

Corrosion and Corrosion Tests

Introduction

Since a great percentage of coil coated materials spend their service life in an external environment, a key performance measure for prepainted metal is resistance to corrosion. Corrosion is a chemical or electrochemical reaction between a material, usually a metal, and its environment that produces a deterioration of the material. For more information about the process of corrosion, see [NCCA Tool Kit #4, Fundamentals of Corrosion](#).

The entire coil coating value chain is well aware of the need to resist corrosion. To achieve this, proper substrate selection is critical, as is proper processing, pretreating, and painting of this substrate. The necessary material parameters to prevent or reduce corrosion are well known, as are the necessary material handling, fabricating, transporting and installation needs within the metal construction industry. The industry attempts to gauge the performance of prepainted metal in actual conditions by conducting tests that are intended to accelerate the corrosion process. This tool kit provides information regarding accelerated corrosion tests, including the widely used ASTM B117 salt spray test, as well as alternative tests that provide more realistic results for some applications and are recommended by NCCA.

Resource Material

Many educational resources have been created to address salt spray tests. Rather than add to the existing literature, NCCA has reviewed some existing documents and has selected material from the GalvInfo Center as being a thorough and objective review of the salt spray test.

The GalvInfo Center has prepared extensive information about galvanizing and related topics in the form of GalvInfo Notes, a series of technical bulletins that provide general information and answer the most frequently asked questions. One of the GalvInfo Notes addresses the salt spray test that is often used to determine the performance of prepainted metal in resisting corrosion. To access this material, which provides a good overview of the ASTM B117 salt spray test and its shortcomings, visit the following:

http://www.galvinfo.com/ginotes/GalvInfoNote_3_4.pdf

Current Practice

Despite the known shortcomings of the B117 test method, manufacturers, product designers, and specifiers still use it. Why?

- At one time, the B117 test was the only option available. As it became more widely known and used, it became embedded into myriad internal documents, procedures, forms, specifications, etc.
- Users have a lengthy history of results for their products, sometimes spanning decades. They have developed some familiarity with the results and what they mean for their specific products.
- Inertia. Predecessors used B117, and there has been no need or perceived benefit to changing.
- Lack of awareness that better options exist.

This Tool Kit is part of a series of educational aids developed by the members of the National Coil Coating Association. NCCA is a trade association of coil coaters and suppliers of raw materials and equipment used in the coil coating process. The association concentrates its efforts on providing educational resources and assisting its members in providing superior products and services to their customers. NCCA Tool Kits are informational tools and should not be used as substitutes for instructions from individual manufacturers. Always consult with individual manufacturers for specific instructions regarding their products and equipment.

Alternatives Available Today

There are many different accelerated corrosion test methods in use today. Most of the test methods use a cyclic approach that is intended to replicate actual environmental conditions more closely than the B117 salt spray test. The tests typically involve a series of wet and dry cycles, and some include additional exposure to ultraviolet light, heat, humidity, etc.

Whereas the B117 test is viewed somewhat erroneously as being applicable to a wide range of different products, in reality, no one test method is suitable for all end use applications. Different test methods have been found to provide more realistic results for different end uses. Considering the many applications and products that use coated metal, this is only logical. A metal roof will have a different type of exposure than a car, or a washing machine, or a light fixture, or even a building panel.

NCCA has conducted extensive review of the many test methods that are in use today. Following are NCCA recommended test methods for various applications, along with a brief explanation of what the test entails:

- Automotive: For automotive applications in which the customer has not dictated the test method, a commonly accepted test is SAE J2334. A cyclic test developed through joint efforts of the steel and automotive Industries comparing field exposure data, the test involves a humidity stage, a salt dip stage, and a drying stage.
- For aluminum automotive applications, ASTM G85-Annex 2 was found to be the most representative of on-vehicle corrosion tests in a USAMP industry/government initiative sponsored by the DOE. The test involves a wet/dry cycle and acidification of the traditional ASTM B117 electrolyte using acetic acid.
- Steel Building Products: ASTM G85-Annex 5, a cyclic test employing a dilute electrolyte solution of both chloride and sulphate accelerants, is a useful tool for the evaluation of prefinished steel building products.
- ASTM D5894: A cyclic test exposing the product to alternating weeks of G85-Annex 5 with ASTM G154 UV-A exposure (340 nm), this test is more laborious and expensive to run but may be a better predictor of field performance rankings for prefinished steel materials due to the inclusion of weathering stresses on the product.

Ongoing Research

Additional alternative test methods to gauge corrosion performance are being developed. These methods typically also use a cyclic approach. The developers of these methods hope the results will also replicate actual performance in environmental conditions. Evaluation of these newer test methods is a long process, since materials must be exposed to various environments for decades to determine the effectiveness of the test methods in predicting performance. NCCA is monitoring the newer alternative test methods to ascertain their suitability for prepainted metal. The test methods are not expected to be fully evaluated for several years.