Coil Coatings For Architectural Buildings

An introduction to common chemistries of coil coatings for the architectural market, their performance factors, and defining characteristics

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WHAT ARE COIL COATINGS
Coil Coated Metal

- Coil Coating is paint baked on to metal substrates
- Also called prepainted metal
- Can be applied in multiple layers
- Provides color and protection
- Allows metal to be shaped after being painted

Photo Courtesy of Best Buy Metals
The Application Process

- Coil of metal is unrolled at one end and re-rolled at the other
- Paint applied with large rollers
- Large ovens heat the substrate to ~450F to “cure” the coating
- Multiple layers require multiple applicators and ovens
1. Standard Polyester
2. SuperDurable Polyester
3. PVdF
Standard Polyester Coatings

- Standard polyester coatings cover a wide range of products
- These systems are often more flexible, making them great for forming and profiling
- Can be formulated to show a moderate level of UV resistance

Photo Courtesy of Drexel Metals
SuperDurable Polyester Coatings

- SuperDurable systems change the resin structure to reduce reactivity with UV
- While these systems are less flexible than standard polyesters, they have substantially improved Durability performance
- Used for building panel, ACM, Roofing, and other large exposure architectural systems
PVdF Coatings

• Polyvinyl system as opposed to polyester
• Completely UV transparent for optimal exterior durability
• Resin suppliers must qualify manufactures for production to ensure high level of quality
• Brighter colors are more difficult due to the nature of the resin and may require additional coating layers
• Due to cost these systems are used on more prominent architectural and Corporate ID projects
AESTHETICS
COIL COATINGS AESTHETICS

• Coil Coatings can achieve a wide variety of Aesthetic properties
• Polyester products can cover a wide range of color families, textures, wrinkles, gloss, etc
• Other unique properties for all coatings could include
  ➢ Solar Reflectivity
  ➢ Color shifting pigment
  ➢ Metallics
  ➢ And more…. 
AESTHETICS: WRINKLE COATINGS

- Coating cure rate is adjusted and surface wrinkles
- Wrinkle provides very matte appearance
- Can show improved scratch resistance and durability over smooth systems
- Used to imitate roof tiles or shingles
AESTHETICS:
METALLIC COATINGS

• Flakes of Aluminum added to provide metallic appearance
• Different flakes provide different types of metallic appearances
• Size and shape of the flake will change from matte metal to a “sparkle”
AESTHETICS: COLOR SHIFTING COATINGS

- Color shifting products change color as the observer views the panel from different angles.
- Use different types of mica to achieve the look.
- Often the mica provides a color and “shifts” to show the coating underneath.
- Some micas provide multiple colors.
AESTHETICS: SOLAR REFLECTIVE COATINGS

• Pigments and coatings will absorb heat from sunlight
• Unique products can reflect some of this heat to help cool the building
• Total Solar Reflectance testing can indicate the level of reflectance provided by a coating
• Often this is used to help reduce cooling costs on a building

Photo Curtesy of CRRC
FORMABILITY
Formability is a factor of several properties.

“Slip” is determined by the Coefficient of Friction.

“Hardness” is determined by abrasion resistance tests.

“Scratch Resistance” is determined by several scratching tests and is a factor of both Slip and Hardness.
# TABER PERFORMANCE FOR ABRASION

<table>
<thead>
<tr>
<th></th>
<th>Taber – 1kg 500 Cycles CS – 10 (mg removal)</th>
<th>Taber – 1kg 1000 Cycles CS – 10 (mg removal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Polyester</td>
<td>32</td>
<td>48</td>
</tr>
<tr>
<td>Super Durable Polyester</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td>PVdF</td>
<td>13</td>
<td>23</td>
</tr>
</tbody>
</table>

- Abrasion resistance improves as the quality of the chemistry improves

Note: The more paint that is removed during abrasion, the higher the mg removal number will be.
C.O.F. PERFORMANCE FOR SLIP

<table>
<thead>
<tr>
<th>Material</th>
<th>C.O.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Polyester</td>
<td>18</td>
</tr>
<tr>
<td>Super Durable Polyester</td>
<td>12</td>
</tr>
<tr>
<td>PVdF</td>
<td>10</td>
</tr>
</tbody>
</table>

• Coefficient of friction is a unitless measurement of the resistance generated by dragging a known weight across the surface of a coating.

• Coatings can have optimized friction for the appropriate handling purposes.
**COIL COATINGS FLEXIBILITY TABLE**

<table>
<thead>
<tr>
<th>Product</th>
<th>T-Bend*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Polyester</td>
<td>0T</td>
</tr>
<tr>
<td>SuperDurable Polyester</td>
<td>1T</td>
</tr>
<tr>
<td>PVdF</td>
<td>2T</td>
</tr>
</tbody>
</table>

*T-Bend is a precision flexibility test to determine the coating flexibility of pre-painted metal sheets by manipulating the metal.

Supplied from ASTM
Durability can be defined by several parameters.

Most commonly in coil this refers to UV durability which is measured in color change and gloss retention.

It can also refer to corrosion resistance and film integrity.

Testing for durability can be accelerated using specific equipment or it can be real world outdoor exposure.

South Florida is the most common outdoor exposure site.
How Do We See Color

Rods & Cones

TO BRAIN

Blue / Yellow Signal

Black / White Signal

Green / Red Signal
How Do We Measure Color
What is Gloss

Gloss is the smoothness of a surface
Smooth surfaces look shiny, rough surfaces look flat
How is Gloss Measured

• Gloss can be measured at three different angles
  ➢ 60 °, 20 °, and 85 °
  ➢ Describes the angle the sensor is oriented
• Result is a % of light hitting the sensor
• 3 Gloss ranges for Coil coatings
  ➢ High Gloss – 70+
  ➢ Medium Gloss - 20-69
  ➢ Low Gloss – 0-19
COIL COATING QUV PERFORMANCE

Color Change $dE$

- Standard Polyester
- Super-Durable Polyester
- PVdF

Hours

1000
2000
3000
COIL COATING QUV PERFORMANCE

Gloss Retention %

- Standard Polyester
- Super-Durable Polyester
- PVdF

Hours

0 10 20 30 40 50 60 70 80 90 100 110
0 1000 2000 3000
Salt Spray Corrosion
COIL COATING CORROSION RATING SYSTEM

- ASTM has a standard for salt spray corrosion (B117) as well as for rating the failure (D1654)
- Ratings are divided into blisters and “creep”
- Blisters are rated by size and frequency
- Size ratings are 2 (largest) to 8 (smallest)
- Frequency is rated Few (f), Medium (m), Medium Dense (md), and Dense (D)
COIL COATING CORROSION RATING SYSTEM

**TABLE 1 Rating of Failure at Scribe (Procedure A)**

<table>
<thead>
<tr>
<th>Millimetres</th>
<th>Inches (Approximate)</th>
<th>Rating Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Over 0 to 0.5</td>
<td>0 to 1/64</td>
<td>9</td>
</tr>
<tr>
<td>Over 0.5 to 1.0</td>
<td>1/64 to 1/32</td>
<td>8</td>
</tr>
<tr>
<td>Over 1.0 to 2.0</td>
<td>1/32 to 1/16</td>
<td>7</td>
</tr>
<tr>
<td>Over 2.0 to 3.0</td>
<td>1/16 to 1/8</td>
<td>6</td>
</tr>
<tr>
<td>Over 3.0 to 5.0</td>
<td>1/8 to 3/16</td>
<td>5</td>
</tr>
<tr>
<td>Over 5.0 to 7.0</td>
<td>3/16 to 1/4</td>
<td>4</td>
</tr>
<tr>
<td>Over 7.0 to 10.0</td>
<td>1/4 to 3/8</td>
<td>3</td>
</tr>
<tr>
<td>Over 10.0 to 13.0</td>
<td>3/8 to 1/2</td>
<td>2</td>
</tr>
<tr>
<td>Over 13.0 to 16.0</td>
<td>1/2 to 5/8</td>
<td>1</td>
</tr>
<tr>
<td>Over 16.0 to more</td>
<td>5/8 to more</td>
<td>0</td>
</tr>
</tbody>
</table>

- "Creep" defines the amount of corrosion forming from exposed metal under the paint.
- The further the "creep" is from the exposed metal, the worse the performance.
- Best performance is rated at a 10 while worst performance is a 0.
## COIL COATING CORROSION PERFORMANCE

### Salt Spray Resistance (ASTM B117, ASTM D714)

<table>
<thead>
<tr>
<th>Panel</th>
<th>Standard PE</th>
<th>Super-Durable</th>
<th>PVdF</th>
</tr>
</thead>
<tbody>
<tr>
<td>digital images</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Face</td>
<td>M6</td>
<td>F8</td>
<td>F 8</td>
</tr>
<tr>
<td>Scribe</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Bend</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Cut Edge</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
COIL COATING FLORIDA WEATHERING

8 Years

Color Change (dE)

Std PE: Red
SDPE: Red
PVdF: Red
Std PE: Silver
SDPE: Silver
PVdF: Silver
COIL COATING
WARRANTIES
COIL COATINGS WARRANTIES

- Paint warranties cover several different factors
- Warranties are like Snowflakes, from far away they look the same but up close shows each is unique
- Each will have two lengths of time
  - Film Integrity
  - Color/Chalk
- Ratings for Color/Chalk will vary
COIL COATINGS WARRANTIES

- Film integrity – Ensures paint will maintain adhesion to substrate.
  - Reported in Years
  - If you have a 40 year warranty it is referencing film integrity
- Color – signifies the maximum change in color due to aging
  - Reported as Delta E
  - Often warranted for a shorter period than film integrity

Photo by Andy Freeberg
COIL COATINGS WARRANTIES

• Chalk – As the paint degrades it may create powder on the surface of the coating
  ➢ Reported on a 0-10 scale determined by an ASTM Test method
  ➢ Tied to the same warranty length as color
• Gloss retention is often not warranted however it is a key indicator to product durability

Provided by ASTM
AAMA AND COIL COATINGS

- American Architectural Manufacturers Association
- Provides specifications for coatings used in Architectural Market
- 3 levels for coatings which include coil
  - 2603 – Basic coatings
  - 2604 – High Performance coatings
  - 2605 – Superior Coatings

Provided by AAMA
• Specifications set for each level on a number of tests
• Physical property testing
  ➢ Color & Gloss
  ➢ Hardness
  ➢ Adhesion
  ➢ Chemical Resistance
  ➢ Abrasion Resistance
• All testing tied to ASTM method
Weathering Testing
- Color and Gloss retention (N/A 2603)
- Erosion resistance (N/A 2603)
- Humidity Resistance
- Salt Spray Corrosion
- Chalking Resistance
Product Summary

1. Standard Polyester
   - Low Cost
   - Low Durability
   - Very Versatile
   - Short or no Warranty
   - Best suited to smaller/lower exposure projects
   - AAMA 2603 or less

2. SuperDurable Polyester
   - Middling Cost
   - Medium/High Durability
   - Long Warranty
   - Wide range of exterior building needs
   - AAMA 2604 or better

3. PVdF
   - Highest Cost
   - Highest Durability
   - Long Warranty
   - Often used for corporate or high profile projects
   - AAMA 2605
Course Summary

• The 3 major coil coating chemistries available for Architectural systems are Standard Polyesters, Super-Durable Polyesters, and PVdF
• When selecting a coating system it is important to pay attention to its aesthetic properties, formability, durability, and the corresponding warranty
• All warranties are not made the same and total years can be the same but values in the warranty can be different
Now the design professional will be able to:

- Identify 3 major chemistries of coatings offered to the Architectural industry
- Understand the key performance attributes of these coatings and how they change between the chemistry
- Make educated decisions on coating selection based on cost, lifespan, performance, and product warranty
- Understand how warranties can differ beyond length of time
QUESTIONS?