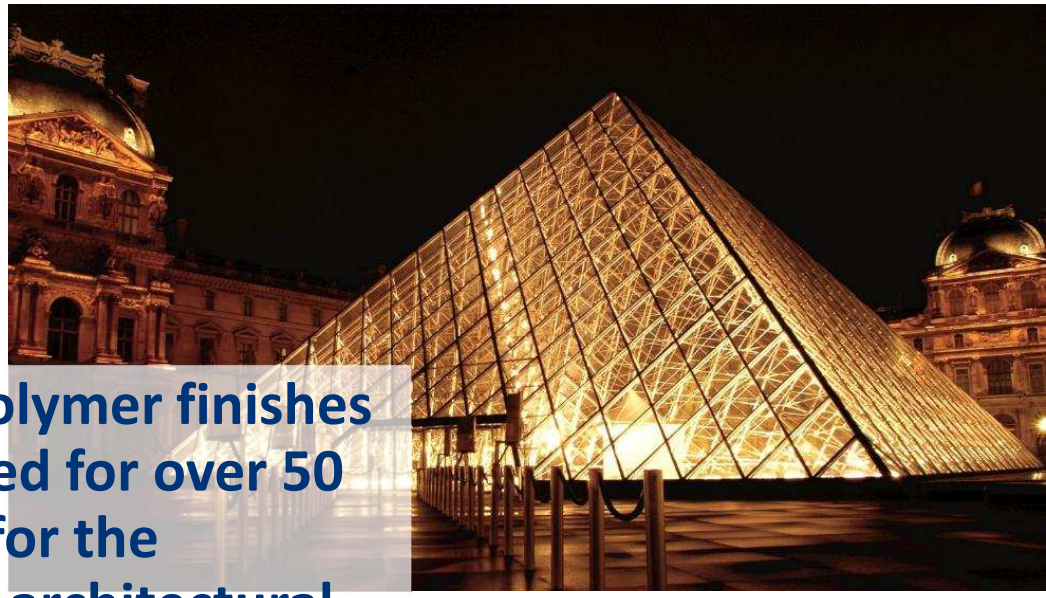
New Fluoropolymer Topcoat Standard for Protective and Restoration Coatings

Dr. Kurt Wood
Arkema, Inc.
Chair, SSPC C.1.8 committee

SSPC The Society For Protective Coatings

ARKEMA INNOVATIVE CHEMISTRY



Baked fluoropolymer finishes have been used for over 50 years for the protection of architectural metal substrates

KYNAR 500® PVDF was introduced in 1965!

WHY? FLUOROPOLYMER COATINGS OFFER UNPARALLELED WEATHERABILITY

Continuous south Florida exposure (S45) since October 1967

Shown here:
Some of the oldest of the 5000+ panels on exposure on Arkema's test fences in south Florida

- ***Top portion sits under a flap and preserves the original color***
- ***Number at upper left is month and year of exposure***

KYNAR500® BY ARKEMA

ARKEMA

FADE AND CHALK RESISTANCE HIGHLIGHTS RESIN DURABILITY-
COIL COATINGS, 17 YEARS FLORIDA EXPOSURE

KEY INNOVATIONS IN WEATHERABLE FLUOROPOLYMERS OVER THE DECADES

1980s:

- Field applied options in several chemistries (1-k PVDF, 2-k FEVE)

2000s:

- Waterborne versions of standard chemistries (1-k, 2-k)
- "FSF" options (fluoropolymers manufactured without any PFAS)

2015:

SSPC: The Society for Protective Coatings

Technology Update No. 12

Ambient-Curing Fluoropolymer Finish Coats Applied to Metal Substrates

IMPORTANT STANDARDS AVAILABLE FOR FLUOROPOLYMER TOPCOATS

ARCHITECTURAL OEM:

- AAMA 2605 FOR FINISHES ON ALUMINUM
- AAMA 615 ON VINYL
- AAMA 625 ON COMPOSITES

American Architectural Manufacturers Association

ALL THREE AAMA STANDARDS SHARE A 10-YEAR SOUTH FLORIDA GLOSS AND COLOR RETENTION COMPONENT

FIELD-APPLIED COATINGS (PROTECTIVE, ARCHITECTURAL RESTORATION):

???

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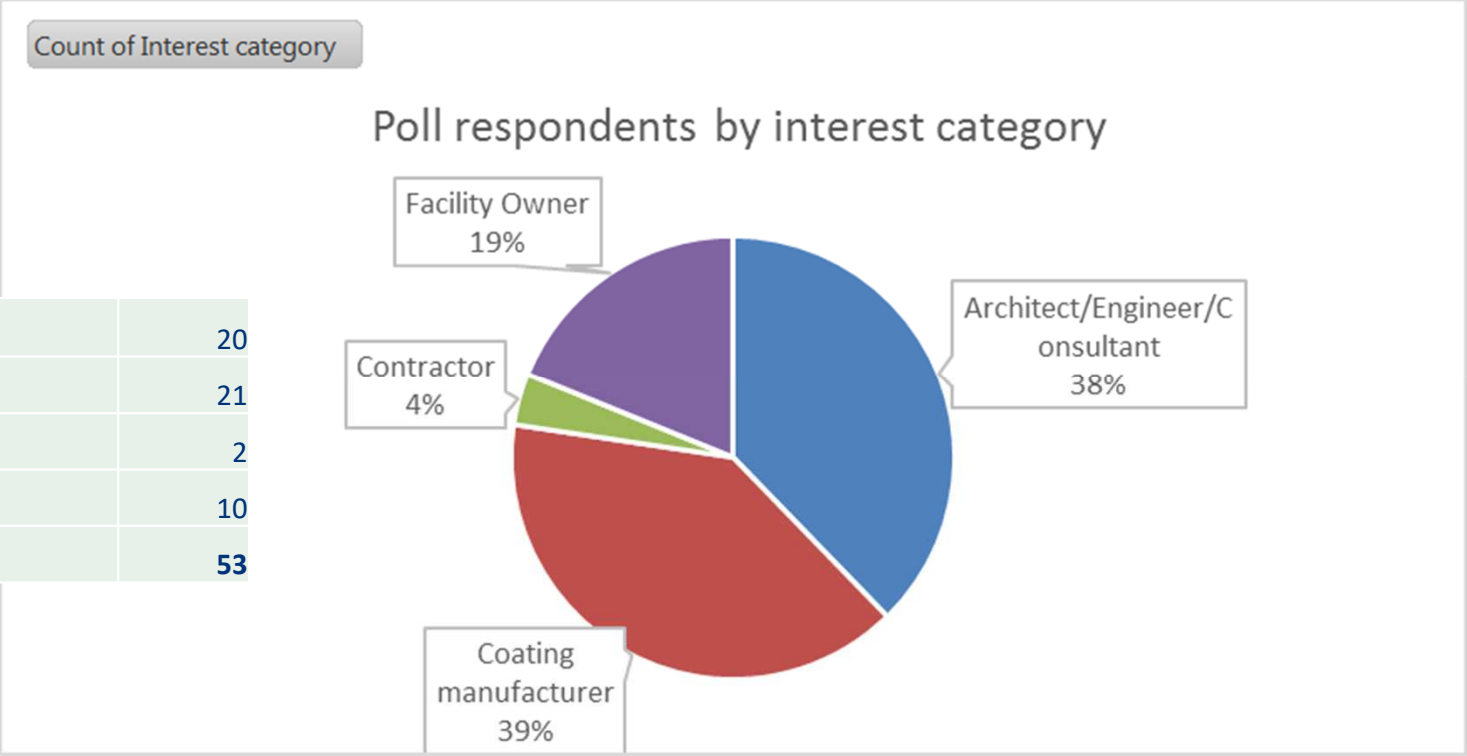
FIELD-APPLIED COATINGS (PROTECTIVE, ARCHITECTURAL RESTORATION):

Enter the SSPC C.1.8 Fluoropolymer Topcoats Committee!

SSPC The Society For Protective Coatings

FIRST STEP: A POLL OF SSPC MEMBERSHIP, TO CONFIRM AND SHARPEN OUR UNDERSTANDING OF MARKET NEEDS

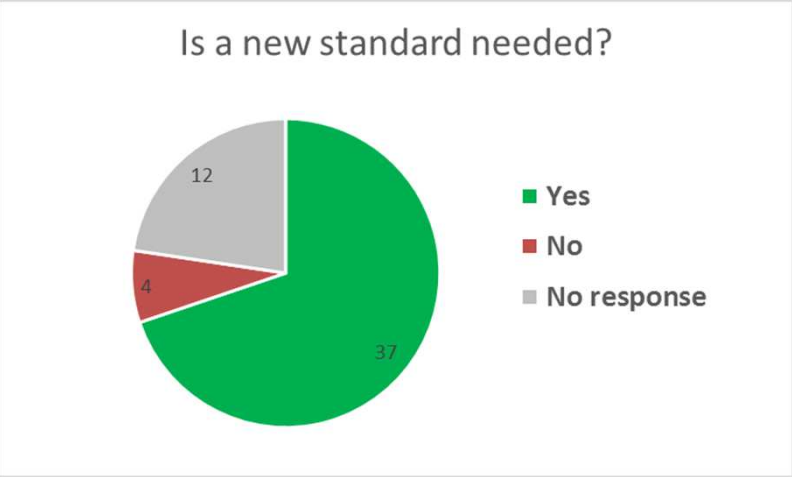
Count of Interest category	
Architect/Engineer/Consultant	20
Coating manufacturer	21
Contractor	2
Facility Owner	10
Grand Total	**53**

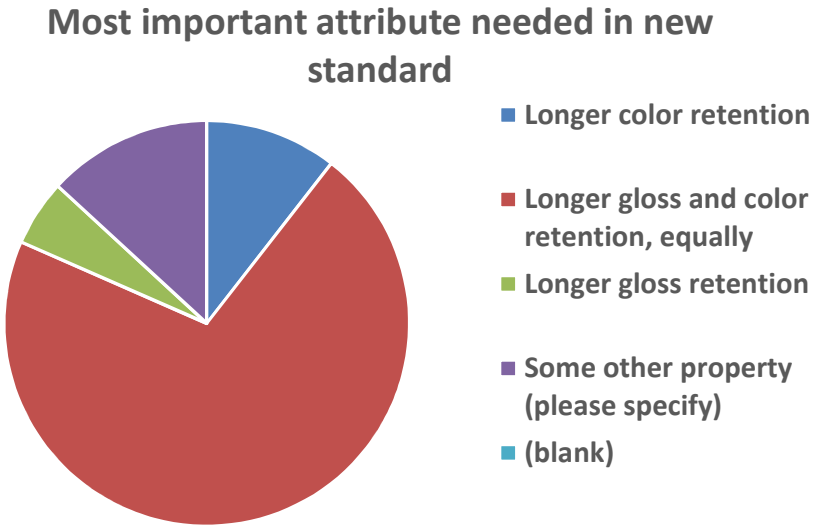


The most weatherable field-applied topcoat specs (SSPC Paint 36, MPI 311) have been based around acrylic technology, and color retention performance is limited to light colors

POLL: NEED FOR A NEW FLUOROPOLYMER STANDARD

Q. Do you believe there is a need for a new SSPC standard for fluoropolymer topcoats, with enhanced weatherability vs. SSPC Paint 36, SSPC Paint 24, and MPI 311/315?





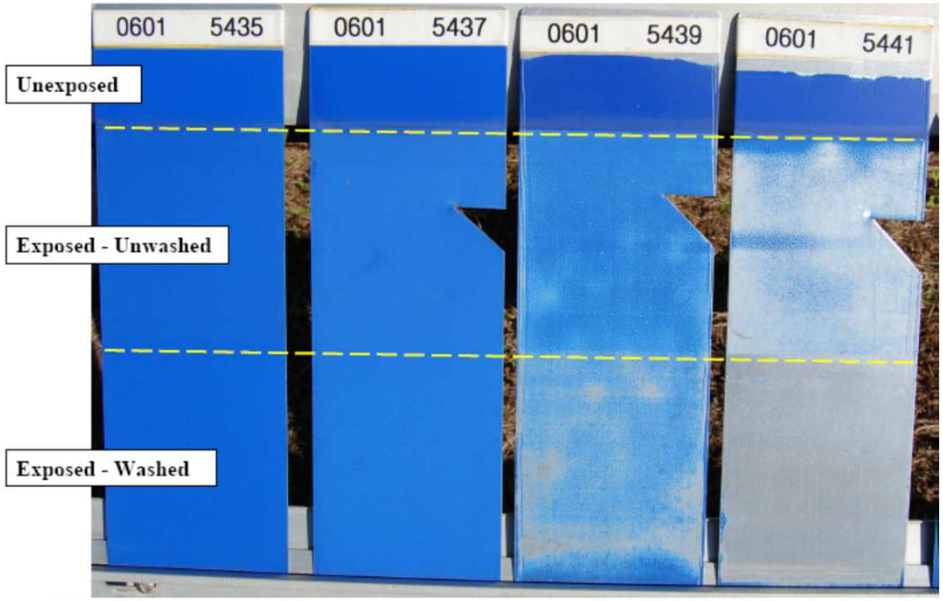
- *Key colors for the new standard included safety red, safety yellow, blue and green*

GENERAL FEATURES OF THE DESIRED NEW FLUOROPOLYMER TOPCOAT STANDARD

- ***KEY PERFORMANCE ATTRIBUTE:*** Quantum improvement in color and gloss retention vs. SSPC Paint 36 and MPI 311, in darker and saturated colors
- ***PERFORMANCE-BASED SPECIFICATION:*** Should not be limited to any specific fluoropolymer resin chemistry, or to solvent vs. waterborne, etc.
- ***SHOULD HAVE AN ACCELERATED WEATHERING OPTION (like Paint 36):*** Topcoat weatherability (in the specified color!) can be demonstrated using either natural or accelerated testing
  - Natural weathering should be 10-year south Florida S45 type
  - Accelerated weathering should be less than one year, ideally about six months

CAN WE RELIABLY DIFFERENTIATE 10-YR FLA WEATHERING IN A 6-MONTH TEST? PREVIOUS WORK WITH PVDF SUGGESTED *YES*.

Arkema study of 1-k waterborne coatings, 12 PVC with cobalt blue pigment, 1.5 mil dft
Appearance after 7.5 years south Florida exposure (South 45º)



70% PVDF

50% PVDF

MPI 311 type acrylic latex

- *Cobalt blue pigment allows some penetration of UV into the binder*
- *Pigment is highly weatherable: color fade comes only from binder degradation and chalking effects*
- *Color fade rate scales roughly with total acrylic content*
- *No chalking or cracking for systems with 50% or higher PVDF*

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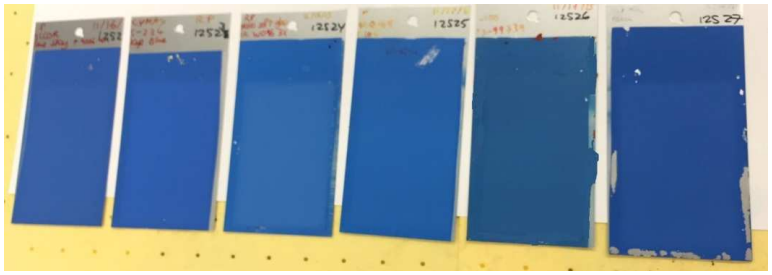
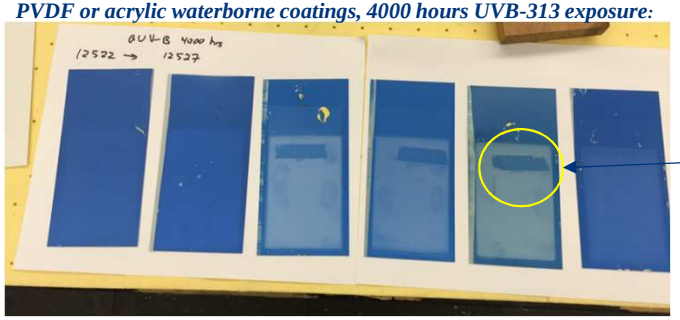
HOW DO DEEPTONE BLUES DO IN FLUORESCENT CABINET EXPOSURE?

PVDF or acrylic waterborne coatings, 4000 hours UVA-340 exposure:



PVDF A, >50% PVDF B, > 50% Acrylic 6 Acrylic 4 Acrylic 5 PVDF C <50%

PVDF or acrylic waterborne coatings, 4000 hours UVB-313 exposure:

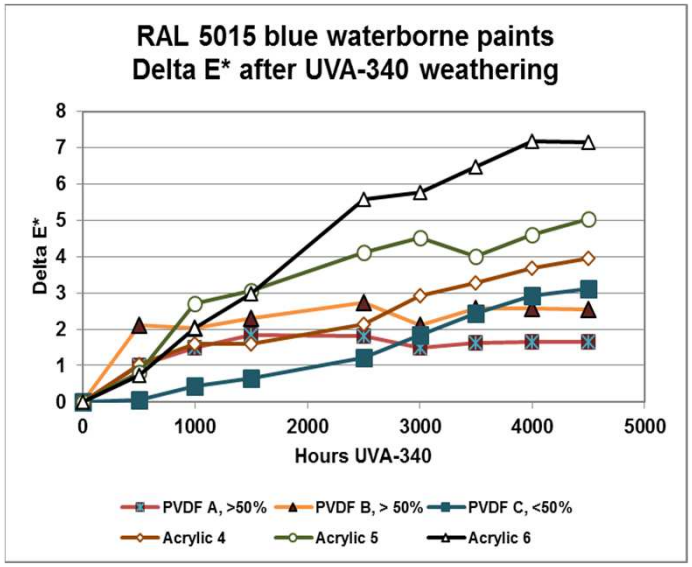


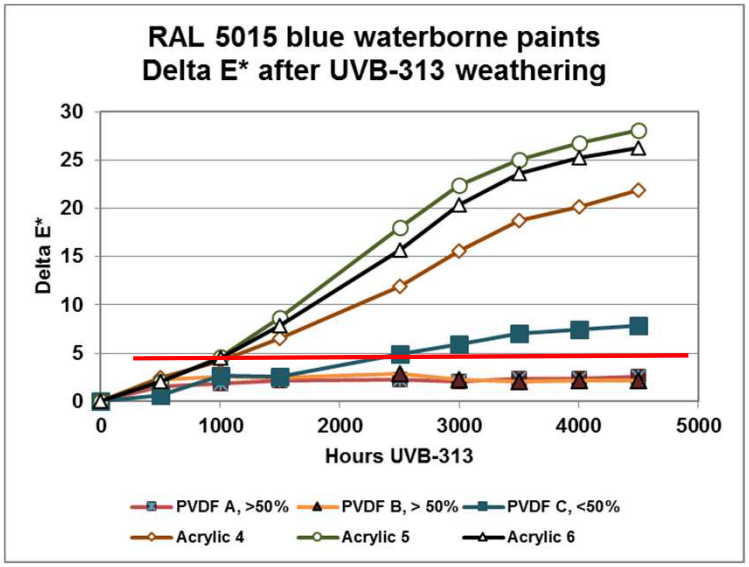
PVDF A, >50% PVDF B, > 50% Acrylic 6 Acrylic 4 Acrylic 5 PVDF C <50%

Chalk test

UVA-340 exposure *UVB-313 exposure* :

UVA-340 did *NOT* give a clean differentiation between acrylics and PVDF-based coatings, at least over 4000-5000 hours





UVB-313 DOES give a clean differentiation between acrylics and PVDF-based coatings, including chalk behavior also seen in Florida

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C.1.8 ROUND ROBIN WEATHERING TEST, 2018-2020

- Main objective: ***Can we identify an accelerated weathering test cycle that cleanly differentiates between high performance fluoropolymer topcoats, and conventional non-fluoropolymer controls?***
- **51 topcoat formulations from 10 manufacturers**: 4 FEVE types, 3 Paint 36 controls, 4 PVDF types, and 2 MPI 311 controls), all **in four standard colors**: off-white, NETPEP gray, safety red, and deeptone blue
- **Three candidate accelerated test cycles** with replicate testing at two different laboratories:
  - ASTM D7869 Xenon with enhanced time of wetness
  - UVA-340 Fluorescent cabinet, enhanced irradiance cycle (G154 Cycle 6)
  - UVB-313 Fluorescent cabinet, legacy fluoropolymer cycle (8 hr light, 4 hr condensation)
- For service life prediction purposes, samples are also being tested in Florida (south facing 45°), and in solar concentrators (ASTM G90)

Thanks to participating laboratories!

Q-LAB

ATLAS MATERIAL TESTING SOLUTIONS

AMETEK MEASUREMENT, COMMUNICATIONS & TESTING

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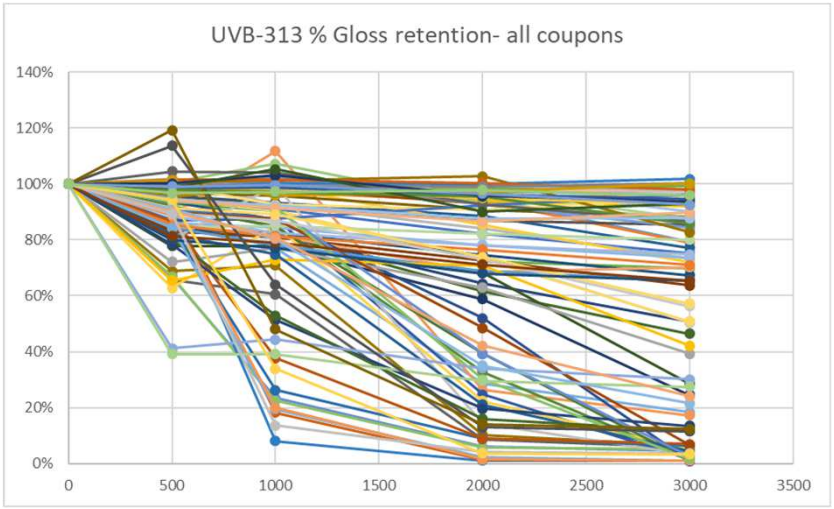
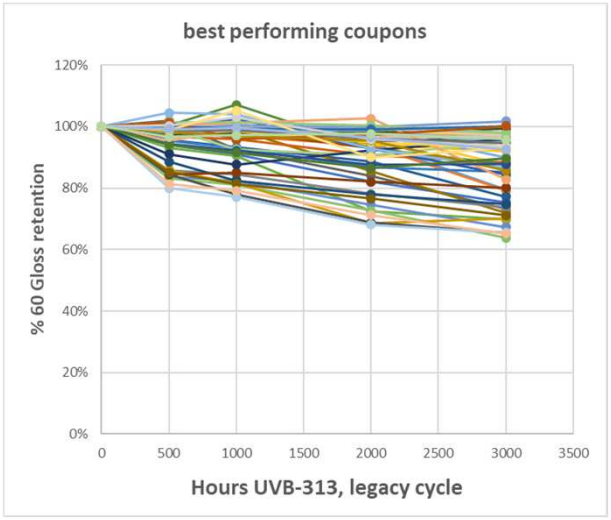
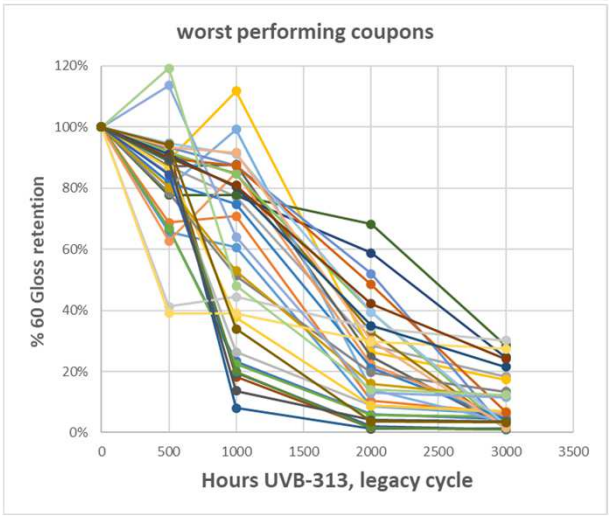
EXAMPLE OF ROUND ROBIN DATA: % GLOSS RETENTION IN ARKEMA UVB-313 CABINET

Gloss retention at > 2000 hours UVB-313 clearly shows different populations



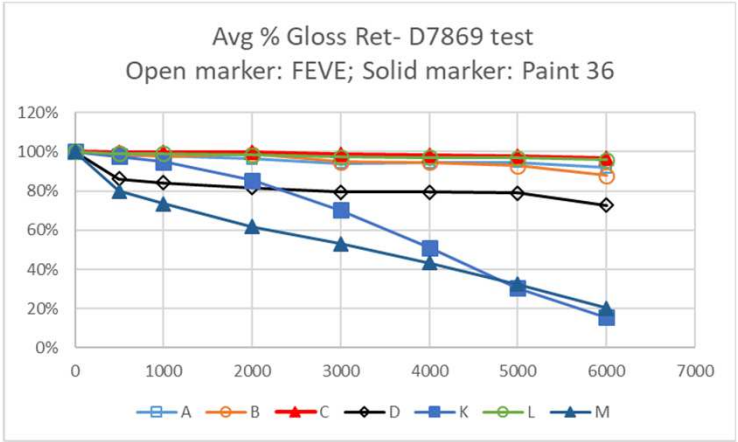


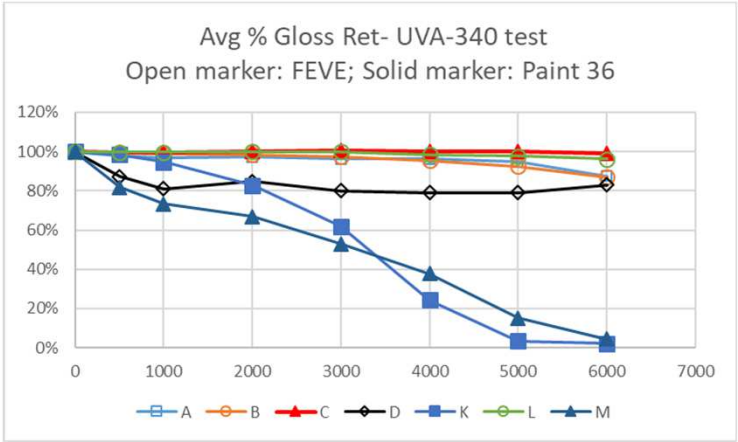


HOW MUCH ACCELERATED EXPOSURE TIME IS NEEDED TO SEPARATE FLUOROPOLYMERS FROM CONTROLS?

(DATA SHOWN: AVG. GLOSS RETENTION BY SYSTEM, FOR 2-k SYSTEMS)

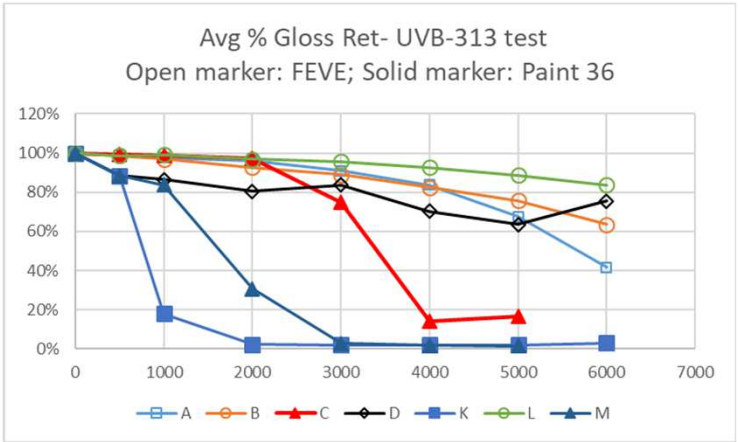
Xe D7869





UVA-340 hi irradiance

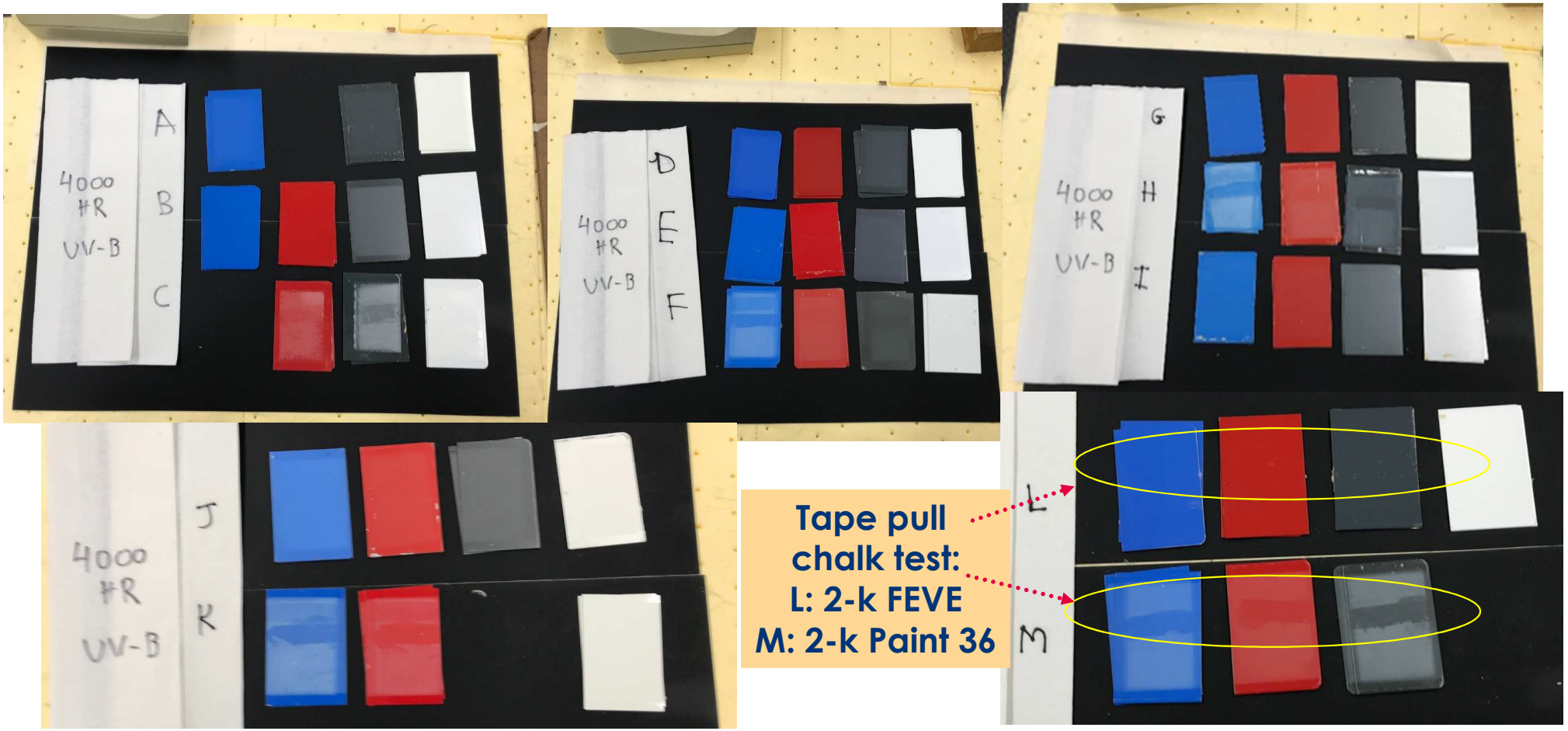
UVB-313



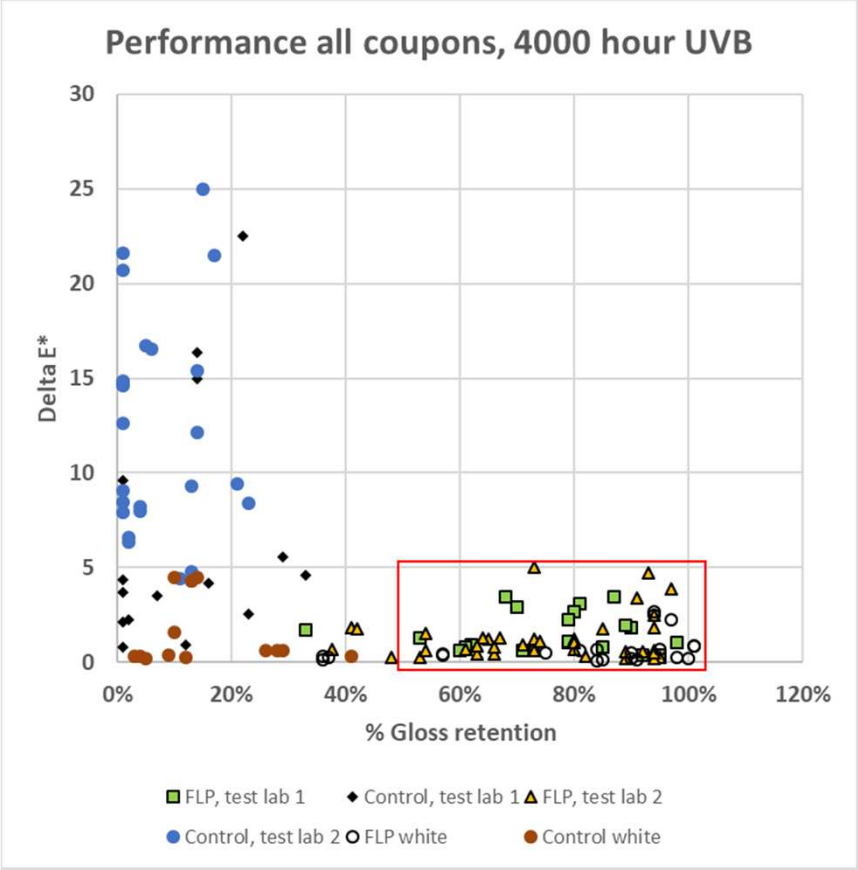
Only the UVB-313 cycle showed a reliable differentiation between the fluoropolymers and all the controls, within 4000-6000 hours (6-9 months) testing

4000 HOURS UVB-313 RELIABLY DISTINGUISHES FLUORO-POLYMERS FROM PAINT 36 AND MPI 311 CONTROLS

Darker bar on some coupons shows where tape removed chalking



ROUND ROBIN CONCLUSION: UVB-313 METHOD OFFERS A RAPID AND RELIABLE WAY TO DIFFERENTIATE HIGH PERFORMANCE FLUOROPOLYMER TOPCOATS FROM CONVENTIONAL CONTROLS



- *Can use same performance criteria in the standard for 10-year Florida and accelerated testing:*
  - *% Gloss retention > 50%*
  - *Delta E* < 5*
  - *Chalking ≥ 8 (≥ 6 for whites)*
- **Spearman rank correlation > 0.90 for differentiation of fluoropolymers vs. all Paint 36, MPI 311 controls, at 4000 hours UVB-313 cycle (zero false positives)**

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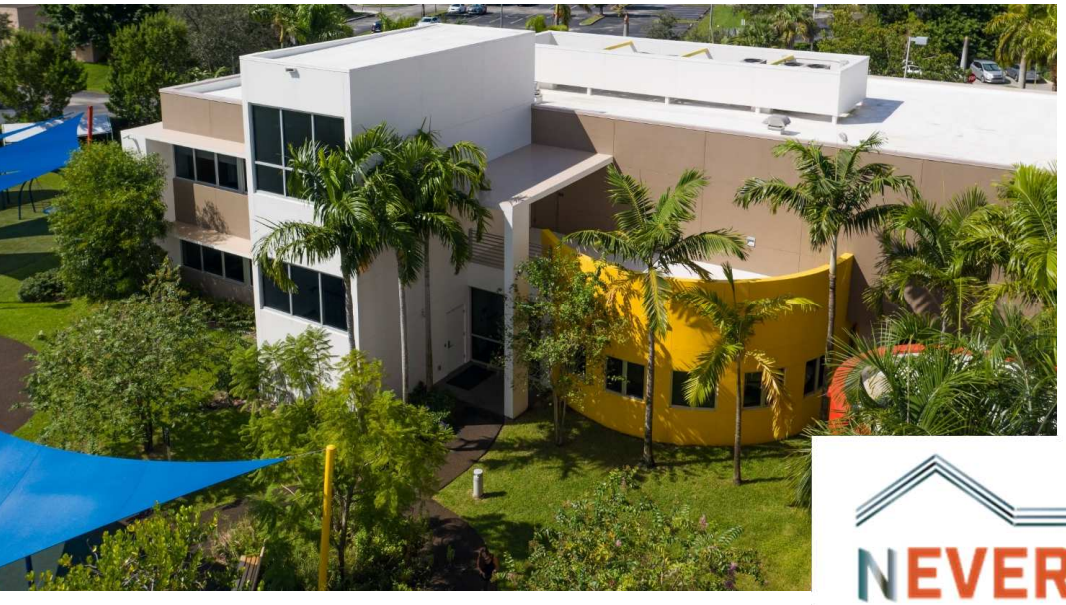
STATUS OF NEW STANDARD: APPROVED IN COMMITTEE BALLOTING NOV 9, 2020; NOW GOES TO SSPC STANDARDS REVIEW COMMITTEE

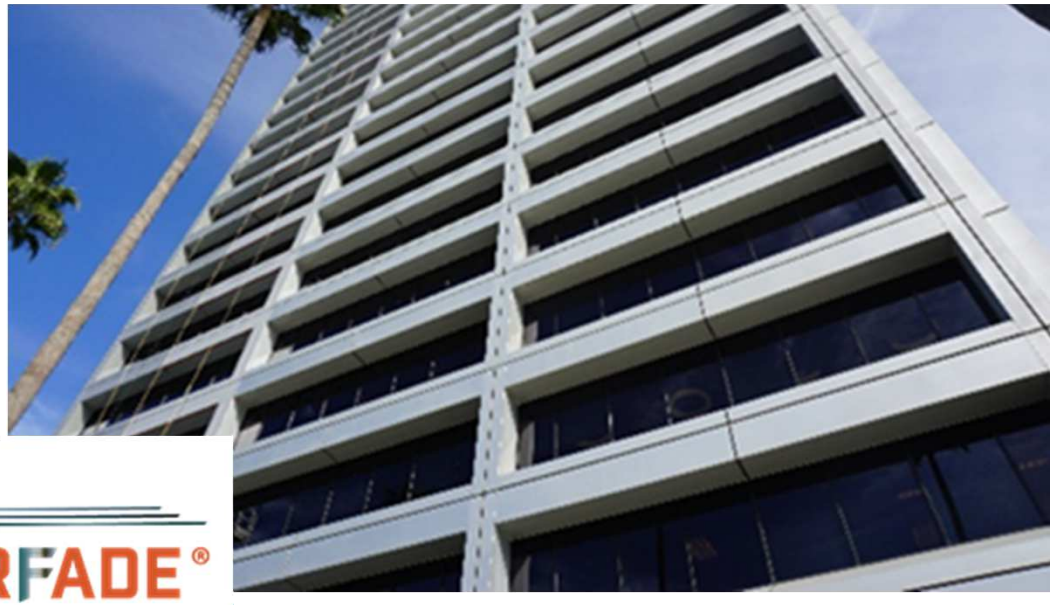
- ***Official version with assigned number should be out by Q1 2021***
- ***But: Commercial paints meeting the new standard have already been qualified, through the round robin testing***

Photos courtesy of APV Engineered Coatings

NEVERFADE®
FAÇADE RESTORATION COATINGS
WITH KYNARAQUATEC® TECHNOLOGY

APV®
ENGINEERED COATINGS

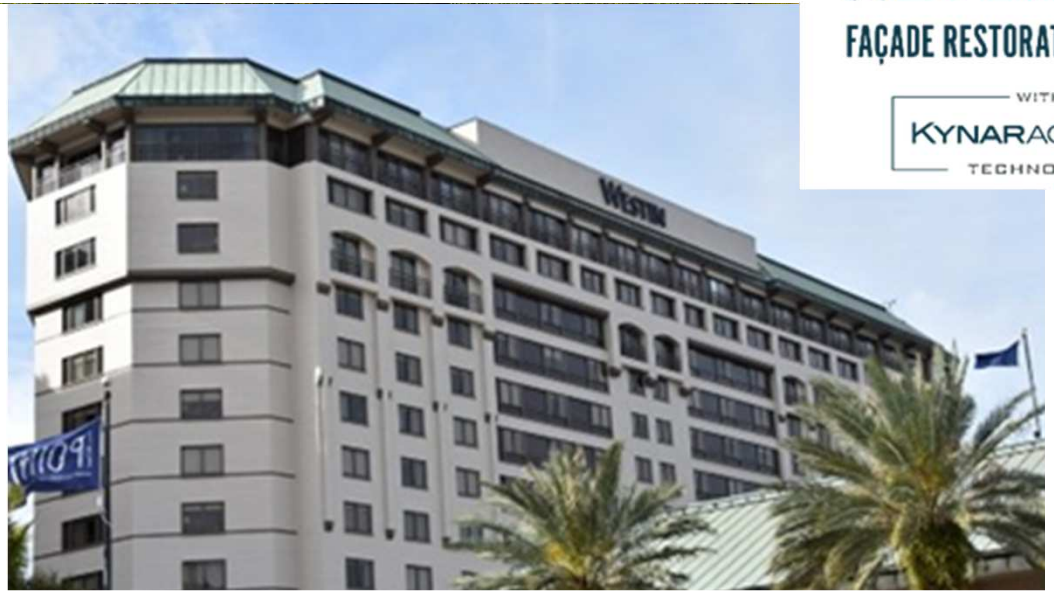




NEVERFADE®

FAÇADE RESTORATION COATINGS

WITH KYNARAQUATEC® TECHNOLOGY



Thank You!

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