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Market Trends and Technical Insights: Powder Coatings for Architectural Applications

American Coatings Association

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Watch Webinar

Deep Industry Knowledge – Extensive Industry Relationships – Decades of Industry Experience

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Agenda

- **Introduction to ChemQuest**
- **Architectural Coatings Market Overview**
  - Market Size
  - Value Chain
  - Application Process
  - Powder Coatings vs. Liquid Coatings
- **Formulating for Outdoor Durability**
- **Areas of Active Research in Architectural Coatings**

The ChemQuest Advantage:
Insight to navigate the intersection of strategy, markets, operations, and technology

Strategic Thought Partners

Delivering distinctive, thorough, actionable, confidential, and professional work to support our clients in every aspect of sustained, profitable growth, including:

- **Business Strategy & Transformation**
- **Technology Development**
- **Operational & Manufacturing Efficiencies**
- **M&A Advisory Services**

100% of our work is proprietary, offering a full portfolio of services under NDA

Extensive Industry **Relationships** and **Knowledge**

Stakeholders across the value chain trust our thought leaders:

- Team is more than 130 minds strong, including ~ 48 Ph.D. scientists.
- Senior personnel each have a minimum of 25 years of experience in specialty chemicals and materials.
- Extensive roster includes former senior managers from major manufacturers, business owners, and senior technical managers.

Our Mission is **Enabling Our Clients to:**

- Build enterprises that challenge established thinking and drive transformation.
- Gain competitive advantage through distinctive, targeted, and substantial improvements that sustain profitable growth.
- Unlock new and hidden insights, empowering an organization's smart risk-taking, catalyzing innovation excellence and value creation.
- Be successful — because our success emanates from yours.

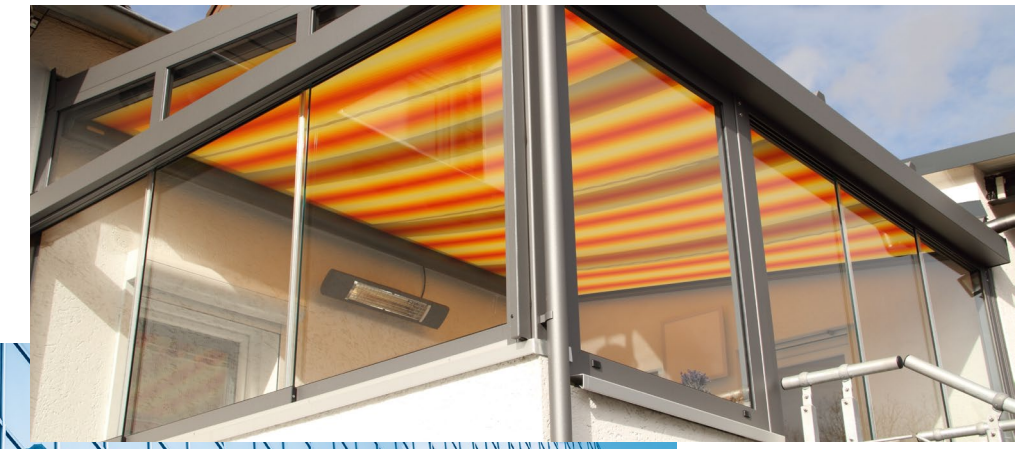
Architectural Coatings Market Overview

Architectural Coatings Market Definition

- Definition: Factory-applied coatings over extruded aluminum for use in building and construction applications

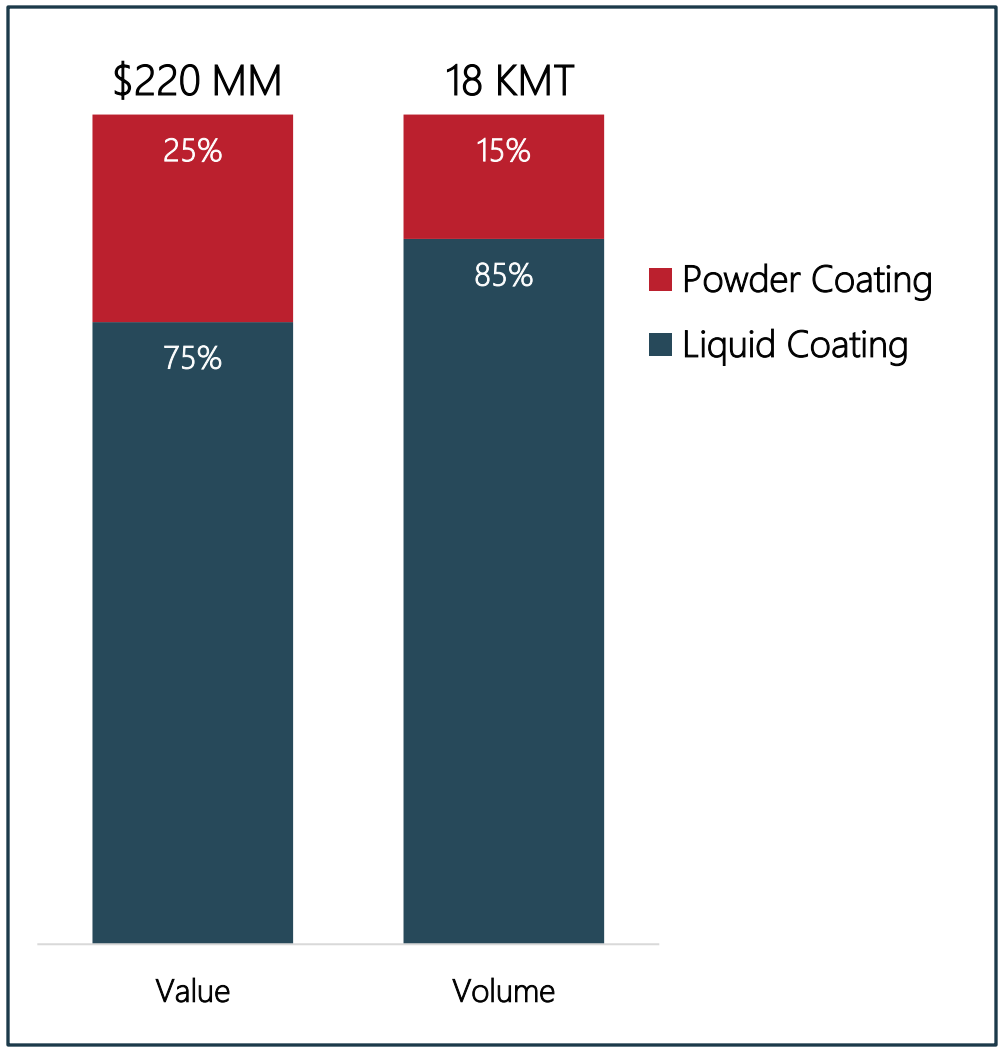
  Specifically excludes coil coatings and field-applied coatings

- Types of finished products utilizing these coatings include, but are not limited to:
  - Ornamental
  - Doors and windows
  - Storefronts
  - Rainscreens/louvers/sunshades
  - Curtain walls



Architectural Coatings Market – United States

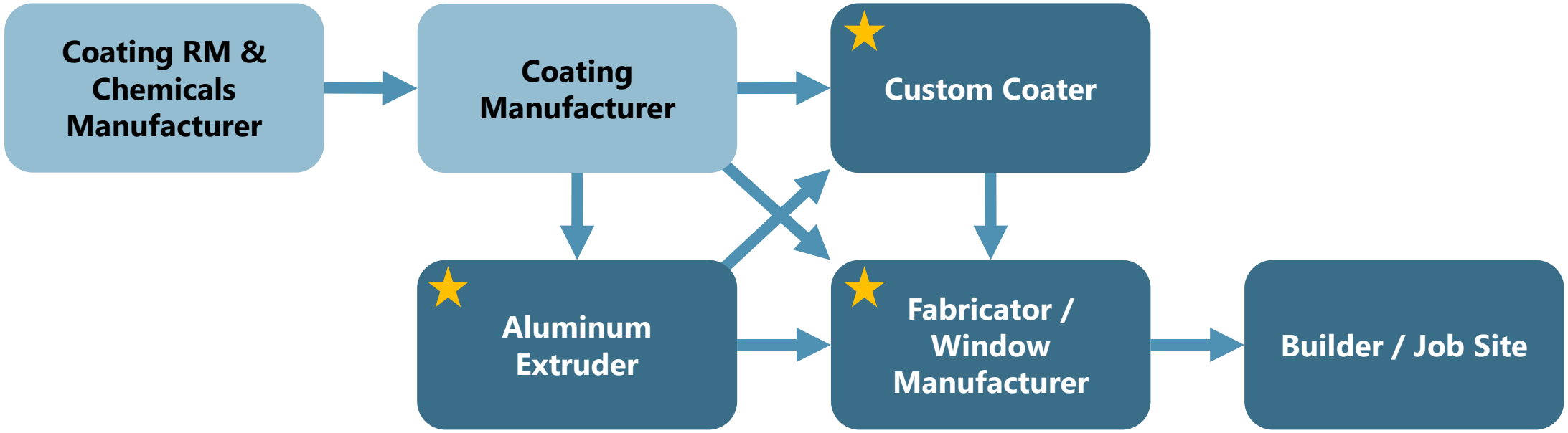
Powder coatings make up about 15% of the coating volume and 25% of the coating value.



- In the U.S., coatings for architectural aluminum are categorized under the AAMA specifications, which are now part of the Fenestration & Glazing Industry Alliance (FGIA).
  - AAMA 2603: 1-year weathering specification
  - AAMA 2604: 5-year weather specification
  - AAMA 2605: 10-year weathering specification
- Similar specifications exist in Europe and are governed by the Qualicoat and GSB organizations.

Architectural Coatings Material Flow

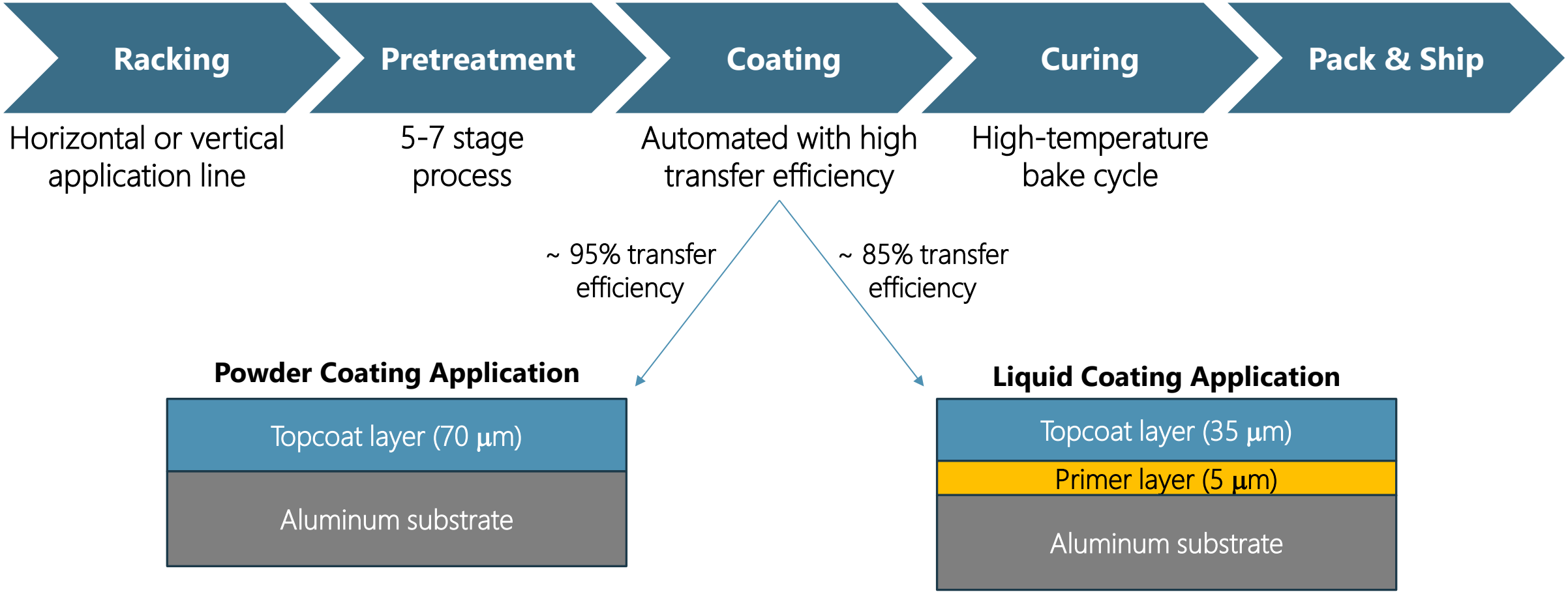
Significant integration exists within the value chain, creating several locations where coatings may be applied.



★ Denotes value chain members who may apply coatings to extruded aluminum

Architectural Coatings Application Process

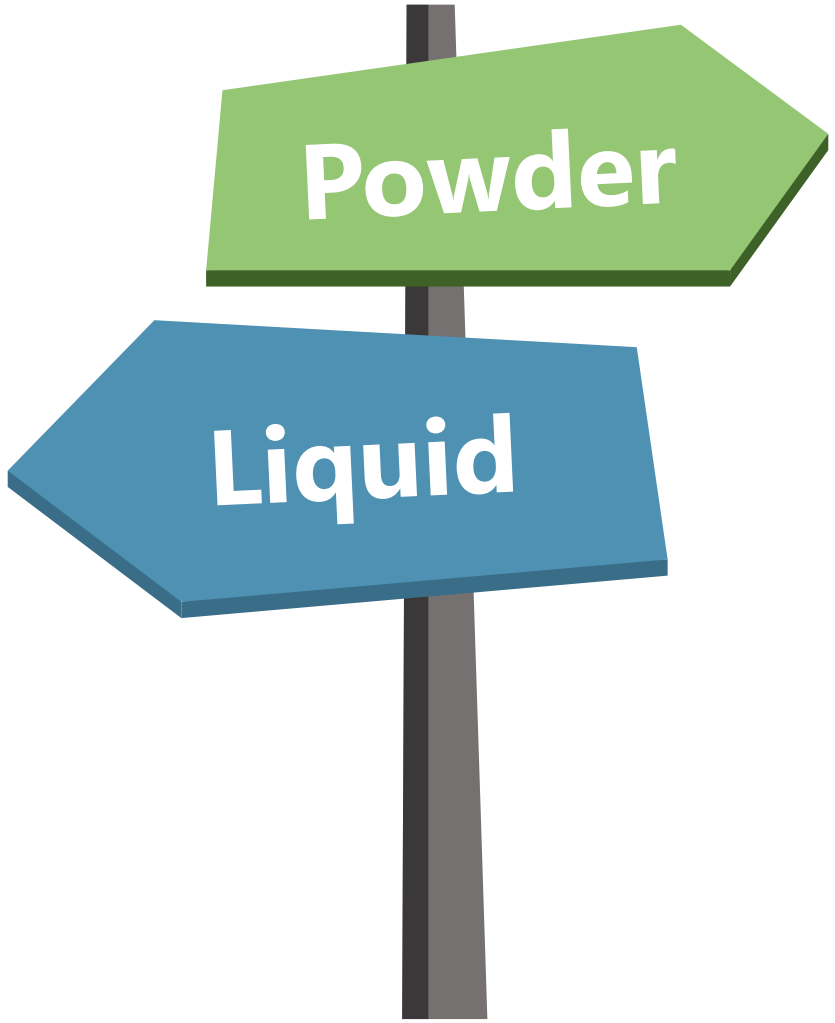
Process is audited by the coating supplier to ensure the highest level of quality and consistency.



Advantages of Liquid and Powder Coatings

Both technologies can meet the most stringent AAMA 2605 specifications, but each offers a set of unique advantages.

- Wider variety of colors and shades available
- Brighter, more consistent metallic effects
- Lower coating cost, as applied
- Lower total dry film thickness, including primer layer
- Shorter lead times



- Material of choice when sustainability is prioritized
- Zero VOC, eliminates requirement for abatement system
- One-coat system, does not require a primer
- Higher transfer efficiency
- Lower bake temperature

Formulating for Outdoor Durability

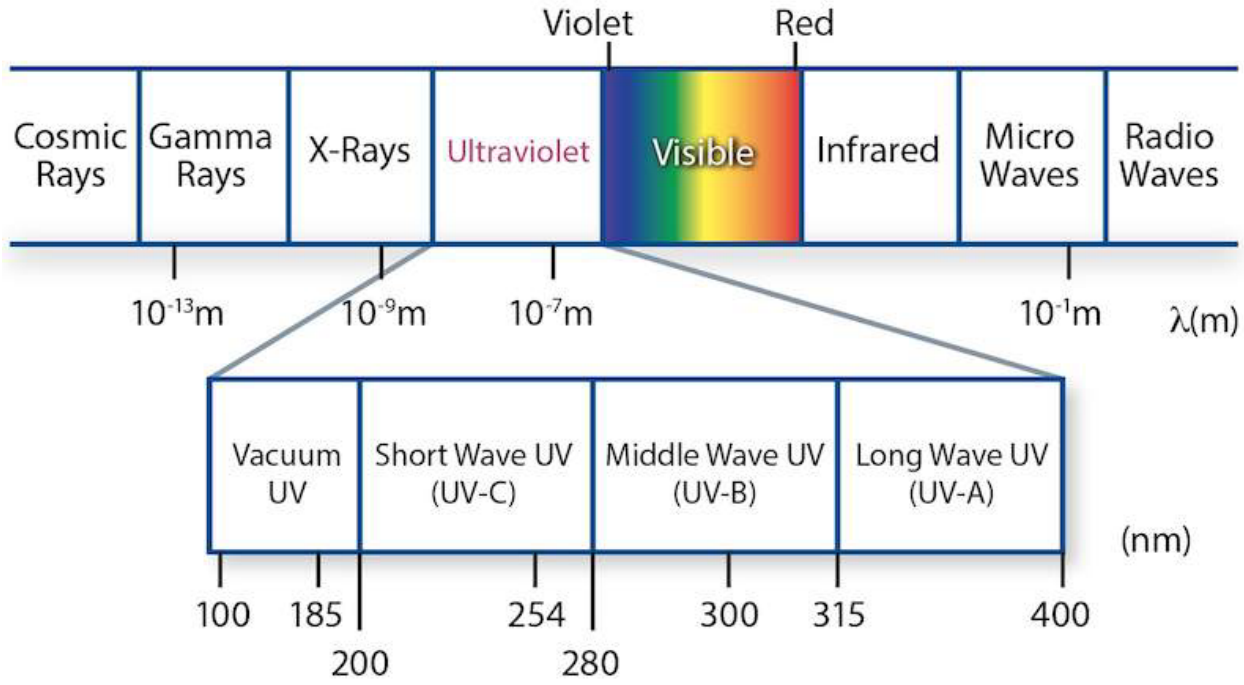
Comparison of Weathering Test Methods

No accelerated weathering test correlates perfectly with natural exposure.

- QUV
  - 340A: long wave
  - 313B: medium wave
- Xenon Arc

  Simulates the solar spectrum
- EMMAQUA
  - Solar concentrator
  - 10-12 times more UV energy than natural exposure
- South Florida

  True outdoor exposure



Specifications for Architectural Coatings

Third-party organizations govern the specifications that are adhered to by the building & construction industry.

- AAMA – American Architectural Manufacturers Association
  - Now FGIA – Fenestration and Glazing Industry Alliance
  - Self-certification, meaning that no third-party testing is required to qualify for AAMA specifications
  - Widely used in North America
- Qualicoat
  - Qualicoat is based in Switzerland and is widely used in Europe
  - Third-party testing is required for coatings to qualify for Qualicoat specification
- GSB International – German association of certified coaters and materials

  Corrosion specification is commonly referenced.

Weathering and Corrosion Testing Comparison

AAMA

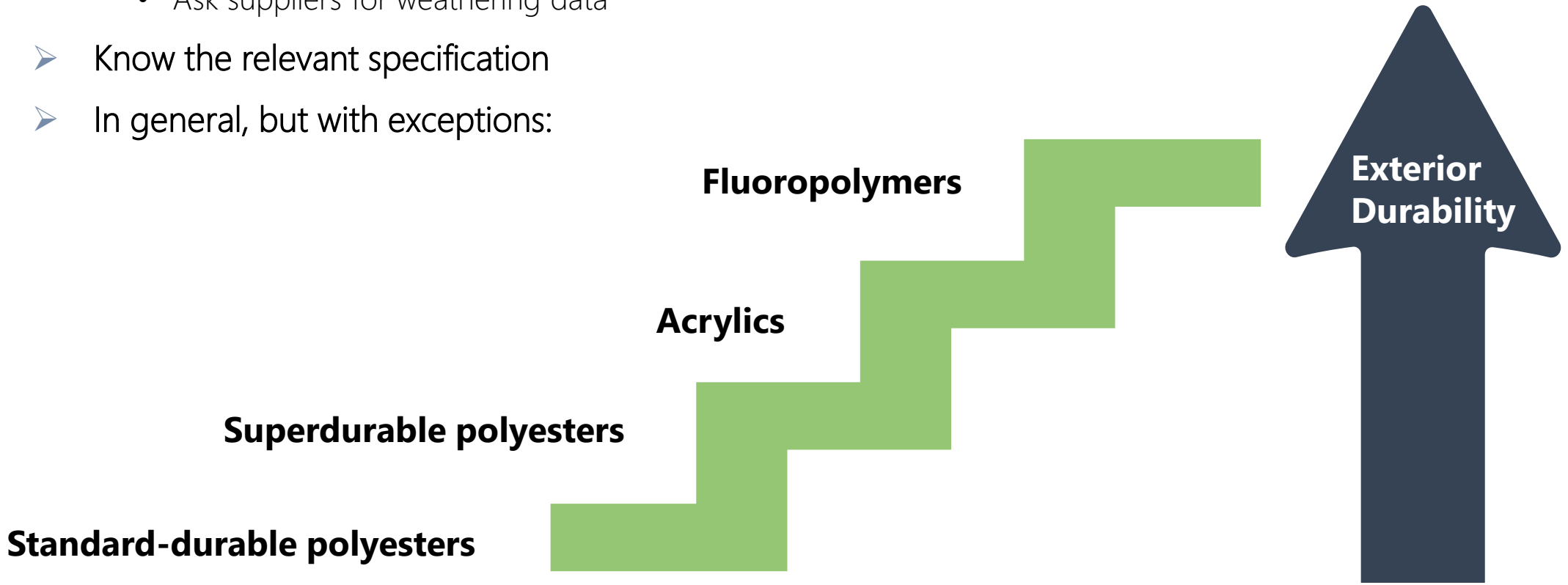
Specification	South Florida Weathering			Salt Spray (ASTM B117)	Salt Spray (ASTM G85, Annex A5)
	Years	Color Retention	Gloss Retention		
2603	1	Slight Fade	Slight Fade	1500	-
2604	5	5 ΔE	30%	3000	-
2605	10	5 ΔE	50%	-	2000

Qualicoat

Class	South Florida Weathering			Accelerated Weathering			Acetic Acid Salt Spray
	Years	Color Retention	Gloss Retention	Method	Color Retention	Gloss Retention	
1	1	Depends on the color	50%	1000 hrs Xenon Arc	Varies by color	50%	1000 hrs
1.5	2					75%	
2	3					90%	
3	10			3 Years Florida		80%	2000 hrs

Formulating for Exterior Durability

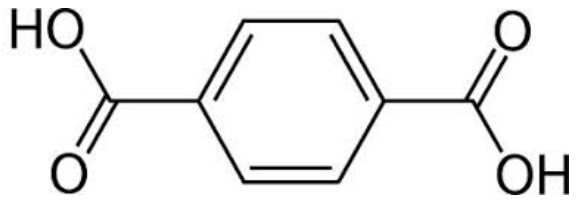
- All components affect exterior durability
  - Avoid “weak links”
  - Ask suppliers for weathering data
- Know the relevant specification
- In general, but with exceptions:



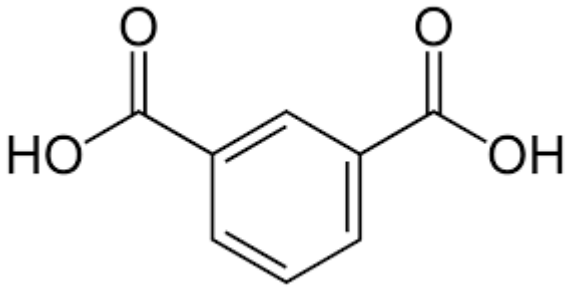
Standard-Durable and Superdurable Polyesters – Key Difference is Exterior Durability

- Standard-durable and superdurable refers to the resin, not the formulated coatings
- Superdurable replaces terephthalic acid with isophthalic acid to improve exterior durability
  - Powder coatings based on standard-durable polyesters can be formulated to meet AAMA 2603 specifications
  - Powder coatings based on superdurable polyesters can be formulated to meet AAMA 2604 specifications
- Carboxyl or hydroxyl functionality are available
- Standard bake or low-temperature-cure options
- Superdurable polyesters are more brittle than standard polyesters

Terephthalic Acid



Isophthalic Acid



Various Crosslinkers are Used in Combination with Standard-Durable and Superdurable Polyesters

Carboxyl Functional Polyesters

- Triglycidyl isocyanurate (TGIC)
- Hydroxy alkyl amide (HAA)
- Araldite® PT 910
- Glycidyl methacrylate (GMA) acrylics
- NOT – bisphenol A epoxies

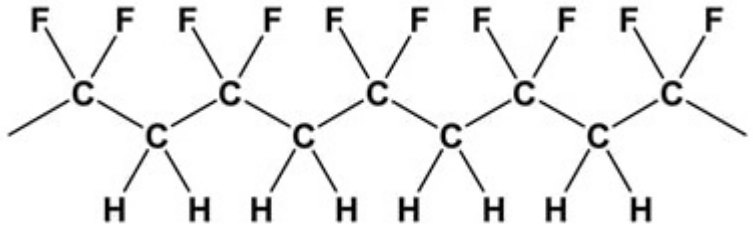
Hydroxyl Functional Polyesters

- Aliphatic blocked isocyanate
- Tetramethoxymethyl glycoluril (TMMGU)
- Uretdione
- NOT – Aromatic blocked isocyanate

Hyperdurable Powder Coatings can be Formulated to Meet AAMA 2605 Specifications

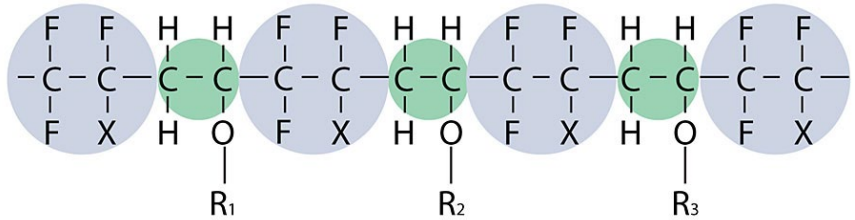
Polyvinylidene Fluoride (PVDF)

- Predominately used in liquid coatings
- Thermoplastic
  - Higher molecular weight
  - Higher melting temperature
- Typically blended with acrylic resins to reduce cost and balance properties



Fluoroethylene Vinyl Ether (FEVE)

- Predominately used in powder coatings
- Thermoset – hydroxyl functional
- Crosslinked with aliphatic blocked isocyanates
- Can be blended with superdurable polyesters for cost reduction



Source: "FEVE Powder Technology for Weather- and Corrosion-Resistant Coatings," PCI, Sept 2020

Pigments and Additives in Exterior Durable Coatings

Pigments

- Inorganic pigments typically withstand UV better than organic pigments
  - MMO – Mixed metal oxides
  - CICP – Complex inorganic colorant pigments
- Not all organic pigments can withstand 2+ years of Florida weathering
  - Yellow 213 (Quinoxalindione)
  - Red 254 (DPP)
  - Red 257 (Nickel Complex)
  - Violet 19 (Quniacridone)
  - Blue 15:1, Blue 15:3 (Phthtalocyanine)
  - Green 36 (Phthalocyanine)

Extender Pigments

- Can affect corrosion resistance
- Calcium carbonate is not recommended for long-term outdoor durability

Additives

- Some waxes are not weatherable
- UV absorbers (UVAs) and hindered amine light stabilizers (HALS) are typically added to clear coatings

Active Areas of Research in Powder Coatings for Architectural Applications

- Materials to replace PFAS-containing products
  - Fluoropolymers used in AAMA 2605 applications
  - PTFE used for textures and/or mar resistance
- Improved appearance to close the gap with liquid coatings
  - Expanded color palette
  - Wider gloss range
  - Brighter, more consistent metallics
  - Smoother coatings at lower film build
- Enhanced performance
  - Improved flexibility, especially in AAMA 2604 and AAMA 2605 applications
  - Higher level of burnish and mar resistance
  - Resistance to chipping / gouging during shipping and installation

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Thank You!

Questions? Comments?
Please reach out:

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