

HIGH-PERFORMANCE WATERBORNE RESINS AND COLORANTS DESIGNED FOR CONSTRUCTION, INDUSTRIAL AND ARCHITECTURAL COATINGS



eps[®]
ENGINEERED
POLYMER
SOLUTIONS *Science
Simplified*

Presenters



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EPS® Overview

Resins



Construction
EPS® 2252



Industrial Coatings
EPS® 2580



Architectural Coatings
EPS® 2799

Core business competencies in resins and colorants

Waterborne acrylic emulsions for architectural, wood, roof coatings and industrial coatings

Polyester resins for coil, NBPA packaging and general industrial coatings

Colorants for In-Plant and Point-of-Sale markets

Business in North America, Europe, and Asia

We serve customers who are leading formulators of high performance technology driven coatings

Colorants



Architectural & Industrial

NovoColor® SF

Trends: Cool Roof Coatings

Economic

- Repair and /or coat vs tear off and replace
- Federal and local tax deductions
- Less energy required for cooling
- Peak Energy Use Reduction

Sustainable

- Protect the roof surface by providing a low-cost, sacrificial layer that absorbs the punishment of the elements
- Extends the life of the roof – Can recoat to refresh the surface
- Reflective roof coatings reduce surface temperatures
- Avoids building or occupant disruption and roof replacement

Single Ply Membrane Roofing

- A roof system in which the principal roof covering is a single layer of flexible membrane
 - Poly vinyl chloride (PVC)
 - Thermoplastic polyolefin (TPO)
 - Ethylene propylene diene monomer (EPDM)
- Adhered or mechanically fastened to roof – seams heat welded or adhered
- TPO roofing usage is increasing
- Aged roofs need to be replaced or coated due to degradation
- Adhesion to TPO is challenging due to its non-polar composition
 - New/Unweathered TPO even more challenging to adhere to



EPS[®] 2252: Polymer for Low Surface Energy Substrates

- Excellent adhesion to TPO, EPDM, metal, asphalt, and other common roofing substrates
- <50 g/L VOC capable
- Can be used in both primer and basecoat formulations
- Formulated without APEOs

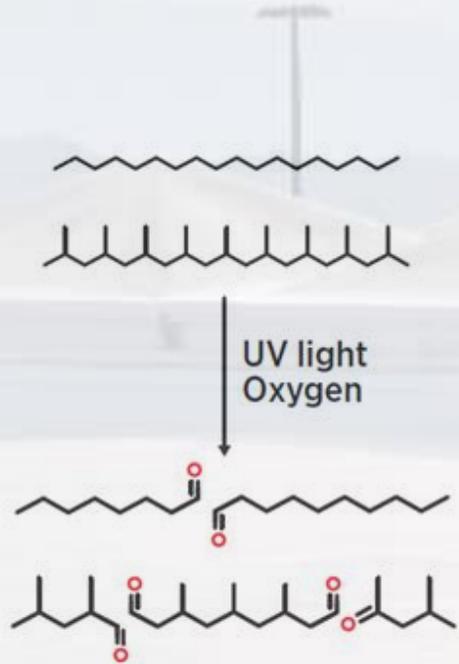
Specifications

Weight Solids	60.0 +/- 0.70%
Weight/Gallon	8.55 +/- 0.10
pH	8.0 - 9.0

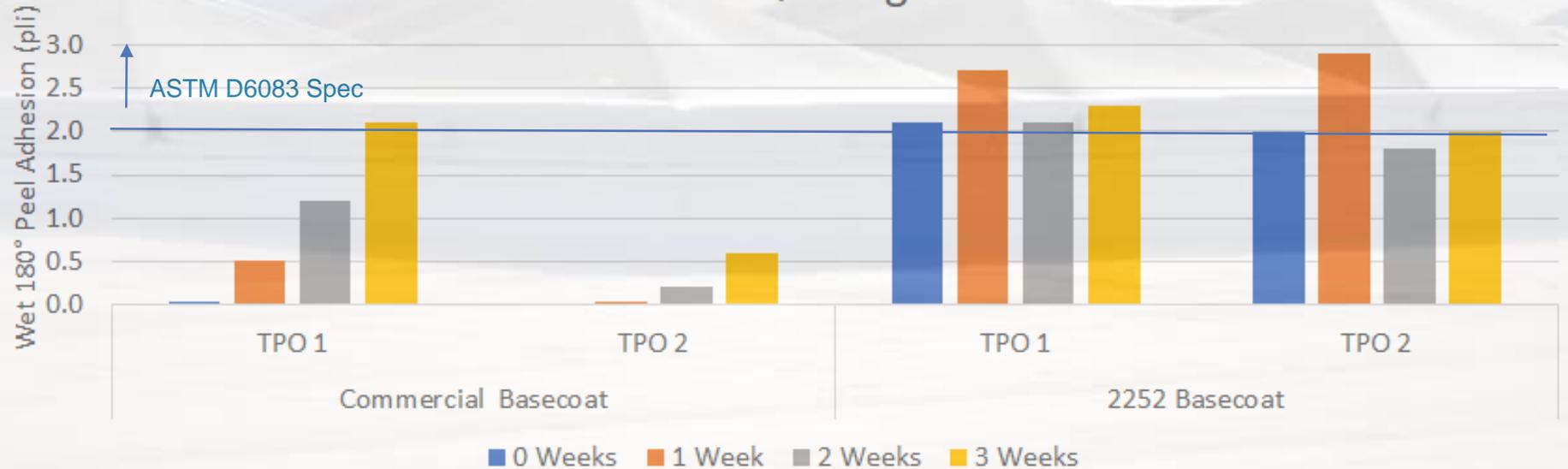
Typical Properties

Volume Solids	59.0 +/- 0.70%
T _g	-32° C
Volatile(s)	Water Ammonia

TPO Adhesion with Aging



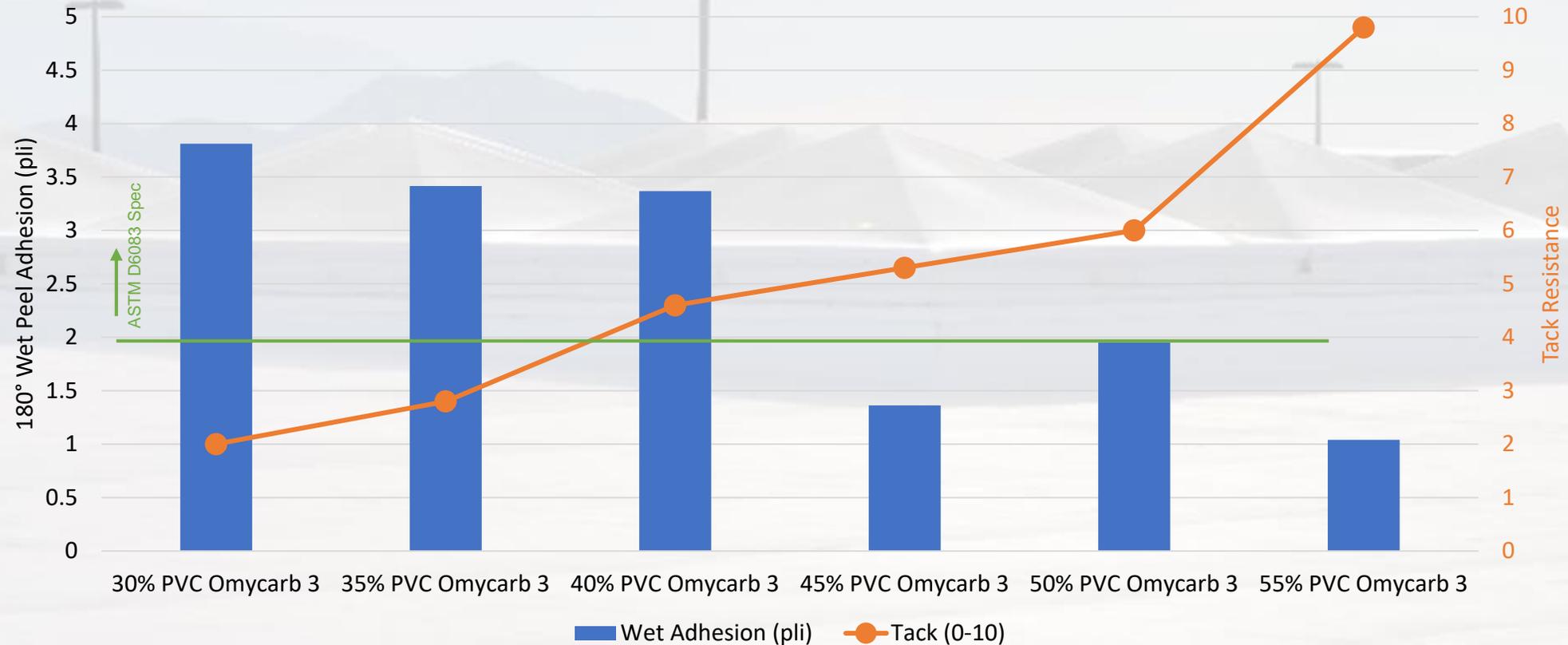
Wet Adhesion of a Commercial Roof Coating and EPS 2252 Basecoat to QUV Aged TPO



Primer Benchmarking



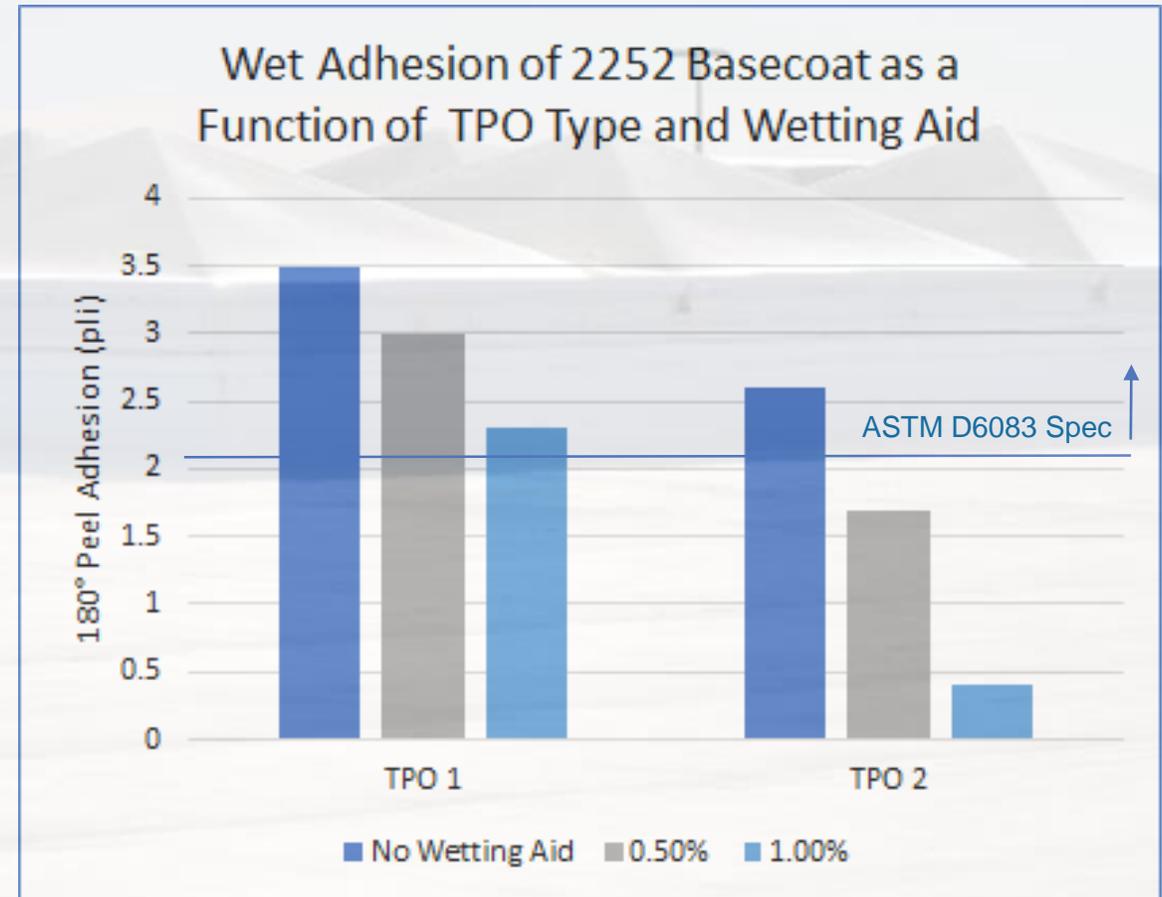
EPS® 2252: Formulation - PVC



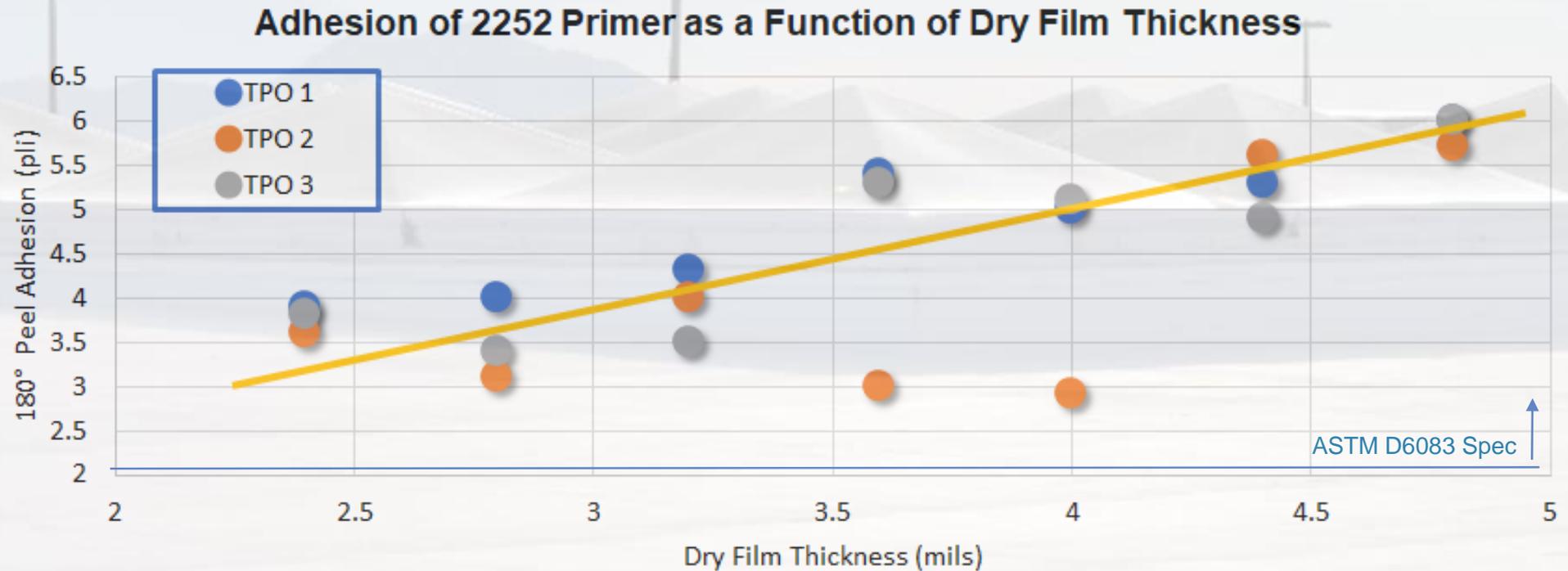
Highly filled systems may negatively impact adhesion and should be evaluated
40% PVC is recommended for an optimal combination of adhesion and low tack

EPS® 2252 Formulation – Dispersants and Surfactants

- The use of and level of dispersants, surfactants, and wetting aids may impact the adhesion performance properties of the roof coating
- A ladder study is recommended to determine the optimum level



Substrate and Film Thickness



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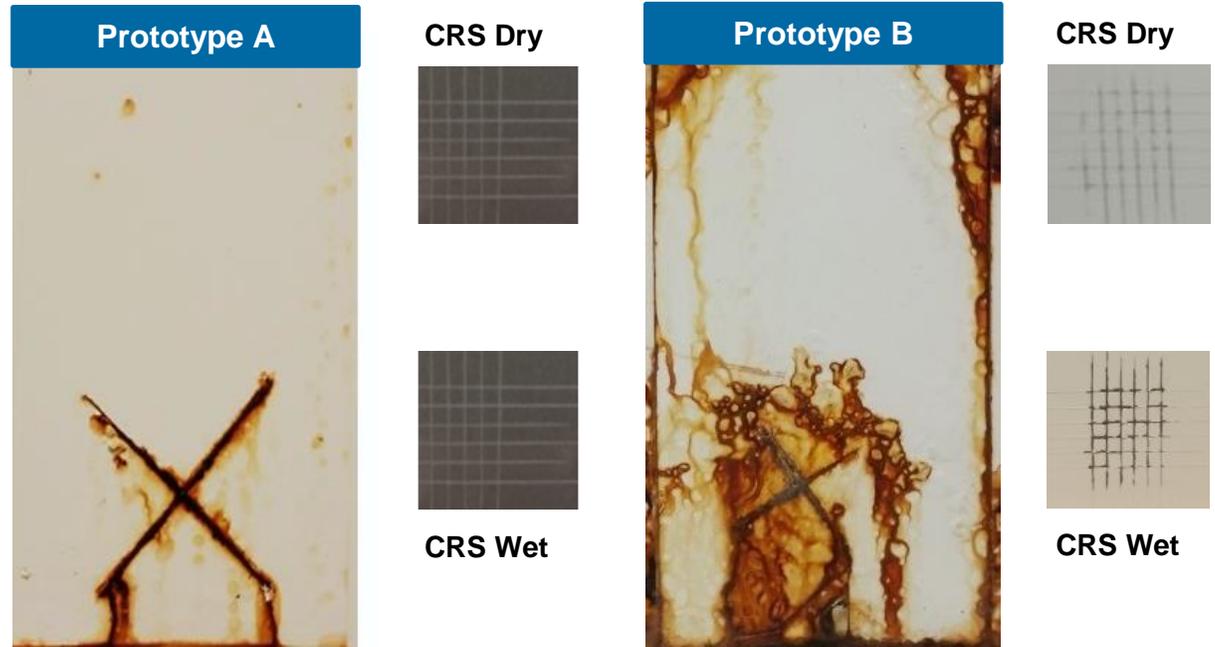
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Direct to Metal Coatings

Industry trends

- Transition from solventborne to waterborne systems for light-duty applications
- Addressing new VOC regulations to improve environmental and EHS profile
- Minimizing applied costs through 1 coat systems
- Addressing VOC regulations without sacrificing anti-blocking properties
- Balancing multisubstrate adhesion with high corrosion resistance (see right)



Corrosion resistance tends to degrade as wet adhesion is improved in waterborne acrylic emulsion coatings

Direct to Metal Coatings Trends

Solventborne transition to Waterborne

Waterborne Acrylic

Pros

1. Low VOC
2. Low flammability
3. Low risk for chemical exposure
4. Quick Dry with low solvent

Cons

1. Lack thin film corrosion resistance
2. Need for substrate prep
3. Incapable of low temperature application
4. Low VOC thermoplastics tend to be soft

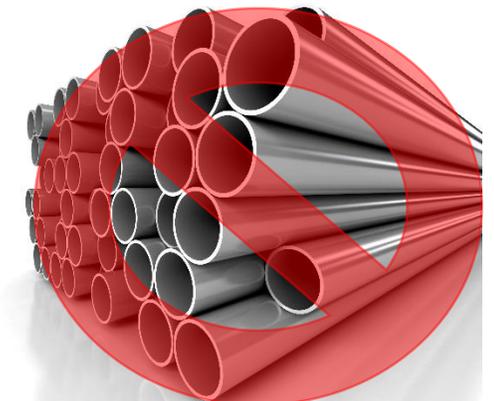
Solventborne Alkyd

Pros

1. Thin film corrosion resistance
2. Substrate tolerance
3. Low temperature applications

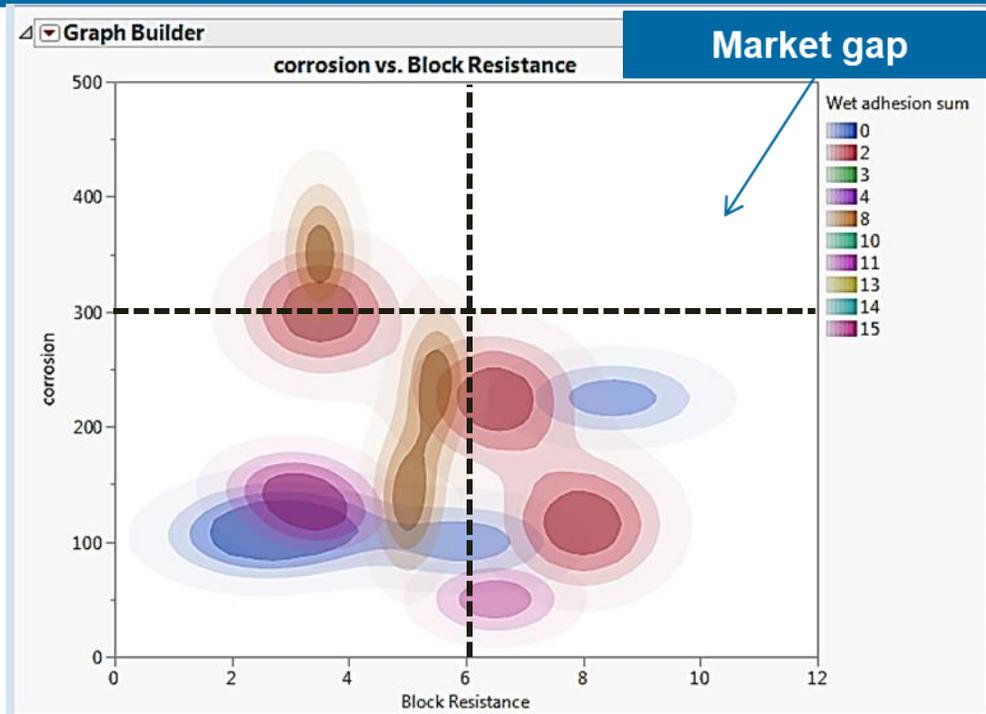
Cons

1. High VOC
2. Highly Flammable
3. High risk for Chemical exposure
4. Slower dry times with high solvent levels

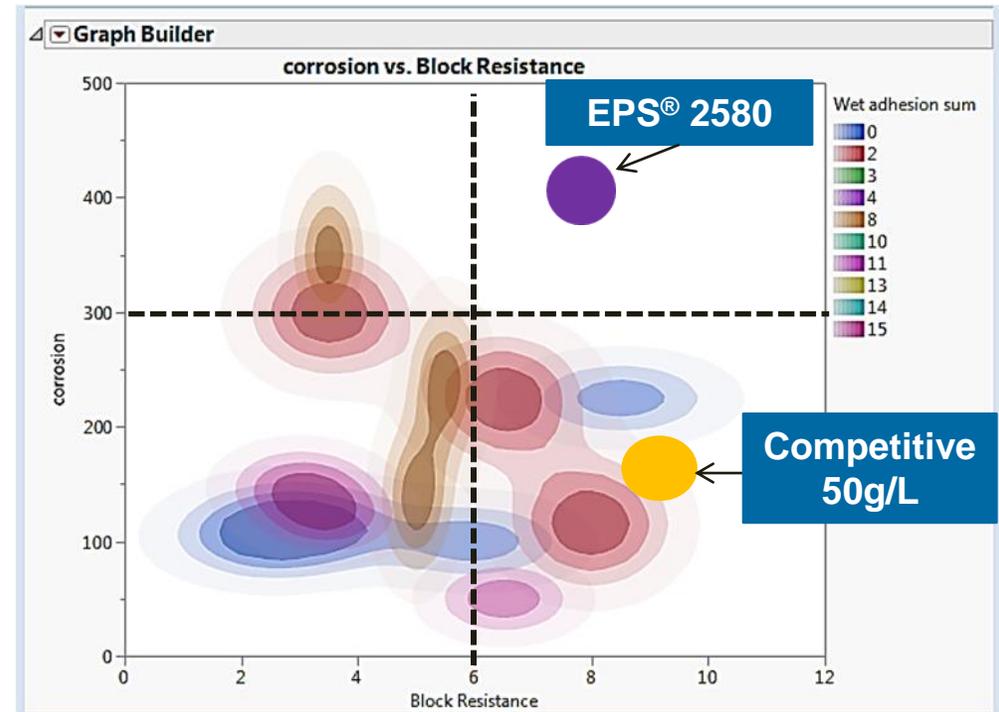


Market Gap Analysis

Performance Attribute Balance Resolution



- Survey of 21 commercial waterborne resins
- Block Resistance tested after 24-hr cure at 50°C
- Corrosion tested at 1.5mil DFT after B117hrs
- Colors represent crosshatch wet adhesion on three substrates

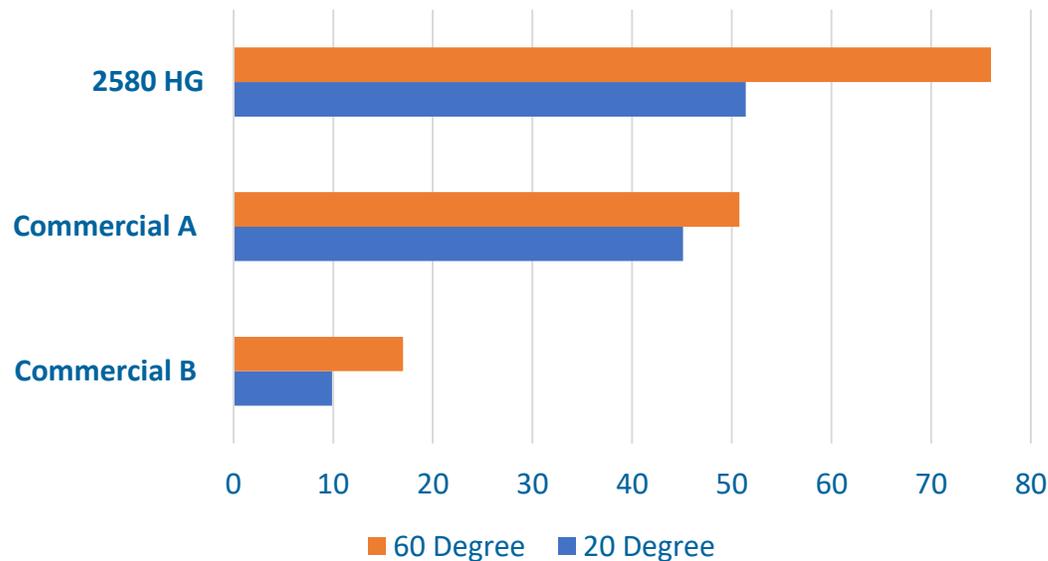


- Careful polymer design and rigorous formulation work filled the market need for a 50g/L capable, block resistant, and thin film corrosion resistant coating.

EPS[®] 2580 Performance Overview

Humidity Resistance and Anti-Blocking Properties

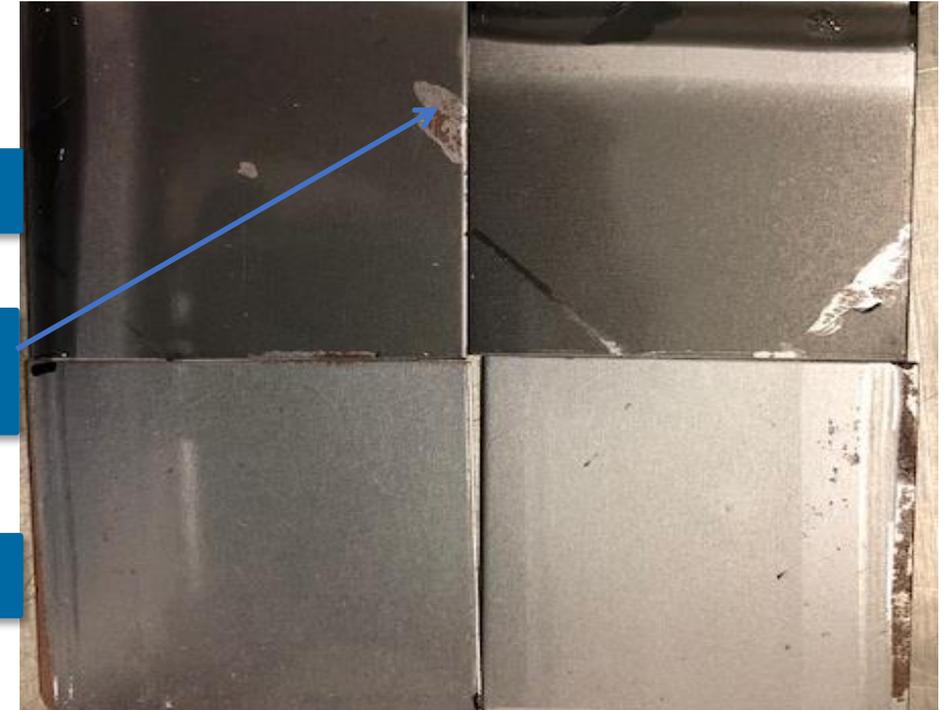
Gloss Retention after Cleveland Humidity



Benchmark

Delamination indicating failure

EPS[®] 2580



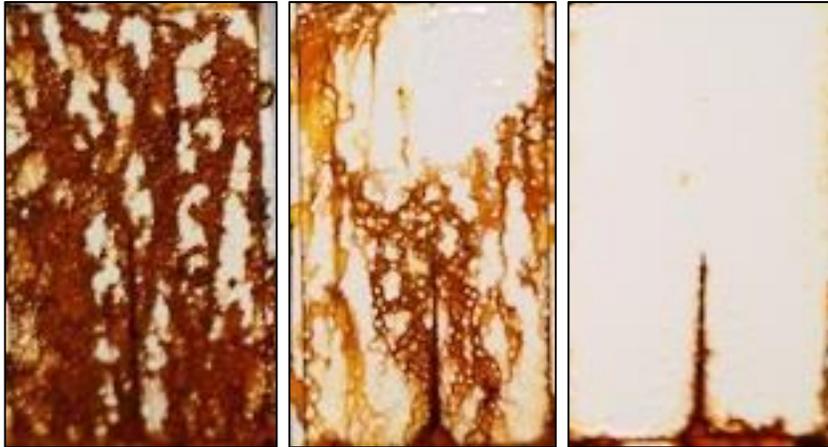
Formulations applied (10mil WFT) and dried for 24hrs. Films were then placed in 60°C Oven for 30min with 1kg weight applied. After 30min, specimens were removed from oven and left at room temp. for 30min with weight still applied. After this the films were separated and assessed for blocking.

Direct to Metal Coatings Challenges

(Thin Film Corrosion)

Corrosion resistance at 300hrs in B117

Benchmark 50g/L product



1mil

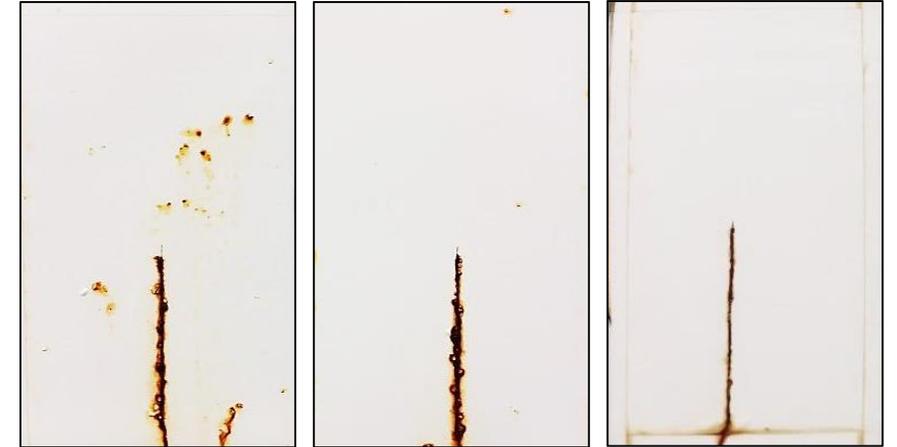
2mil

3mil



EPS® 2580 provides a step change in corrosion performance at thin film builds.

EPS® 2580



1mil

1.5mil

2mil

EPS[®] 2580: <50g/L Direct-to-Metal polymer

- Excellent gloss development
- Corrosion and chemical resistance
- Early water resistance
- Rapid hardness development
- High temperature block resistance
- UV resistance
- Abrasion and scrub resistance



EPS Architectural Polymers

Differentiated Technology, Superior Performance

Direct-to-Substrate Performance

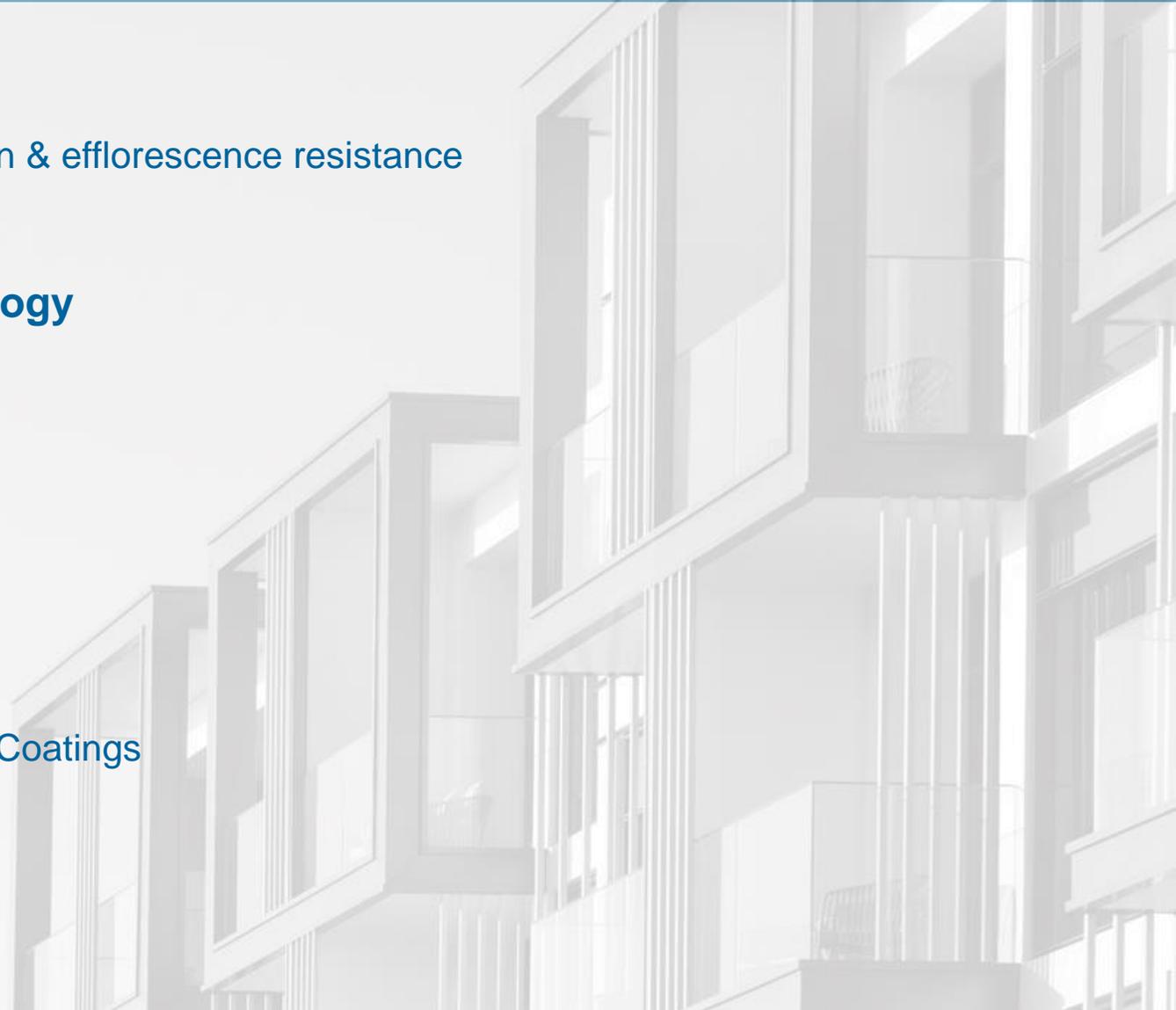
- Highly alkaline substrates: Excellent tint retention & efflorescence resistance
- Tannin stain resistance

Gen II DPUR (Dirt Pick-Up Resistance) Technology

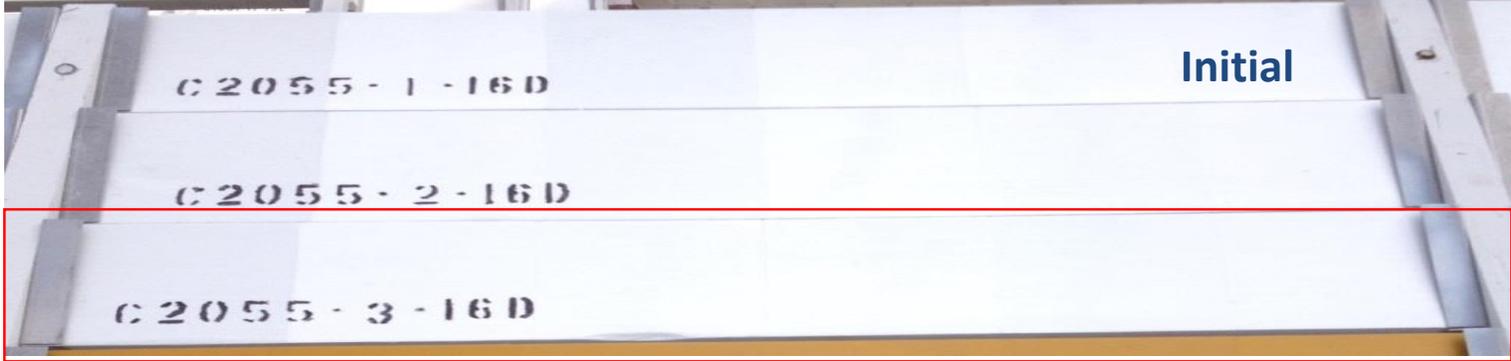
- Proven performance
- Benzophenone-free
 - No added VOC
 - No Prop 65 labeling requirements

Industry-Best:

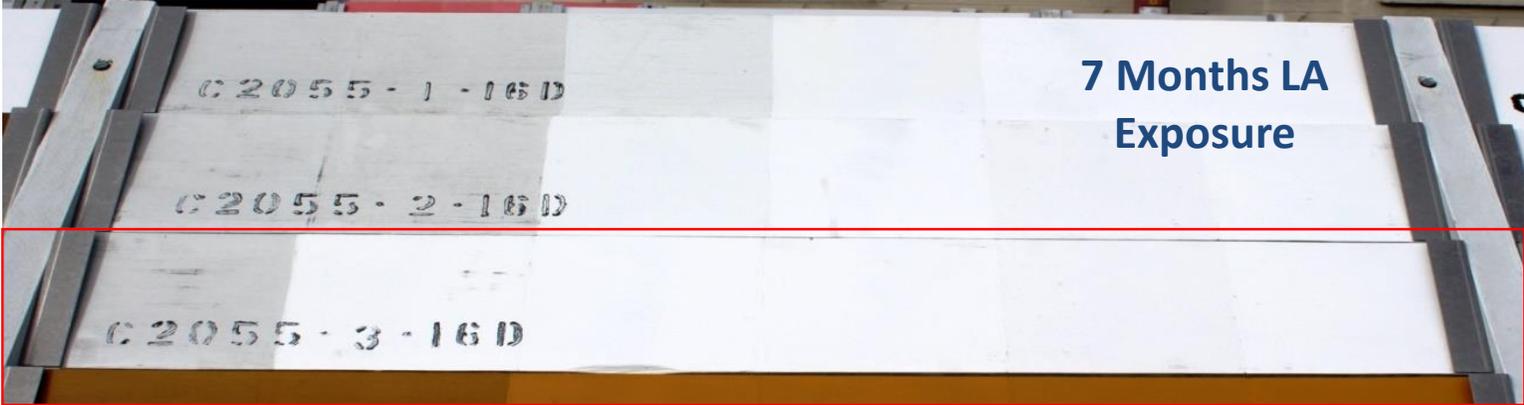
- Gloss Retention & Tint Retention
- Tack & Print Resistance in Gloss Coatings
- Blush Resistance & Wet Adhesion for Concrete Coatings



EPS Gen II DPUR Technology & Gloss Durability

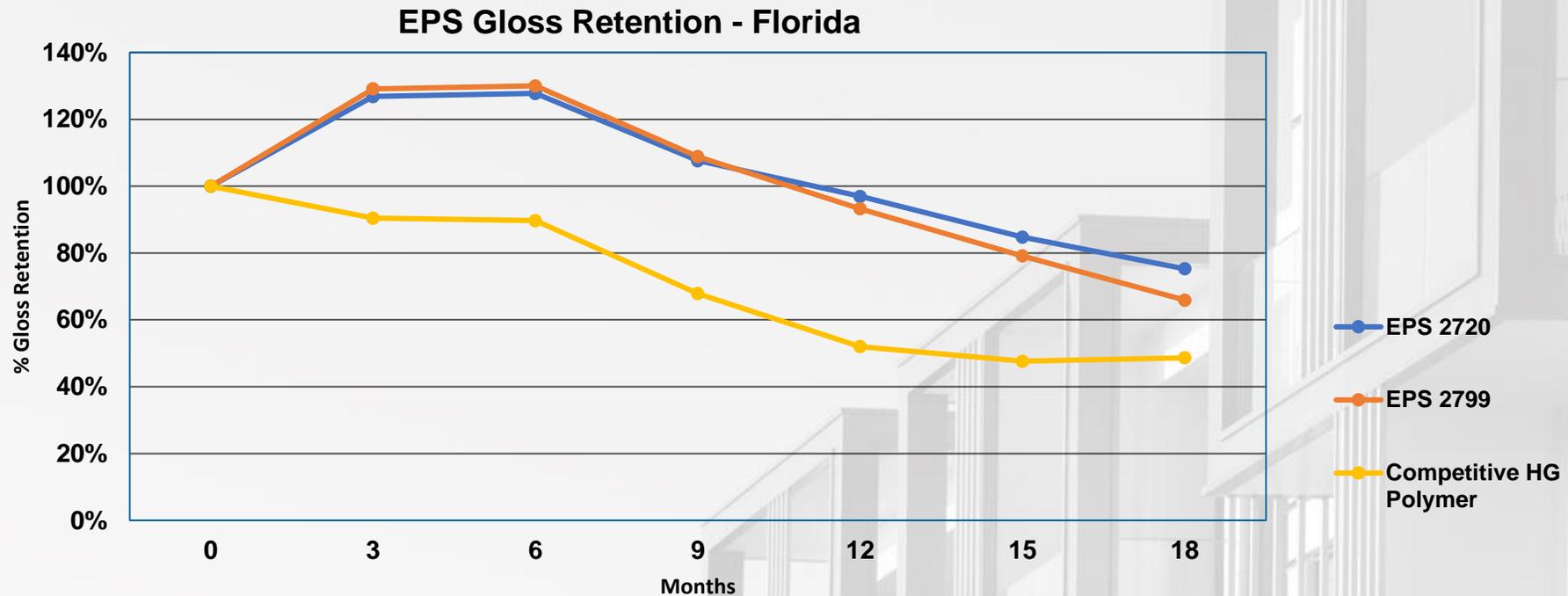


EPS® 2741 EPS® 2720 EPS® 2799

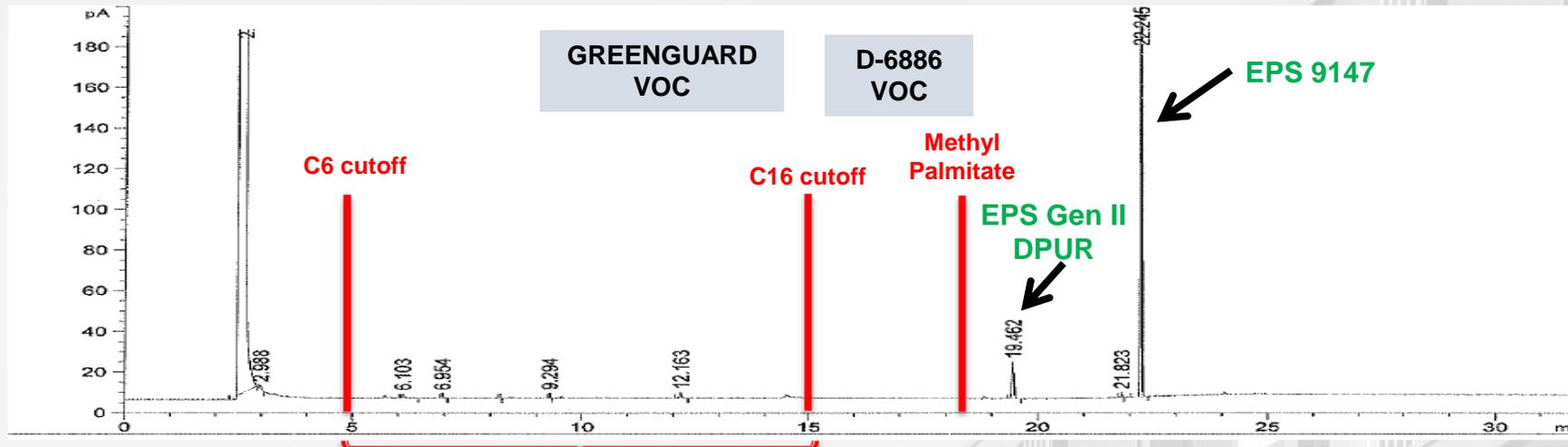


EPS® 2741 EPS® 2720 EPS® 2799

EPS Gen II DPUR Technology & Gloss Durability



Low VOC and Dry Film Emissions

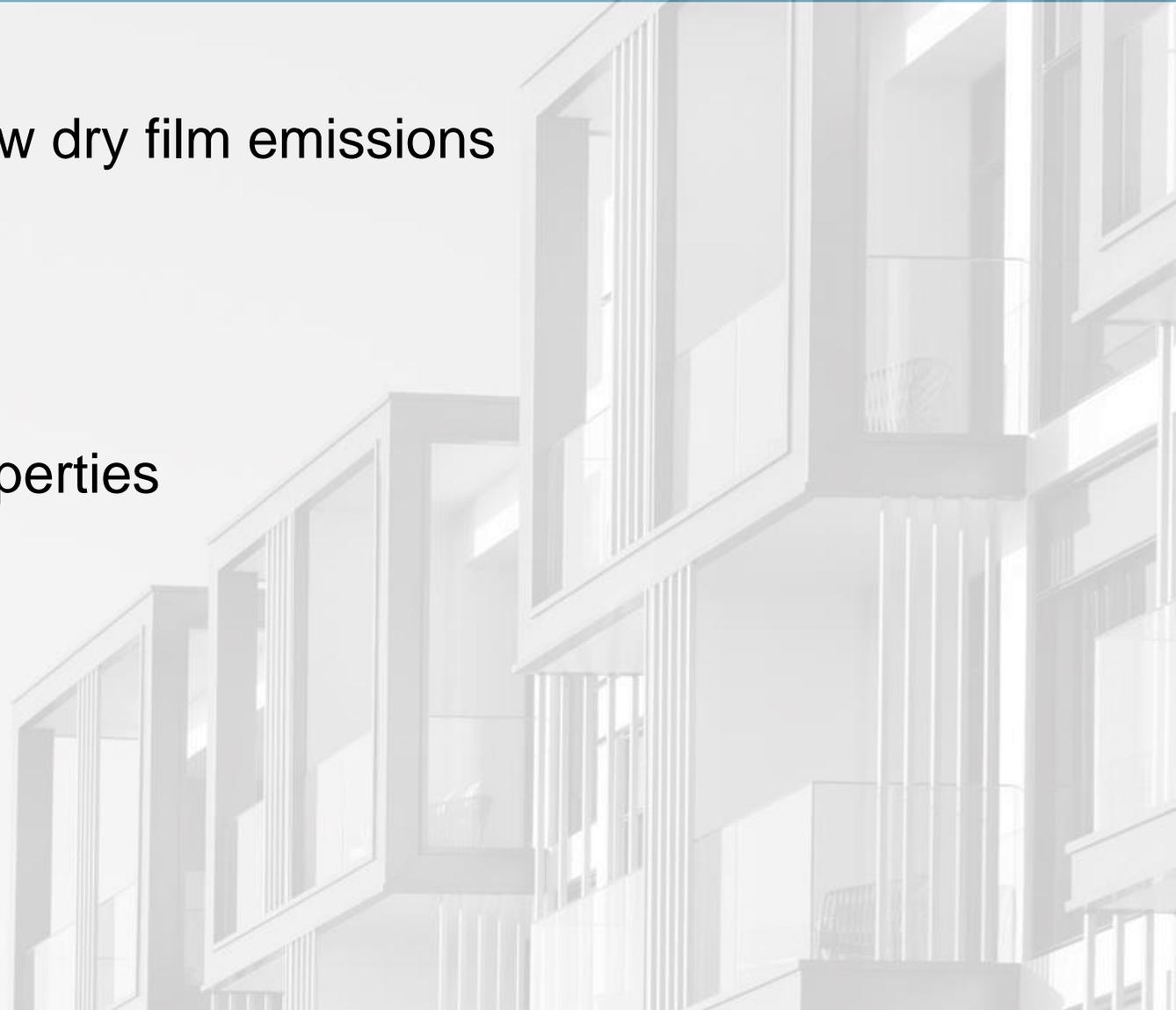


Dry Film Emissions	Blank Control	EPS® 2799 Paint	Commercial 50 VOC HG Paint
Emissions ($\mu\text{g}/\text{m}^3$)	4	5	633
Emissions w/o low VOC coalescent	n/a	n/a	27

EPS® 2799

High Performance Commercial / Institutional Coatings

- Near 0 VOC formulations w/ very low dry film emissions
- Chemical resistance
- Cleaner resistance
- Stain resistance / washability
- High scrub resistance
- Tack / imprint / block resistance properties



MPI 153 Chemical Resistance

Survey of commercial institutional coatings at low to high VOC tested

	EPS 2799 <5g/L	Pre-Cat 95g/L	Competitive 2 g/L	Competitive 50g/L	Pre-cat 135g/L	Competitive 175g/L
50% H ₂ SO ₄	Pass	Pass	Pass	Pass	Fail	Pass
10% HCl	Pass	Fail	Pass	Pass	Fail	Pass
5% H ₃ PO ₄	Pass	Fail	Pass	Pass	Pass	Pass
25% NaOH	Pass	Pass	Pass	Pass	Pass	Pass
Mineral Spirits	Pass	Pass	Pass	Pass	Pass	Pass
Methanol	Pass	Fail	Fail	Fail	Pass	Pass
Motor Oil	Pass	Fail	Fail	Fail	Pass	Pass
Vegetable Oil	Pass	Fail	Fail	Fail	Pass	Pass

MPI Stain & Scrub Resistance

Test (requirement)	EPS® 2799 <5g/L	Pre-Cat 95g/L	Commercial 2g/L	Commercial 50g/L	Pre-Cat 135 g/L	Commercial 175g/L	Pre-Cat 100g/L
Coffee 2.0 dE	1.6	2.5	1.7	0.5	0.5	0.6	1.9
Nigrosin 1.0 dE	0.9	2.2	0.7	1.0	0.7	0.8	1.0
Graphite* 1.5 dE	1.8*	1.7*	2.2*	0.6*	2.8*	2.6*	3.8*
Abrasion 500 cycles	>1600	610	800	230	520	610	428
Scrubability <5% ΔGU	5.8%	85.9%	51.4%	44.7%	85.9%	15.8%	67.4%

*1st generation graphite (since changed by MPI)

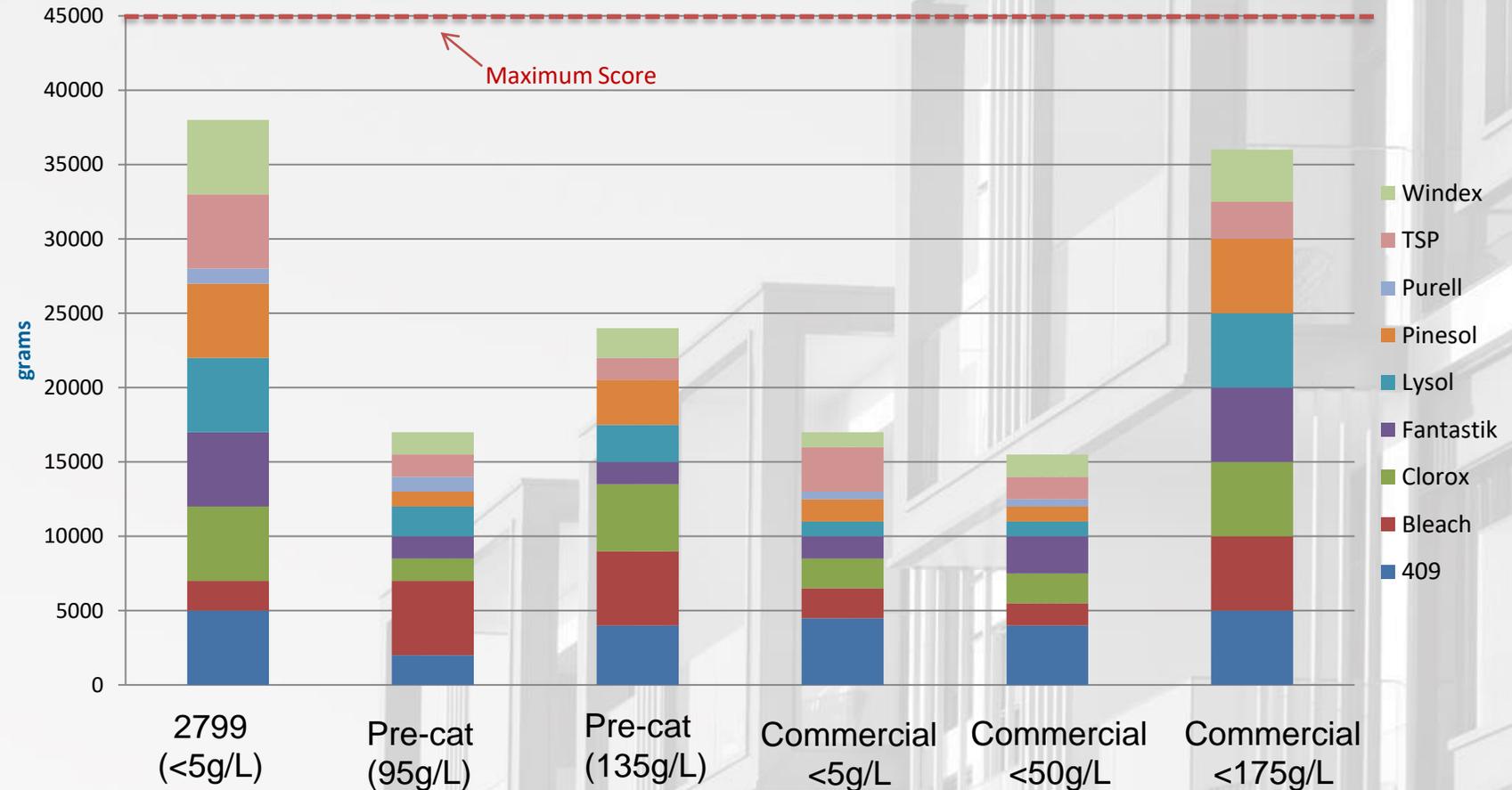
Cleaner Resistance

Scrape test:

- 7-day cure
- 30 minute exposure
- 15 min recovery
- Scrape resistance assessed every 500g

Formula 409	Lysol 4 in 1
Bleach (conc.)	Pinesol
Clorox Green Works	Purell
Fantastik	TSP
	Windex

Scrape Hardness



EPS® 2799 – Versatility and High Performance

Institutional Benefits

- Near 0 VOC Formulations
- Very Low Dry Film Emissions
- Extended service life
- Chemical Resistance
- Cleaner Resistance
- Scrub Resistance

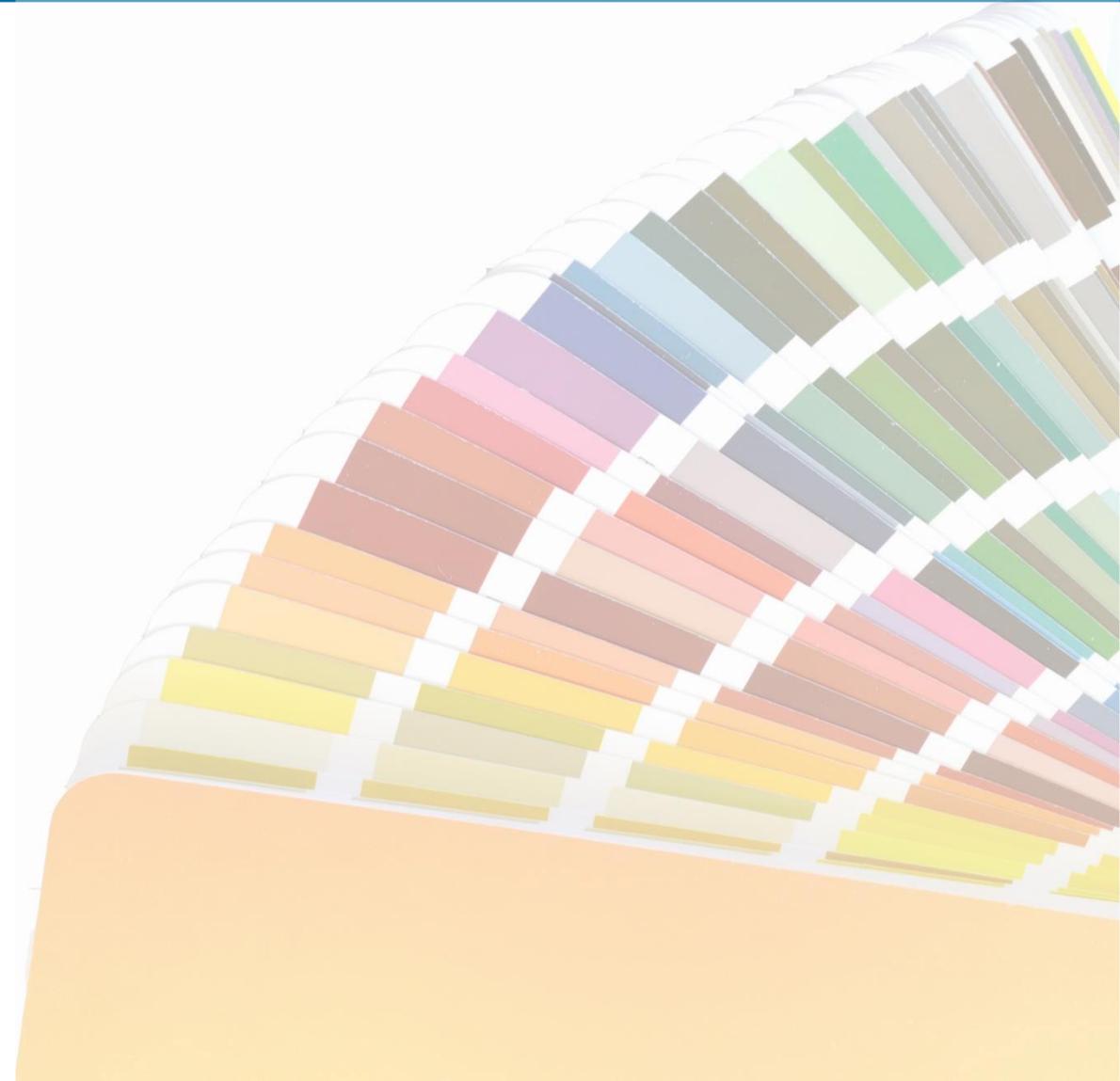
Architectural Benefits

- Int/Ext Flat to High Gloss
- Industry-Best Gloss Retention
- EPS Gen II DPUR Technology
- Tannin Stain-Blocking
- Early Water Resistance
- Tack & Print Resistance

Colorants

Industry trends

- **Coating Technologies:** Increased availability and demand for latex and water-reducible paints
- **Regulatory:** Low VOC, UL GREENGUARD, LEED
- **Performance:** No viscosity drop, no surfactant leaching, maintain film properties
- **Product Development:** Increased focus on colorant/resin synergies
- **Expanded Color Space:** Brighter whites, cleaner deep tones, effect colors
- **Dispensing Technologies:** Higher accuracy, High strength colorants



Current CCA Colorant Product Lines

Product Line	Type	Segments	Applications
NovoColor® II	Low VOC Universal	POS Architectural	POS tinting of latex paints, alkyd paints, and wood stains
NovoColor® HP II	Low VOC Water-Only	POS Architectural	POS tinting of latex paints and water reducible paints
NovoColor® IP	In-Plant Water-Only	In-Plant Architectural Industrial & Construction	In plant tinting of acrylic emulsions, waterborne urethanes and epoxies and water reducible systems
NovoColor® SF (NEW!)	Transparent Water-Only	In-Plant Architectural Industrial & Construction	In plant tinting of wood stains, deco foil coatings and inks require a high degree of transparency
OptiColor® XP	Industrial/Solvent	POS and In-Plant Industrial & Construction	POS tinting of alkyds and wood stains. In-plant tinting of coatings, aerosol paints, inks and adhesives
ExacTint®	Industrial/Solvent	In-Plant Industrial & Construction	In plant tinting of non-polar systems such as modified alkyds, melamine coatings, inks and adhesives

NOVOCOLOR® SF

Waterborne Transparent Pigment Dispersions

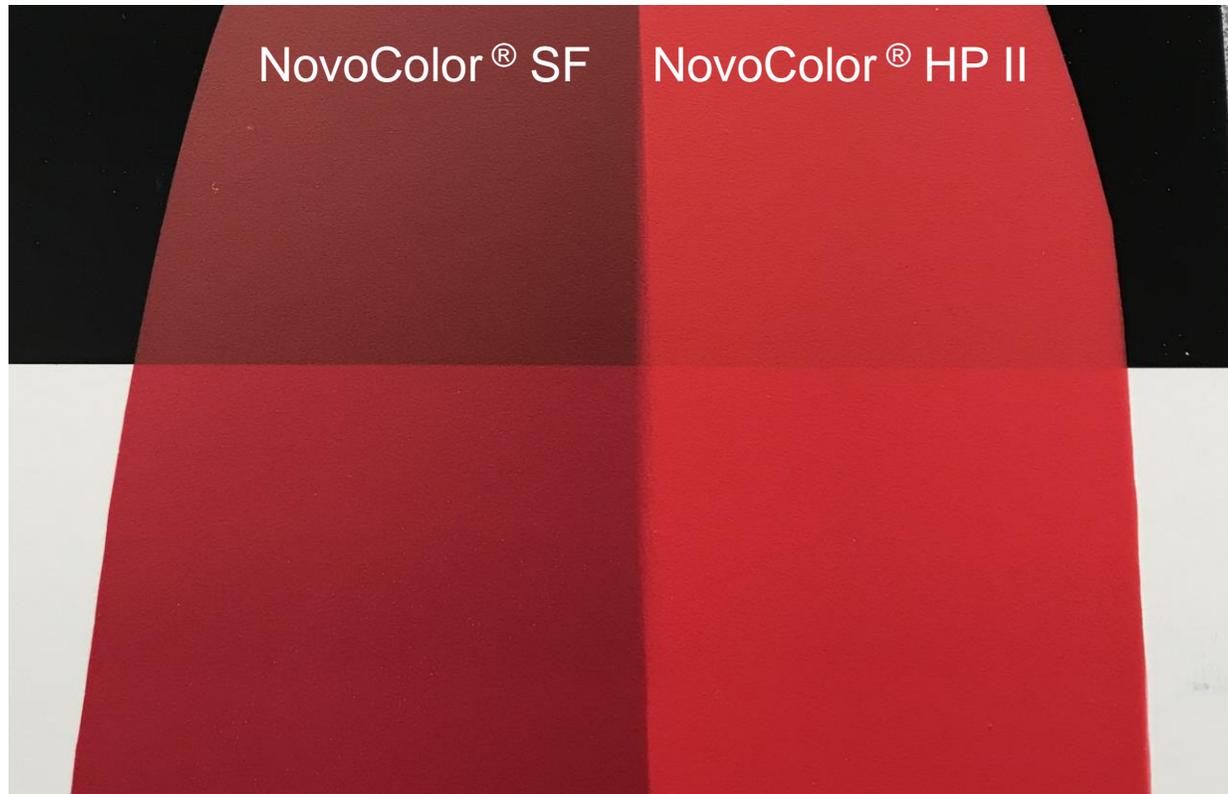
PRODUCT NUMBER	MASS TONE	COLORANT NAME	CI PIGMENT NAME	% PRIME PIGMENT BY WT.
8100		White	PW6	66.2%
8113		Organic Yellow	PY13	35.0%
8114		Medium Yellow	PY83	34.9%
8115		Golden Yellow	PY110	36.4%
8122		Phthalo Green	PG7	32.0%
8132		Phthalo Blue	PB15:3	34.0%
8138		Trans Oxide Red	PR101	30.6%
8140		Carbazole Violet	PV23	34.0%
8142		Organic Red	PR166	40.0%
8144		Rubine Red	PR184	35.0%
8146		DPP Red	PR254	25.0%
8149		Magenta	PR122	20.0%
8170		Trans Oxide Yellow	PY42	39.7%
8188		Brown	PBR25	25.0%
8194		Carbon Black	PBK7	30.7%

Feature	Benefit
High transparency	Ideal for wood stains, deco foil coatings, inks
Durable pigments	Improved lightfastness versus organic dyes
No resins, no ethylene or propylene glycol	Minimal impact on paint properties
APE, formaldehyde free	Safer for the environment
Low VOC	

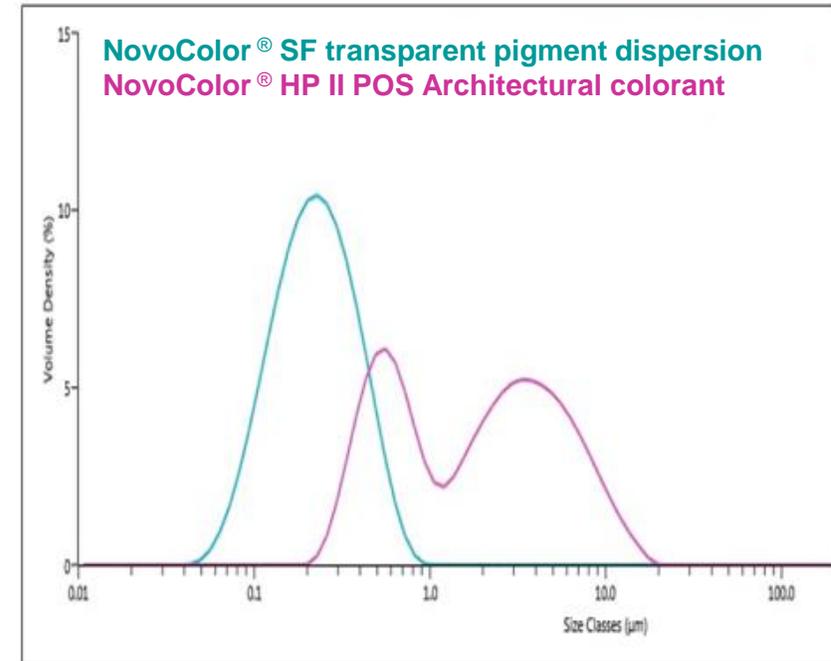
NOVOCOLOR® SF

Product Feature: High Transparency

- Less than 1 micron particle size
- Transparent-grade pigments
- No opacifiers or opaque extenders



Particle Size Analysis



NOVOCOLOR® SF

Product Feature: Durable Pigments

Improved UV durability versus water-soluble organic dyes

QUV testing (2000 hrs)

Unexposed



Exposed

NovoColor® SF

Liquid Dye

NovoColor® SF

Liquid Dye

NOVOCOLOR® SF

Product Feature: No Resins

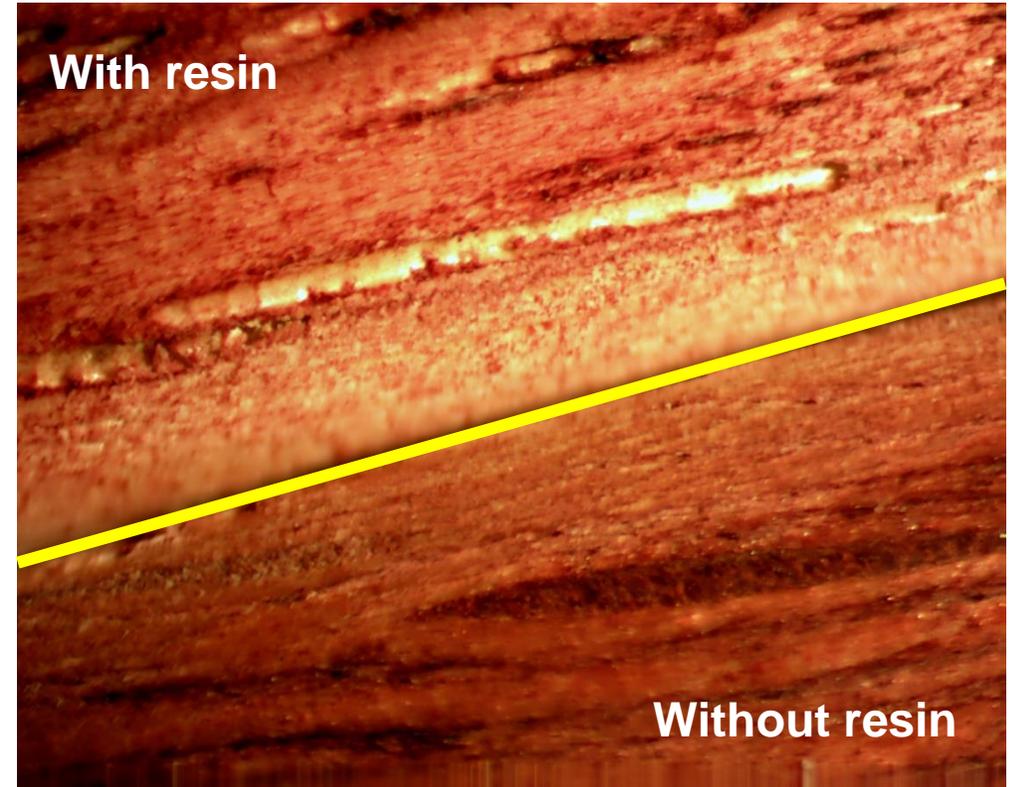
Better wood penetration and transparency



Competitor colorant



NovoColor® SF



NOVOCOLOR® SF

Product Feature: Low VOC

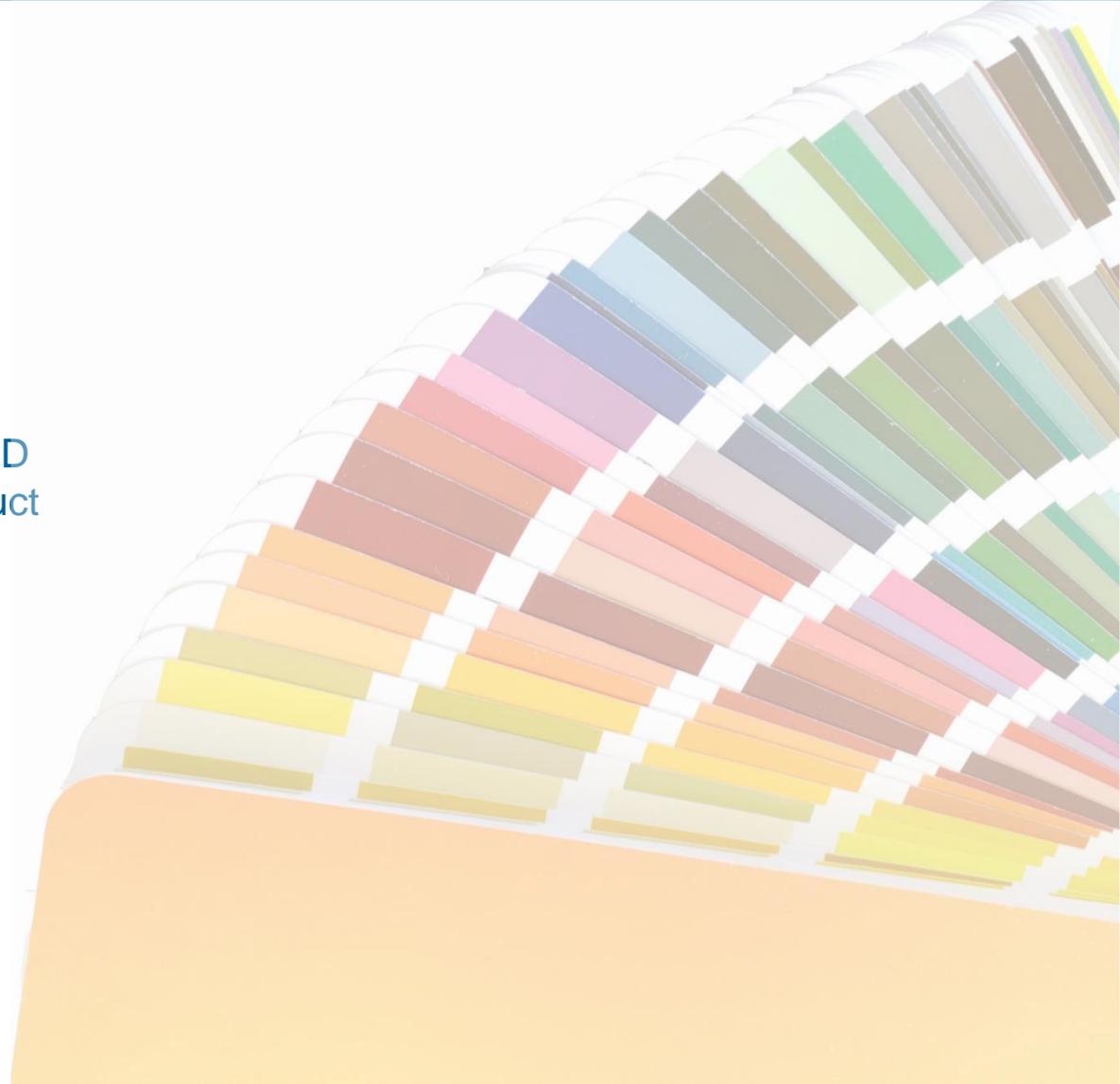
NovoColor® II - Low VOC Universal
NovoColor® HP II – Low VOC Water-Only

Verified low VOC colorants to tint paints for home, office and classroom

NovoColor II and NovoColor HP II have achieved GREENGUARD GOLD Certification

GREENGUARD Certified products are certified to GREENGUARD standards for low chemical emissions into indoor air during product usage. For more information, visit ul.com/gg.

NovoColor® SF and NovoColor® IP formulated with similar Low VOC technology to meet many global low VOC requirements



NOVOCOLOR® SF

Waterborne Transparent Pigment Dispersions

- High transparency
- Compatible in acrylic emulsion and waterborne or water-dispersible alkyd stains, as well as waterborne coatings for plastics
- Excellent color stability
- Capable of matching all types of wood stain colors
- For In-Plant and specialty industrial wood stains and coatings, wood graining inks, specialty inks, fabric, plastic, foil and glass coatings



QUESTIONS

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The data in this presentation represent typical values. Because application variables are a major factor in product performance, this information should serve only as a general guide. EPS assumes no obligation or liability for the use of this information.