Test Results

Test results are summarized in the Tables below.

Weight Check Summary – Pole Specimen

Sample	0 hrs	500 hrs	% Change	1000 hrs	% Change
1	0.697	--	--	0.6965	0.07
2	0.692	--	--	0.692	0
3	0.548	0.546	0.36	--	--
4	0.5605	0.561	0.09	--	--
5	0.5955	--	--	0.595	0.08
6	0.629	0.6295	0.08	--	--
7	0.65	--	--	0.65	0
8	0.55	0.5505	0.09	--	--
9	0.684	0.685	0.15	--	--
10	0.6165	0.616	0.08	--	--
11	0.697	--	--	0.6965	0.07
12	0.6885	--	--	0.688	0.07
13	0.57	--	--	0.57	0
14	0.6555	--	--	0.655	0.08
Average	--	--	0.14	--	0.05

3-pt Bending Performance – Pole Specimen

Sample	Flexural Strength (ksi)** 0 hrs	Flexural Strength* (ksi) 500 hrs	Flexural Strength** (ksi) 500 hrs	Flexural Strength (ksi)* 1000 hrs	Flexural Strength (ksi)** 1000 hrs
Conditioned Side Up	62 ± 6	46 ± 5	58 ± 8	47 ± 4	60 ± 3
Conditioned Side Down	58 ± 2	41 ± 2	56 ± 10	39	67 ± 8

*Thickness < 0.250

**Thickness > 0.250

The annual TUV at AWSG in Florida was estimated at 275 MJ/m^2 based on several years of data. To attain the same level of total dosage would require 1800 hrs of UV exposure using the UVB 313 nm light source, used in this test. In comparison, the current test represents the equivalent of 28% of the total UV dosage per year assuming AWSG at Florida.

Discussion

Weight Checks:

There is no significant weight loss during the aging study. Change in weight can occur due to resin degradation over long periods of UV exposure or due to water absorption during the condensation cycles. However, it should be noted, that no change in weight does not imply that there may be no degradation in the material. Property measurements need to be performed to ensure there is no change in performance.

Flexural Testing:

Flexural tests were performed with both conditioned side Up and conditioned side Down. This was done because it was not clear ahead of time, whether the aging would affect the tensile properties or the compressive properties. During typical full-pole strength tests, failure occurs typically on the compression side. However, there is the possibility that exposure to UV and humidity can affect the tension properties enough that the pole may fail in tension first. Hence, flexure testing was performed for both cases so that tension and compression characteristics of the conditioned side could be monitored. Detailed results are presented in the Appendix.

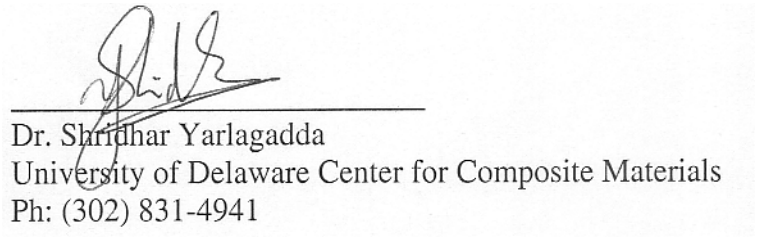
Results indicate that the strengths are within statistical bounds and show no degradation due to UV/humidity exposure. There is however, a distinction in flexural strength based on the thickness of the pole specimen, due to the way the pole is fabricated (pultruded). The thinner sections (<0.250") show lower strengths due to lesser material in the section. This is confirmed by 1000 hr tests that also show lower strengths for thinner sections, but show no degradation due to UV and aging.

Appearance/Color:

There is fading of color over the 1000 hrs of aging with no visible surface damage. The loss of color occurs at each of the intervals (500 and 1000 hrs) monitored, though flexural tests show no change in performance. In all cases, there is no visible damage to the surface of the specimen.

Conclusions

Results indicate no change in the performance of pole specimens for up to 1000 hours of accelerated aging using the UVB313 lamp with the 4hr UV/4hr condensation cycle. Color fading occurred during the test, as seen at the 500 and 1000 hr intervals.



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Appendix: Detailed Results for 3-pt Flexure

Baseline Pole Specimen (0 hours)

Specimen	Face (No UV)	Thickness (in)	Width (in)	Failure Load* (lbs)	Failure Stress (psi)
14-1	Up	0.277	0.459	242.0	61.84
14-2	Up	0.277	0.458	265.8	68.07
14-3	Up	0.276	0.461	218.9	56.10
Average					62.01
Std. Dev					5.99
COV					9.66
16-1	Down	0.276	0.467	218	55.15
16-2	Down	0.275	0.461	229.1	59.14
16-3	Down	0.274	0.460	224.4	58.48
Average					57.59
Std. Dev					2.14
COV					3.71

Pole Specimen (500 hrs)

Specimen	UV Side	Thickness (in)	Width (in)	Failure Load* (lbs)	Failure Stress (psi)
8-1	Up	0.239	0.458	123.4	42.45
8-2	Up	0.239	0.469	126.9	42.63
8-3	Up	0.239	0.460	151.7	51.96
10-1	Up	0.257	0.487	190.6	53.33
10-3	Up	0.250	0.494	180.3	52.56
6-1	Up	0.266	0.489	225.4	58.63
6-3	Up	0.265	0.490	266.2	69.62
Average					53.03
Std. Dev					9.38
COV					
4-1	Down	0.231	0.489	113.3	39.08
4-3	Down	0.232	0.492	130.7	44.42
3-1	Down	0.232	0.491	124.1	42.26
3-3	Down	0.232	0.491	117.2	39.91
10-2	Down	0.249	0.488	166.9	49.65
6-2	Down	0.264	0.488	241.2	63.83
Average					46.52
Std. Dev					9.28
COV					19.95

Pole Specimen (1000 hrs)

Specimen	UV Side	Thickness (in)	Width (in)	Failure Load* (lbs)	Failure Stress (psi)
5-1	Up	0.246	0.487	178.6	54.54
5-3	Up	0.246	0.481	195.4	60.42
17-1	Up	0.277	0.484	247.9	60.08
17-3	Up	0.276	0.492	256	61.48
1-1	Up	0.276	0.484	251.9	61.49
1-3	Up	0.276	0.486	274.5	66.73
2-1	Up	0.263	0.486	220.5	59.03
2-3	Up	0.263	0.485	219.1	58.78
18-1	Up	0.232	0.486	135.3	46.55
18-1	Up	0.232	0.487	137.4	47.18
Average					57.63
Std. Dev					6.42
COV					11.14
5-2	Down	0.248	0.494	188.7	55.90
17-2	Down	0.276	0.485	276.2	67.28
1-2	Down	0.277	0.489	267.9	64.26
2-2	Down	0.262	0.485	294.5	79.61
20-2	Down	0.263	0.493	256	67.57
18-2	Down	0.232	0.487	114	39.14
Average					62.29
Std. Dev					13.66
COV					21.93