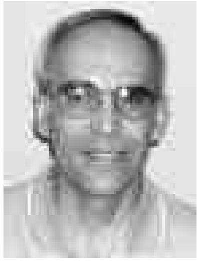

Stephen F. Rudy, CEF
Enequist Chemical Co.
100 Varick Avenue
Brooklyn, NY 11237
718/497-1200
E-mail: sfrudy@aol.com

Corrosion Testing Procedures & Alternatives

The incessant problem of corrosion—the electrochemical oxidation/reduction process—has been challenging mankind for more than 2,000 years. For those of us in the metal finishing industry, it's the core reason we have a livelihood. Improvements to all facets of process handling and treatments improve corrosion resistance while maintaining aesthetically preferred appearances. The minimization or retarding of corrosion is a direct function of several important parameters. Among these are: surface condition of the base metal, cleaning and activation, plating quality, and post treatments. Product development, in conjunction with industry requirements, continually introduces new processes, procedures, and improvements. The quality of finishing is typically evaluated by conducting corrosion tests, specifically developed for unique service applications. Most of these tests are industry standards. Finishers and their customers integrate them as a guide and requirement for the acceptance of processed parts.

Standard procedures for corrosion testing address these conditions: base metal, plated deposits, intended service application (*e.g.* indoor, outdoor, marine), relative humidity, and temperature. Each test adheres to a set of guidelines: standardization, preparation (sample & equipment), operating conditions, length of test exposure, and interpretation of results.

Corrosion Test Procedures

The confidence level for each test is based on the ability to produce and maintain an artificial corrosive atmosphere, linked to the actual expected conditions. Individual testing may relate to hours, days, months, or years for interpretive results. Accelerated tests speed up exposure conditions, attributing results to years or even decades.

Let's review some of these test procedures and their applications.

Relative Humidity [ASTM D-2247]

This test is a very good evaluation for the protection of surfaces exposed to a continuously moist environment. Parts may be in areas where moisture accumulates on them. The humidity cabinet is designed to accommodate relative humidities from 50-100%, cycling, and temperature fluctuations. The effect of rust inhibitors on unplated surfaces is a good application for this test. Parts may be in areas where moisture accumulates on them.

Neutral Salt Spray [ASTM B-117]

Perhaps most plating finishes are based on this test. Parts for testing include: plumbing ware, construction materials, hardware, and automotive. An enclosed, certified test cabinet produces a fog mist consisting of 5% sodium chloride in a pH solution of 6.5–7.2, maintained at 92-98°F (33–37°C). The test parts or panels are fastened and inclined as per requirement. The client and testing facility (plater or lab) agree on targeted corrosion testing results. Many results follow standards, such as zinc plating thickness and type of chromate.

Copper-accelerated Acetic Acid Salt Spray (CASS) [ASTM B-368]

Corrosion testing by this method is very specific. It was introduced for evaluating copper/nickel/chrome deposits over steel and zinc substrates. Comparison to the neutral salt spray (ASTM B-117) highlights these differences. CASS includes 1 gram of cupric chloride per 3.8 liter of the

5% sodium chloride solution; solution pH is 3.1–3.3; and temperature is 118–122°F (48–50°C). Cupric chloride provides a galvanic effect. The lower pH speeds the corrosion (redox or reduction/oxidation) reaction. CASS was developed especially for evaluating the protection of chrome-plated topcoats under severe conditions for automotive and similar end use.

Corrodkote ASTM B-380

This test is an alternate method to the CASS test. The surface preparation and application differs. A special paste consisting of ammonium chloride, ferric chloride, and clay (kaolin type) is applied to the test surface. This paste and its consistency simulates the holding effect of accumulated scale and dirt on exterior automotive surfaces. Inside a humidity cabinet, the prepared parts or panels are exposed to: 80–90% relative humidity, 208–216°F (98–102°C).

Acetic Acid Salt Spray [ASTM B-267]

This method accelerates redox corrosion versus the Neutral Salt Spray (ASTM B-117) by operating at pH 3.1-3.3. The 5% sodium chloride solution pH is adjusted with acetic acid. These differences are designed to make B-267 twice as aggressive as B-117.

Sulfur Dioxide Or Kesternich [ASTM B-605]

European assembly plants for automobiles initiated the use of this method. It consists of placing parts and panels into a controlled 100% humidity cabinet, subjecting the specimens to sulfur dioxide gas (generating sulfurous acid) at 99–110°F (37–43°C). The cycle consists of 8 hr running followed by 16 hr of cooling.

Simultaneous Thickness & Electrochemical Potential [STEP]

We are slipping one method under the wire. Although STEP is not a corrosion test, its scope and results are related to corrosion protection. It was developed to measure the quality of multiple nickel and chrome electroplated layers. Deposited metal layers are dissolved and the electric potential of each layer is determined. The size or magnitude of the potential difference between each stripped layer is a measure of the coating's effectiveness to minimize corrosion. In many tests, the difference in potential between a layer of semi bright and subsequent layer of bright nickel is determined. The result is a very good predictor of corrosion protection.

Unfortunately, there isn't one singular corrosion test. This is because of the different field service applications, environments, desired aesthetic appearances, and wear resistance requirements. Therefore, specific corrosion tests are available for the intended purposes and profile criteria.

There are corrosion tests available for specific evaluation of coatings relative to the intended service applications. Each of the methods as described are approved by ASTM and their reliability is very good. Personnel involved in metal finishing—including platers, manufacturing industries, scientists, and engineers—use the right corrosion test methods. This ensures that the highest quality standards and service life can be expected from plated parts. ***P&SF***