

## **Tier Testing of Coatings Systems to Establish Performance Parameters for Electric Power T&D Support Structures including Poles, Lattice, Towers and Substation Equipment**

In a world that offers a seemingly unlimited number of protective coatings options, how can you insure that you are selecting the best option for the application? It's not an easy or clear-cut decision, and one that will have a lasting effect on the service life of a utility's assets. Coatings systems that are not selected wisely have an increased risk of corrosion, loss of reliability, and require additional maintenance and repair. As though that isn't enough, it is often the case that these added costs limit new equipment purchases or line upgrades.

MATCO' Tier Testing for Coating Systems can help. We've developed a rigorous test regimen approved by the Electric Power Research Institute (EPRI) that's designed to "weed out" inferior candidate coating systems. This innovative program relies on performance based testing to evaluate a coating system's overall performance in regards to, among other criteria, adhesion, corrosion resistance, moisture penetration, cathodic disbondment, electrical impedance, cyclic exposure, ultraviolet (UV) exposure; and cross sectional metallographic inspection. Test results are presented in ranking order in terms of performance under various conditions designed by our in-house Corrosion & Coatings Engineering Team to match a client's service environment. By knowing how a coating system will perform under these simulated test conditions, wise decision making can be made that's based on fact rather than speculation.

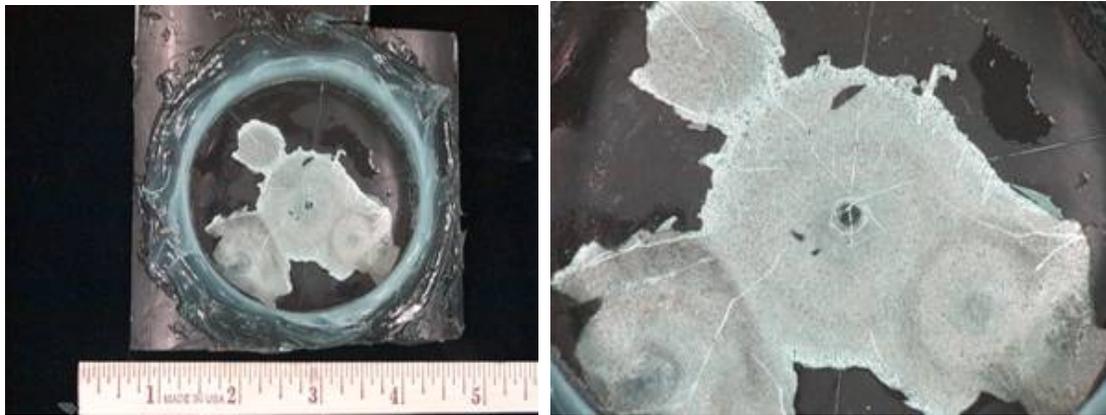
This highly effective program was developed in 2005 by MATCO's senior level Ph.D. chemists, materials/corrosion engineers and electrochemical specialists. Each of the four tiers, or levels, of testing has specific criteria the coating system *must pass* in order to proceed to the next level. Coating systems that have not performed adequately in any given tier are eliminated from further testing. Clients pay only for the tests performed for each coating system.

Tier Testing for Coating Systems attributes:

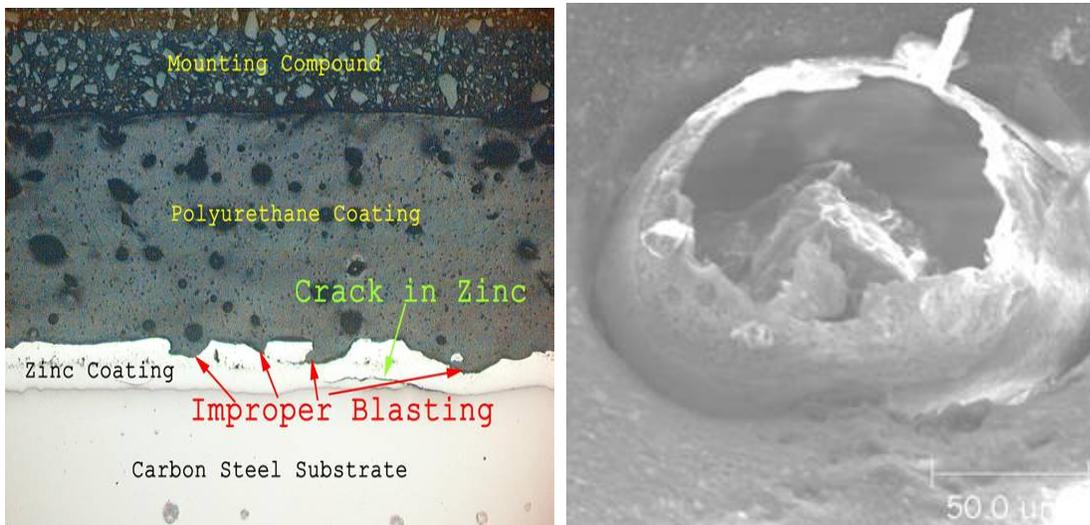
- Unbiased and economical way of comparing different coating systems that rank specific performance characteristics of different coatings under various simulated service environments.
- Distinguishes acceptable vs. unacceptable coating characteristics for above and below grade coating systems for electric utility transmission line structures.
- Flexibility – different coating types and service environments dictate changes in test protocols.
- Performance requirements are identified in terms of desired outcomes.
- Coating manufacturers are encouraged to formulate coating systems that achieve performance goals.
- Quantifiable performance criteria can be used to certify different coating systems.
- Redundant testing is eliminated if a coating system does not pass the Tier it is in.
- Tests can be performed simultaneously to meet client expectations.

- Repeatable, standardized ASTM, NACE, ISO and SSPC test methods are used.
- Galvanized steel, weathering steel, aluminum, ductile iron and other metals are candidates for Tier Testing.

Each Tier is designed to test a specific aspect of a coating system’s performance. The first two levels of Tier Testing tests two of the most important coating characteristics: delamination resistance and coating uniformity, thickness, surface preparation and identification of internal defects. If a coating system doesn’t pass these two important performance parameters, we know the coating system will not provide adequate barrier protection and delamination resistance. Figures 1 and 2 present the results of cathodic disbondment testing while Figures 3 and 4 present a metallographic evaluation and scanning electron microscopic view of a coating defect.



Figures 1 (left) and 2 (right): Tier Testing, Level 1 Cathodic Disbondment Testing to determine adhesion characteristics.



Figures 3 (left) and 4 (right): Tier Testing, Level 1. Metallographic evaluation and scanning electron microscopy (SEM) to identify internal defects such as porosity, bubbles and pinholes.

Coating systems that successfully pass Tier 1 are advanced to Tier 2, which includes cyclic exposure testing and electrochemical impedance spectroscopy (EIS), shown in Figures 1 and 2, to evaluate a coating's performance and ionic barrier properties; adhesion testing prior to and after exposure testing and hot water temperature testing to determine how well the coating system performs when exposed to outdoor higher humidity temperatures in regards to corrosion resistance.

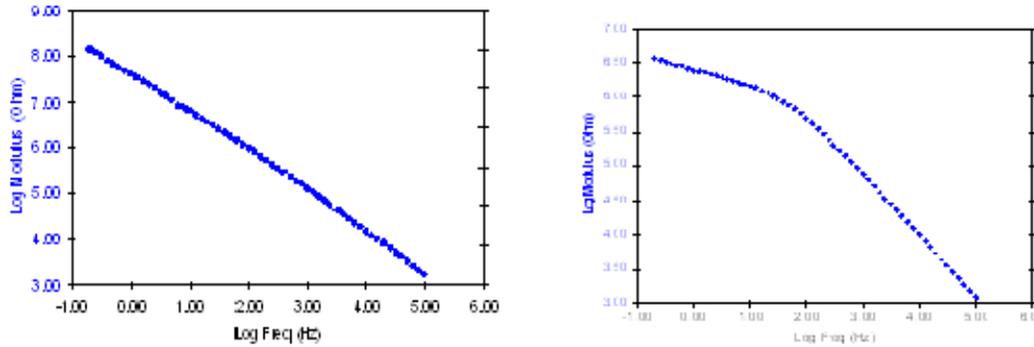


Figure 5 (left) and 6 (right): The image on the left shows the electrochemical behavior of a purely capacitive coating (Ideal), while the image on the right shows the electrochemical degradation (from Ideal) of an organic coating. A computerized electrochemical system and EIS software are utilized to collect data and help with analyses. This technique will clearly identify coatings that do not have good corrosion resistance in a relatively short period of time.

Tier 3 includes ultra-violet (UV) exposure testing to assess the changes that occur in a coating's appearance and surface degradation due to UV rays from sun exposure. To evaluate performance, gloss and color measurements are taken before, during, and after UV testing as well as gravelometer testing to determine impact and mechanical damage resistance.

Tier 4 is designed to ensure that a coating system does not deviate over time from its original chemical make-up. Tests include Fourier transform infrared spectroscopy (FTIR), Scanning electron microscopy/energy dispersive x-ray spectroscopy (SEM/EDS), X-ray diffraction (XRD), to provide a general overview of the paint in terms of binder type, pigments present, and a general compositional breakdown. This tier can be performed at any time regardless to whether or not the coating system has successfully passed the previous three tiers.

At the completion of testing, a comprehensive report that includes photographic documentation, test results, ranking, performance characteristics, and discussion and recommendations is provided to the client.

By knowing how a coating system will perform prior to application, our clients are given a glimpse of the future without the wait and costs associated with an inferior coating. Trust MATCO's tier testing experts to provide the right solution for you!