX	ΔE^*ab		0.29	0.32	0.36	0.39



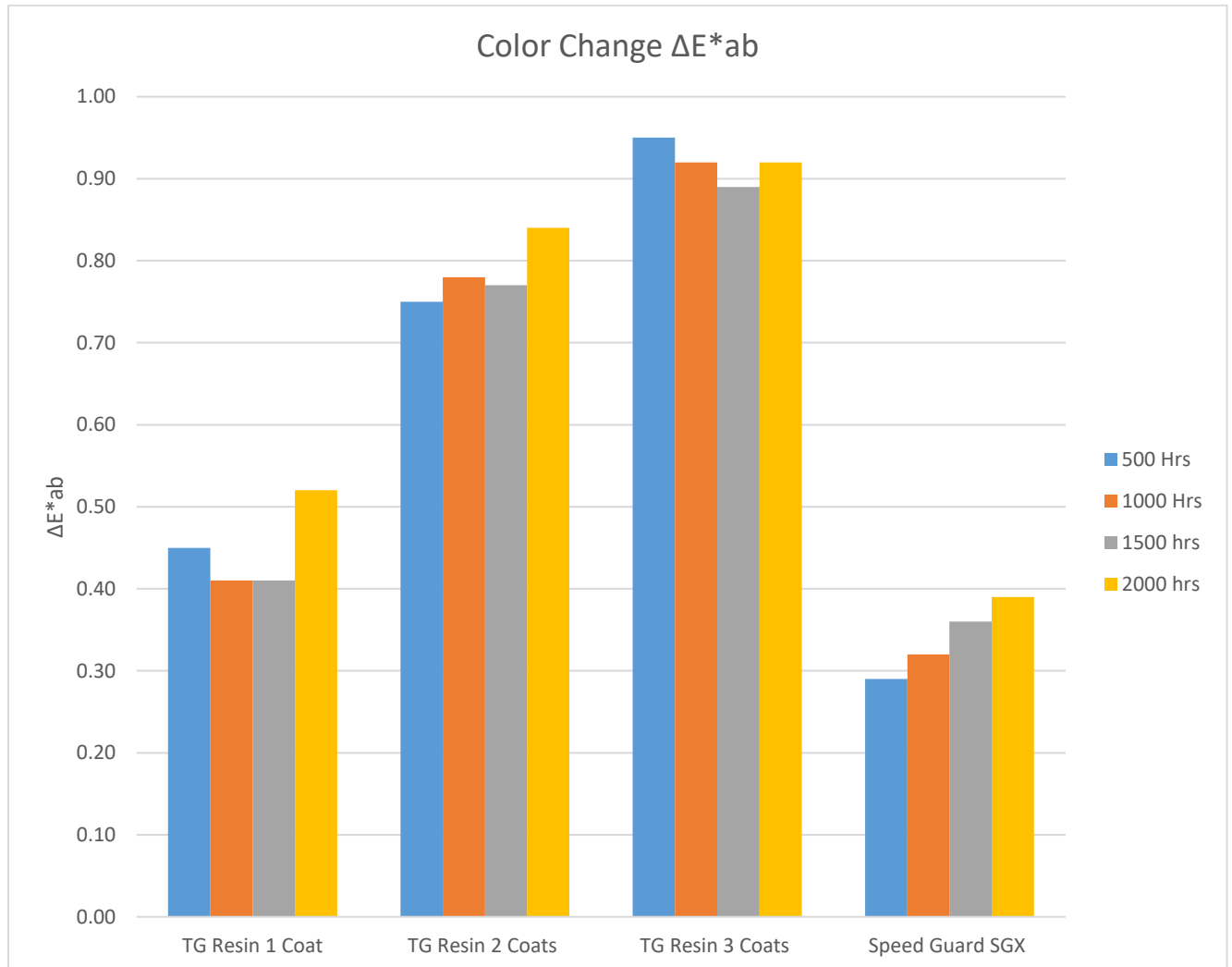


Figure 1 Color Change after Xenon exposure showing ΔE^*ab Data comparison

Summary:

Observation is that TG Resin results are very good for panel 1, panel 2 and panel 3.

Speed Guard SGX panel also performed very well. Generally speaking, readings below the value of 1 are considered excellent results.



Table 2 Average Gloss Readings for Each evaluation

SPECIMEN NAME	Gloss Degree	Initial Readings	500hrs Readings	1000hrs Readings	1500hrs Readings	2000hrs Readings
		Average	Average	Average	Average	Average
TG Resin 1 Coat	20°	2.9	84.4	83.8	82.9	85.5
	60°	31.9	92.9	92.8	93.0	93.3
	85°	2.4	98.1	98.1	97.9	99.6
TG Resin 2 Coats	20°	36.2	84.3	84.8	84.5	85.7
	60°	95.3	93.3	93.4	93.4	93.7
	85°	73.7	97.7	97.3	97.4	99.6
TG Resin 3 Coats	20°	84.9	83.7	84.3	83.8	86.0
	60°	93.4	93.5	93.6	93.5	93.8
	85°	98.3	98.3	97.7	97.8	99.8
Speed Guard SGX	20°	84.1	86.0	87.0	86.1	86.7
	60°	94.5	94.5	94.2	94.0	93.9
	85°	96.9	97.7	97.5	97.5	99.4

Summary:

Gloss degree angles of 20 degree and 60 degree are used to evaluate high gloss coatings. Gloss Unit (GU) rating 85 or higher is considered to be "High Gloss". TG Resin panel 1, panel 2, panel 3 and Speed Guard SGX panel all achieved GU's of 85 degrees and higher at 2000hrs. TG Resin and Speed Guard SGX panels all performed very well in maintaining or increasing GU's over the course of testing at 500hrs, 1000hrs, 1500hrs and 2000hrs.



Figure 2 Gloss Unit Comparison of Data at 20°, 60°, and 85° after Xenon Test



Appendix A Color Measurements

Table 3 Color Readings after Xenon Test

Sample Name		Initial	500	1000	1500	2000
TG Resin 1 Coat	L*	88.21	87.92	87.92	87.91	87.81
	a*	-0.98	-0.96	-0.94	-0.94	-0.95
	b*	0.25	-0.10	-0.04	-0.03	-0.07
	c*	1.02	0.97	0.94	0.94	0.96
	h°	165.72	185.84	182.43	181.64	184.23
	ΔE^*_{ab}			0.45	0.41	0.41
TG Resin 2 Coats	L*	88.49	87.91	87.92	87.90	87.78
	a*	-0.83	-0.95	-0.94	-0.95	-0.95
	b*	-0.37	0.10	0.15	0.11	0.09
	c*	0.91	0.96	0.96	0.96	0.95
	h°	203.61	173.95	170.85	173.31	174.66
	ΔE^*_{ab}			0.75	0.78	0.77
TG Resin 3 Coats	L*	88.07	88.35	88.34	88.32	88.26
	a*	-1.05	-0.80	-0.79	-0.77	-0.78
	b*	0.43	-0.45	-0.41	-0.38	-0.43
	c*	1.13	0.91	0.88	0.86	0.89
	h°	157.71	209.14	207.37	206.11	208.75
	ΔE^*_{ab}			0.95	0.92	0.89
Speed Guard SGX	L*	88.15	87.93	87.87	87.82	87.80
	a*	-0.94	-0.91	-0.90	-0.91	-0.91
	b*	0.30	0.13	0.16	0.15	0.14
	c*	0.99	0.92	0.92	0.92	0.92
	h°	162.17	172.02	169.96	170.38	171.17
	ΔE^*_{ab}			0.29	0.32	0.36