Painting Concrete

Concrete and related materials usually are painted, both for aesthetic reasons and for protection. Concrete certainly is inert compared to steel, but it can be damaged by moisture and various chemicals and by abrasion, impact, and other stresses. The coatings that are applied to concrete must resist these “insults” and act as barriers to prevent migration of moisture and chemicals to the surface of the concrete. Coatings also must be resistant to the alkalinity of concrete and be able to seal its porous surface.

Chemistries that meet these requirements include epoxies and epoxy hybrids, polyurethanes, polyureas, polyesters, and polyvinylesters. A number of different coatings are designed especially for concrete: stains, sealers, primers, and various topcoats, including elastomeric coatings and coatings with antiskid properties.

For good adhesion, the concrete surface must be clean. Concrete may be covered with dirt, membrane-curing compounds (waxes, oils, or acrylic polymers), moisture, or laitance (a fine, loose, dusty layer). A low level of dirt may be removed by scrubbing with a bristle brush and detergent followed by vacuuming to remove light deposits of laitance. If heavy deposits of dirt or laitance, membrane-curing compounds, or form-release agents are present on the surface, abrasive blasting or acid etching is required. These treatments also ensure that the surface is adequately roughened (ideally, with a texture similar to fine- or medium-grade sandpaper).

Because of possible problems due to the nature of concrete and its surface, it is important to have a “toolbox” of tests designed for the characterization of the concrete surface and the coatings applied to it.

Application usually is straightforward—brushing, rolling, or spraying. However, great care must be taken to avoid defects, particularly pinholes and craters, which might allow transmission of water and chemicals to the concrete surface. Multiple coating layers help prevent this by improving barrier properties and reducing the possibility of defects going all the way to the surface of the concrete. Good adhesion, on application and over time, is critical, both for appearance and protection.

Because of possible problems due to the nature of concrete and its surface, it is important to have a “toolbox” of tests designed for the characterization of the concrete surface and the coatings applied to it. Here is a list of particularly useful ones:

- **ASTM D7682—Replication and Measurement of Concrete Surface Profiles Using Replica Putty.** The surface profile of concrete affects bonding of coatings applied to that surface. This method enables an operator to obtain a permanent replica of the concrete surface, which then can be compared to visual profile standards or characterized for profile depth.

- **D4138—Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Cross Sectioning Means.** This practice describes the measurement of dry film thickness by microscope observation of precision cuts in the coating film. This is an on-the-job measurement, then the coating must be repaired.

- **D6132—Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using an Ultrasonic Gage.** This test method has the advantage of not damaging the coating. It covers the measurement of film thickness on a variety of substrates, including concrete.

- **SSPC-PA9—Measurement of Dry Coating Thickness on Cementitious Substrates Using Ultrasonic Gages.** This is another useful nondestructive test method.

All film thickness measurements over concrete are affected by the roughness of the surface. A number of gage readings must be taken in different areas to determine the average thickness and its variability.

- **D7234—Pull-Off Adhesion Strength of Coatings on Concrete Using Pull-Off Adhesion Testers.** A plug or “dolly” is glued to the surface of the coating, and then a portable device is used to grip the dolly and pull the coating away from the concrete surface. The force needed to disbond the coating is a measure of the adhesion.

The pH and moisture on a concrete surface can affect the stability of an organic coating and its adhesion. The pH of new concrete is 12–13, mostly due to calcium carbonate, which is a product of cement hydration. As the concrete surface reacts with carbon dioxide in the air, the pH gradually decreases to 8–9, which is a good range for most coatings and flooring. Of course, acid etching will lower the pH considerably and the surface then must be neutralized and flushed with water until the pH is above 6, preferably 7–8. Testing can be done with pH paper or with a pH pencil.

**References:** Websites that I consulted in preparing this article included:

- www.defelsko.com/applications.htm
- www.sherwin-williams.com/home-builders/services
- www.safe-react.com/etchtips.htm