MICOM INC.
LABORATOIRES · LABORATORIES

July 02, 2019

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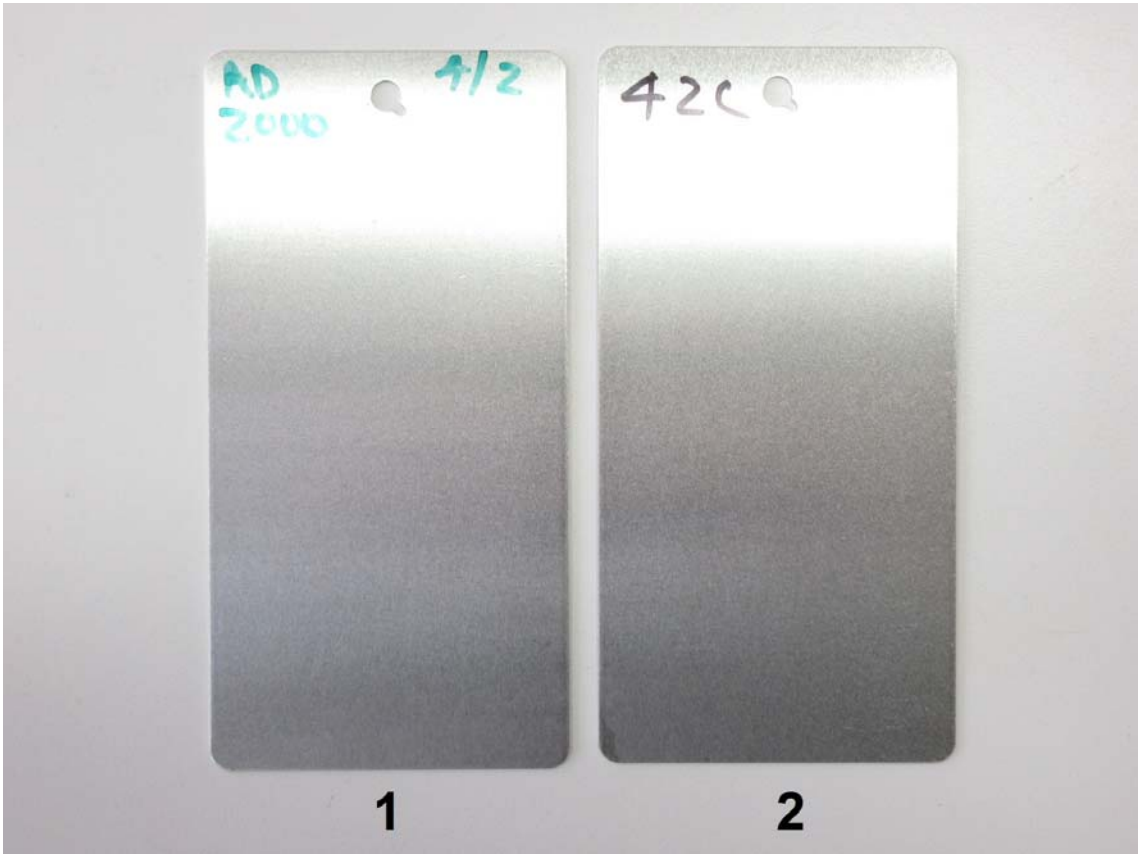
TEST REPORT # MI-19-11268-M

This report was modified on May 27, 2020 to correct the product name.

On May 7th 2019, Micom Laboratories Inc. received 2 samples to perform accelerated Light Aging.

SAMPLES DESCRIPTION:

- Sample 1 : AD2000 Aluminum coated panel, 3” x 6”
- Sample 2 : MG1-3500 Aluminum coated panel, 3” x 6”
-



Samples 1 & 2

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REFERENCE TEST METHOD:

Samples were exposed as per ASTM G154 Cycle 1 - Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials.
The cycle consists of 8 h UV at 60 ± 3 °C Black Panel Temperature followed by 4 h Condensation at 50 ±3 °C Black Panel Temperature.
Conditions in the UV chamber:

- Irradiance: 0.89 ± 0.02 W/(m^2 • nm) @ 340 nm
- Lamp Type: ☒ UVA-340 ☐ UVB-313

Exposure duration: 1340hrs.
Samples were exposed: ☒ As received ☐ Preparation: - - - -

UV chamber used with Fluorescent UV lamps

Samples were rated according to:

- ASTM D523 (Specular Gloss)
- ASTM D2244 (Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates)

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RESULTS:

Tests performed between 2019-05-07 and 2019-07-02.

Sample	Exposition total hrs	Initials values ASTM G155			
		L*	a*	b*	Gloss 60°
#1 AD2000	1340	86.4	0.0	2.2	110.2
#2 MG1-3500	1340	85.5	0.0	2.2	68.4

- **1340hrs**

Sample	1340 hrs ASTM G155				ΔL*	Δa*	Δb*	ΔE^*_{ab}	ΔGloss
	L*	a*	b*	Gloss 60°					
#1 AD2000	87.5	0.1	2.3	107.8	1.0	0.0	0.0	**1.0**	**-2.1%**
#2 MG1-3500	86.3	0.0	2.1	61.8	0.8	0.0	0.0	**0.8**	**-9.6%**

Sample	Exposition hrs	Cracking	Erosion	Oxidation
#1 AD2000	1340	No	No	No
#2 MG1-3500	1340	No	No	No

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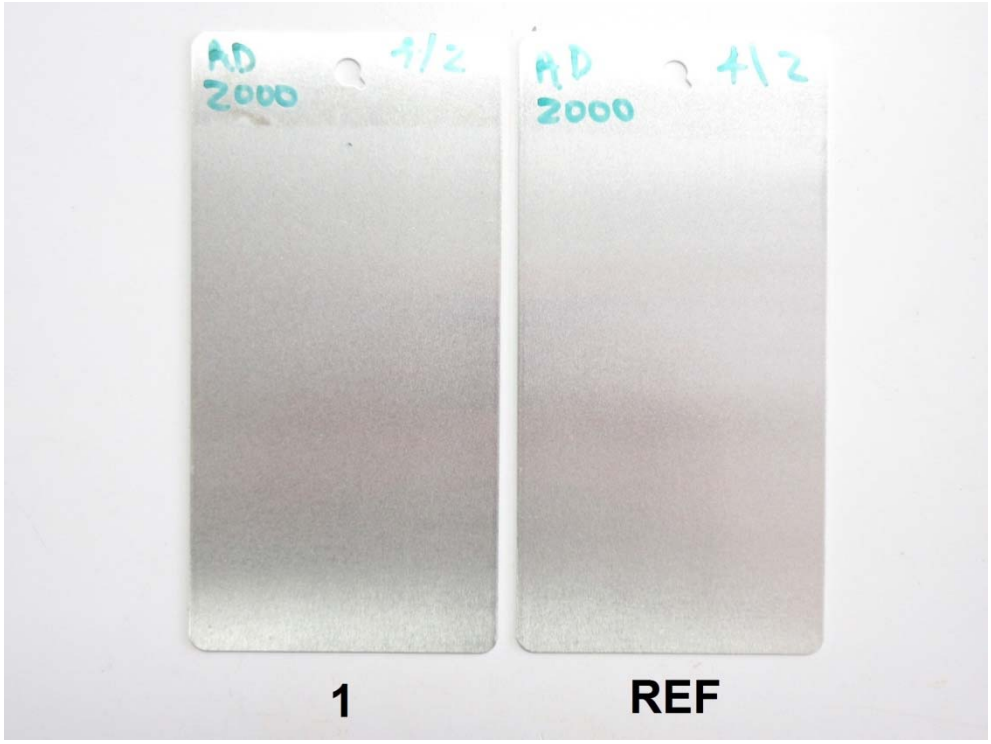
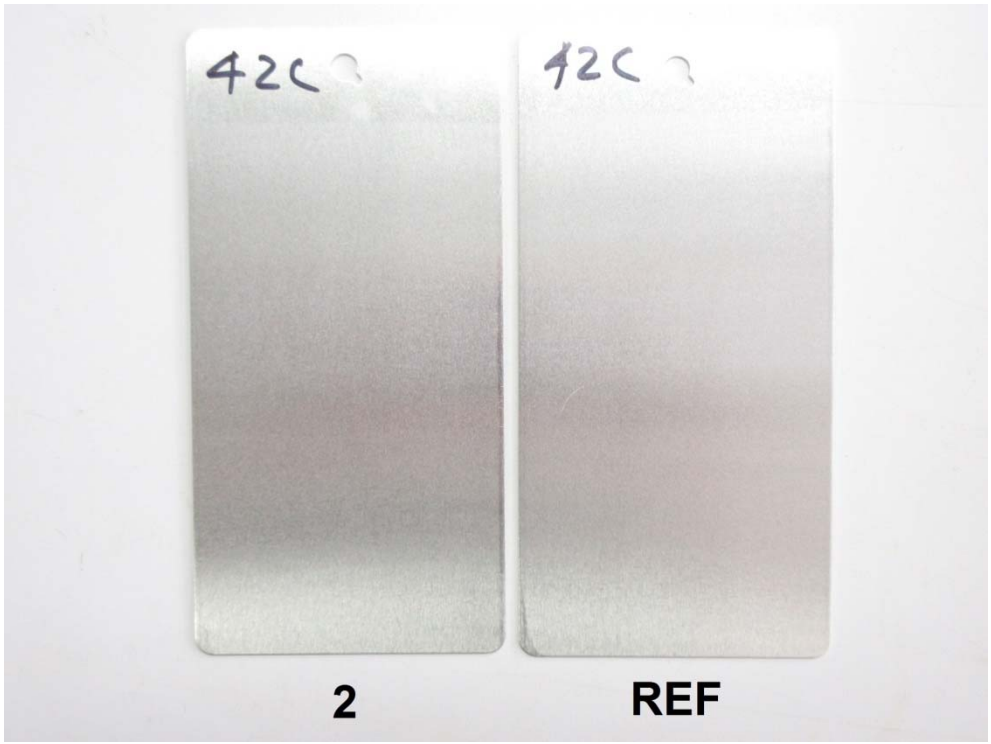


Sample 1 after 1340hrs exposure



Sample 2 after 1340hrs exposure

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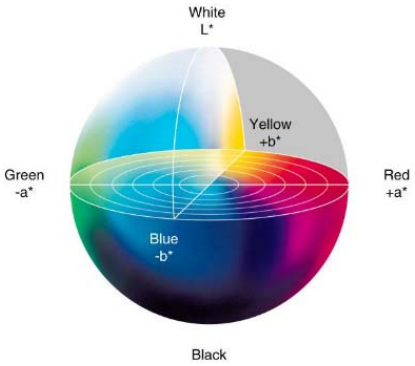
APPENDIX 1: Color & ΔE

L*.a*.b* values: color measurement

L*.a*.b*. coordinates refer to the coordinates of the color in the CIELAB 76 sphere. It is actually a three-dimensional space where the L* axis represents the "lightness" of the color (Black to white), a* is the green-red axis and b* is the blue-yellow axis. L* axis goes from 0 (darkest black) to 100 (brighter white), a* goes from -100 (green) to + 100 (red), b* goes from -100 (blue) to + 100 (yellow)[1].



ΔE (Delta E): Color difference measurement

In order to quantify the difference between 2 colors, a formula that measures the distance between the 2 colors was established and called ΔE (Delta E). The formula used to determine the distance between color 1 (L_1*, a_1*, b_1*) and color 2 (L_2*, a_2*, b_2*) is:

$\Delta E = [(L_2^* - L_1^*)^2 + (a_2^* - a_1^*)^2 + (b_2^* - b_1^*)^2]^{0.5}$

It was found that the *Just Noticeable Difference (JND)*[2] is, for most people, at ΔE = 2.3. That means that the magnitude of difference between 2 colors must be 2.3 or more to be noticed. Over the years, some industries came up with their own JND value based on specific needs and applications. The 2.3 value is, however, still widely used as the JND.

Other rating scales can also be found in the literature:

Scale #1[3]:

0.0 < ΔE ≤ 0.5: No color difference
0.5 < ΔE ≤ 1.0: Difference only perceivable for experienced observers
1.0 < ΔE ≤ 2.0: Minimal color difference
2.0 < ΔE ≤ 4.0: Perceivable color difference
4.0 < ΔE ≤ 5.0: Significant color difference
5.0 < ΔE : Different colors

Scale #2[4]:

0 < ΔE ≤ 1 : Observer does not notice the difference
1 < ΔE ≤ 2 : Only experienced observer can notice the difference
2 < ΔE ≤ 3.5 : Inexperienced observer can notice the difference
3.5 < ΔE ≤ 5 : Clear difference in color is noticed
5 < ΔE : Observer notices two different colors

[1] *a* and b* axis can technically go further than the usual ± 100 range but it never really happens in practice.*
[2] *Mahy et al. (1994)*
[3] *Published by Dr Bela Torok, M.D., Ph.D. (Ophthalmologist) on ResearchGate.net*
[4] *From « colour difference ΔE – A survey » by Mokrzycki W.S., Tatol M., University of Warmia and Mazury, August 2012.*

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