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# Coating Technology for Maintenance and Architectural Applications

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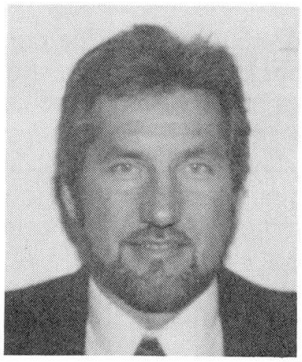

Born in 1948, received his Civil Engineering Degree form the University of Pittsburgh in 1970, and MSCE in 1976. He is currently heads Market Dev. for North America.

## Summary

Moisture-cured polyurethane coatings are widely used in maintenance and new construction applications because they offer durable protection. When compared with other coatings, polyurethane systems rank among the lowest in life cycle costs. Polyurethane coatings also provide chemical and abrasion resistance, low-temperature curing and recoatability and surface tolerance application. Of added significance, the solvent based formulations are commercially available to meet VOC emission limits of 2.8 lbs./gal.

*Moisture-Cured Polyurethane Technology*

Polyurethane moisture-cured coatings are classified as Type II urethanes under the ASTM D-16 Specification. They are single package compositions that cure by the reaction of residual isocyanate groups with atmospheric moisture. The reaction of these products with atmospheric water in the field is a two stage process. The water and isocyanate groups first produce the unstable carbamic acid, which immediately dissociates to form an amine and carbon dioxide. The carbon dioxide evaporates from the film, and the amine reacts with a second isocyanate group, yielding a polyurea. In a two-component polyurethane coating, the polyisocyanate reacts with a resin having a reactive hydrogen, which can be acrylic, polyester or polyether. The paint film resulting from this reaction is the foundation of the performance properties of polyurethanes: durability, corrosion and chemical resistance, and color and gloss retention. Moisture-cured polyurethane coatings are increasing in popularity due to the wide range of application advantages that some manufacturers are claiming:

- Can be applied on cold damp surfaces
- At temperatures below freezing
- No dew point restriction
- Adhesion to bare metal, marginally prepared surfaces and existing coatings
- Year round application season
- Excellent recoatability
- Single component - no mixing/measuring
- Excellent chemical resistance

Moisture-cured polyurethane coatings are applied independent of weather (temperature, humidity and dew point), are quick drying and surface tolerant. Moisture cured surface tolerant polyurethanes can be applied as a two coat or a three coat system using various preparation techniques. Zinc rich primers are preferred when blast cleaning is used to prepare the surface, varying from SSPC-SP 6 "Commercial Grade" to SSPC-SP 10 "Near White," depending upon service conditions. In addition, moisture cured polyurethane based primers perform well even when using lower level of zinc or zinc free

pigmentation. Coatings containing micaceous iron oxide provide excellent adhesion and durability. When overcoating tightly adhered rust remaining from hand/ power tool cleaning, it may be desirable to treat the rusted surface with a clear moisture-cured polyurethane penetrating sealer to help seal and reinforce the substrate surface.

Pigments commonly used in moisture-cured urethanes are titanium dioxide, mica, talc and micaceous iron oxide (natural or synthetic). During application of moisture-cured urethane primers and intermediate coats pigmented with micaceous iron oxide, mica and talcs, platelets align themselves more or less parallel to the substrate in closely packed layers. After the coating has cured, the overlapping pigment particles form a dense barrier against moisture and other corrosion promoters. The pigment layers also reinforce the coating, relieve stresses within the paint film and improve intercoat adhesion.

*New Construction, Maintenance, and Overcoat Painting*

Shop Painting: Moisture-cured polyurethane zinc rich primers are growing in use for fabrication shops due to their greater tolerance for higher film builds without mud cracking, easy touch-up in the field and they can now pass the Class B slip coefficient rating for fayed surfaces. Maintenance Painting: Both moisture-cured zinc rich primer and micaceous iron oxide and aluminum pigmented primer systems are utilized for blast cleaned surfaces. Overcoat Painting: Moisture-cured polyurethane coatings are very popular for overcoat application because of their excellent adhesion to marginally prepared surfaces, rust and existing coats. They are very tolerant of job side conditions that include low temperature variation and surface moisture.

| TEST | APPLIED OVER NEAR WHITE BLASTED STEEL (SSPC-SP 10) | |
|---|---|---|
| | Zinc Rich Moisture Cured Urethane Primer/MIOX Filled Intermediate Coat/Moisture Cured Urethane Aliphatic Topcoat | Moisture Cured Urethane Primer with MIOX and Aluminum/MIOX Filled Intermediate Coat/Moisture Cured Urethane Aliphatic Topcoat |
| Salt Spray ASTM B-117 (8000 hours) | Moderate rust and 1/8" creepage and few medium blisters at score line | Moderate rust, scattered medium blisters and 1/8" creepage at score line |
| Prohesion (8000 hours) 1 hour wet, 1 hour dry | Moderate rust, medium dense blisters and 1/8" creepage at score line | Moderate rust, dense medium blisters and 1/8" creepage at score line |
| Humidity Chamber (7000 hours) | No Effect | No Effect |
| Chemical Resistance (250 hours)<br>37% HCl<br>50% $H_2SO_4$<br>10% $CH_3COOH$<br>50% NaOH | <br>No Effect<br>No Effect<br>No Effect<br>No Effect | <br>No Effect<br>No Effect<br>No Effect<br>No Effect |
| TEST | APPLIED OVER MARGINALLY PREPARED STEEL | |
| | Moisture Cured Urethane Primer with MIOX and Aluminum/MIOX Filled Intermediate Coat/Moisture Cured Urethane Aliphatic Topcoat | |
| Salt Spray ASTM B-117 (6000 hours) | Moderate rust, dense medium blister formation around score line and 1/8" creepage at score line | |
| Prohesion (6000 hours) 1 hour wet, 1 hour dry | Heavy rust, medium to large dense blister formation around score line | |
| Chemical Resistance (250 hours) | Same as above | |
| TEST | APPLIED OVER MARGINALLY PREPARED STEEL | |
| | Moisture Cured Urethane Penetrating Sealer/MIOX Filled Intermediate Coat/Moisture cured Urethane Aliphatic Topcoat | |
| Salt Spray ASTM B-117 (2800 hours) | Slight rust along score line, 1/16" creepage at score line | |
| Prohesion (1500 hours) 1 hour wet, 1 hour dry | Slight rust and 1/16" creepage at score line | |

*Figure 1. Performance Tests for Moisture Cured Polyurethane Systems*