

Metal Roof and Wall Panel Components in Contact with Preservative-Treated Lumber

Background

Developments during the past several years in the preservative-treated lumber industry have led to the introduction of both metal-free preservatives and treatments utilizing dispersed or micronized copper metal. Many of these new products allow much broader contact with other metal sheathing and connectors without the use of a barrier material. Certain specific newer treatments can even allow the use of aluminum products without a barrier.

Historically, preservative-treated lumber was treated with copper-containing chemistry corrosive toward certain types of metal roof or wall panels and most recommended fasteners. The corrosion process is relatively simple. The copper-containing chemistry in the lumber reacts through a catalyst, typically water, with the dissimilar metal panel or fastener resulting in galvanic corrosion.

The Metal Construction Association suggests that copper-containing preservative-treated lumber should ideally be separated from metal roof or wall panels and accessory materials using a polymeric membrane material between the metal panel and the wood substrate. While newer non-metallic and micronized copper preservatives may allow direct contact with metal roofing, it is important to check with the preservative manufacturer for recommendations regarding contact and fasteners. In many installations, the choice of compatible metal fasteners is critical to the integrity of the metal roof or wall assembly. The exception to this would be where the metal panels or fasteners are constructed of copper or copper alloys.

Discussion

Wood preservatives and treatments have been used for decades to prevent damage by termites and other insects; decay from fungi; and to provide resistance to fire damage. One of the more popular treatments was Chromated Copper Arsenate (CCA), invented in 1933 and not widely used in residential construction until the late 1960s. At that time, the other primary preservatives in use were creosote, a coal/tar derivative, and pentachlorophenol (penta), an oil-based preservative.

CCA gained popularity over creosote and penta because it was easier to work with for residential applications. However in 2003, the CCA registrants announced a voluntary change to the formulations of wood preservatives. Lumber treated with CCA was still used for building poles, timber columns, saltwater exposure, utility poles, pilings, and guard rail posts; however, CCA is no longer used for decking and most applications involving dimension lumber.

With the voluntary withdrawal of CCA from the residential marketplace, the wood preservative industry began offering alternative soluble copper-based preservative systems that included Alkaline Copper Quaternary (ACQ) and Copper Azole (CA). Between 2006 and 2009, Micronized Copper Quat (MCQ) and Micronized Copper Azole (MCA) were also introduced into the market and in 2011, preservatives based on organic biocides, not copper, were introduced (Ecolife® and PTI). Today, both copper-based and non-metallic preservative systems are used throughout North America. All of these newer preservative treatments contain biocides that do not include arsenic or chromium, and are currently registered by the EPA.

The preservative treated lumber, where copper is the main ingredient of the preservative, performed similarly to CCA treated lumber; however, it was soon discovered these preservatives also can be corrosive toward metal, other than copper or copper alloys, in situations where the lumber will be exposed to moisture.

Corrosivity of Preservative-Treated Lumber

Corrosion of metals in an aqueous environment is an electrochemical process involving two steps:

- 1) Water and oxygen, must diffuse to the metal surface, and
- 2) Reactants must have enough energy to complete the reaction.

Within lumber treated with soluble copper preservative systems, such as ACQ and CA, most of the soluble copper is chemically bonded to the wood fiber or precipitated within the wood structure. Only a small percentage of copper remains in ionic copper form. Within lumber treated with micronized copper preservative, such as MCA or MCO, the micronized copper particles are physically deposited into wood through a strong adhesion formed between the polymeric dispersants and wood fiber. (Polymeric dispersants keep the micronized copper particles apart from agglomeration and carry the particles into wood during the pressure treatment process.) After treatment, the deposited micronized copper in treated wood slowly releases as free ionic copper which also precipitates within the wood structure and becomes chemically bonded to the wood fiber.

The ionic copper components increase the corrosiveness of the wood product toward metal. At higher moisture contents, wood conducts electricity and ions better making the corrosion reaction occur at a faster rate. This faster corrosion activity is believed to occur within wood with a moisture content of 20% or greater.⁽¹⁾ Service conditions where wood is protected from wetting, and the moisture content is less than 20%, have shown little corrosion potential, even with ACQ and CA.

New preservative formulations such as ACQ, CA, MCA, and MCQ contain more copper than CCA. Because copper ions can accelerate the corrosion of steel and aluminum, micronized copper treated wood was developed to have a lower corrosion rate to steel and aluminum than its counterpart soluble copper treated wood. The organic-based systems, Ecolife® and PTI, have corrosion rates similar to untreated wood, in both wet and dry service conditions.

The potential for corrosion of hardware in contact with treated wood occurs when metals in the preservative (such as copper) are different from the metals in the hardware (the iron in steel, or aluminum). In a wet environment these dissimilar metals create a small electrical current that triggers a chemical reaction resulting in galvanic corrosion. This is the challenge in selecting proper fasteners and connectors to be used with copper-based preservative treated wood. The Metal Construction Association's Technical Bulletin on Fastener Compatibility with Profiled Metal Roof and Wall Panels addresses this for metal panels as follows:⁽²⁾

“Preservative-treated lumber can be incompatible with certain types of fasteners. In those cases where any type of metal roof or wall cladding materials are being attached to preservative-treated lumber, the following fasteners are not compatible: zinc plated screws, zinc-alloy headed screws, stainless capped screws, and aluminum.

Metal panel fasteners that are compatible with preservative-treated lumber are stainless steel fasteners, or hot dip galvanized nails manufactured to ASTM A153 class D or heavier. Other types of fasteners coated with proprietary anti-corrosive technologies may be compatible for use with preservative-treated lumber. Allowable use should be verified with the fastener manufacturer.”

Industry Positions

The manufacturers of wood preservative chemicals make specific recommendations regarding

unpainted galvanized or Galvalume sheet panels. In these recommendations the manufacturers generally advise against direct, long-term contact with wood treated with the newer copper based preservatives such as ACQ, CA, MCA, or MCQ. Both the International Building Code (IBC) and the International Residential Code (IRC) require that stainless steel or hot-dipped galvanized fasteners meeting ASTM International A153 *Standard Specification for Zinc coating (Hot-Dip) on Iron and Steel Hardware* be used. Connectors must be ASTM A653, *Standard Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process*, Class G185 sheet or better for protection against the effects of moisture where treated wood is used.

The manufacturers also recommend that aluminum not be used in direct contact with preservative-treated lumber that has not been treated using carbon-based (Ecolife® or PTI) or micronized copper preservatives (MCA or MCO). In these cases, the Metal Construction Association suggests that metal materials, other than copper or copper alloys, should be separated from the treated lumber with a physical barrier that prevents contact with the metal panels or chemicals leaching through to the metal panels such as, but not limited to, rubber, vinyl, plastic sheeting, asphalt roofing paper, or a maintained industrial coating. Ecolife® and PTI manufacturers allow direct contact with aluminum under even wet conditions and do not require a physical barrier.⁽³⁾

Specific Steel Industry Recommendations

Wheeling Corrugating:

Wheeling Corrugating^(a) conducted a study to determine the effectiveness of a specific barrier in preventing the corrosive attack between treated lumber and metal wall panels.⁽⁴⁾ The research was conducted by H.L. Stauver of Touchstone Research Laboratory, Ltd, in Triadelphia, West Virginia. The conclusion from that study was:

“...it is recommended that all galvanized be protected with water/ice shield membrane or with a similar product in any construction.”

(a) Wheeling Corrugating is no longer involved in the manufacture of roof sheathing materials.

U.S. Steel:

U. S. Steel tested preservative-treated lumber in contact with architectural sheet steel products commonly used for metal roofing and siding applications. Products included G90, Galvalume, acrylic-coated Galvalume, prepainted HDG, and prepainted Galvalume. The preservative-treated lumber were treated with CCA and ACQ chemicals. The results showed that ACQ was generally more corrosive to most coated steel products.

U.S. Steel concluded that isolating steel from preservative-treated lumber using water resistant barrier materials is an effective way to minimize corrosion. The isolating products include peel-and-stick polymeric membranes, polymer tapes, masking and lining materials. U.S. Steel also concluded that using isolating materials with a paper or felt component should be avoided since these products can retain moisture which can increase corrosion potential.⁽⁵⁾

National Frame Building Association (NFBA):

Most metal component manufacturers recommend that panels or flashing should not come into contact with preservative-treated lumber. Many manufacturers recommend installing a barrier material that will stop all electrical current between the treated lumber and metal. Furthermore, NFBA suggests that water should not drain off of treated lumber onto panels or flashing.⁽⁶⁾

National Roofing Contractors Association (NRCA):

The NRCA recognizes the lack of long-term corrosion performance data on newer preservative-treated lumber such as ACQ, CA, MCQ in contact with metal fasteners, panels and flashing. NRCA guidelines include the following:

- *“Aluminum fasteners, flashings and accessory products should not be used in direct contact with any treated wood. ACQ-treated wood is not compatible with aluminum.*
- *Uncoated metal and painted metal flashings and accessories, except for 300-series stainless steel, should not be used in direct contact with treated wood. Metal products, except stainless steel, may be used if separated from treated wood by a spacer or barrier, such as single-ply membrane or self-adhered polymer-modified bitumen membrane material.”⁽⁷⁾*

NRCA also states ... *“NRCA is of the opinion that the corrosion-related concerns regarding the use of currently available treated wood possibly outweigh the benefits that treated wood provides as a component in roof assemblies. In many instances, non-treated, construction-grade wood is suitable for use in roof assemblies as blocking or nailers, provided reasonable measures are taken to ensure the nontreated wood remains reasonably dry when in service. Where a specific construction detail provides for a secondary means of waterproofing, NRCA now considers the use of nontreated, construction-grade wood to be an acceptable substitute for treated wood.”⁽⁷⁾*

Steel Deck Institute:

The SDI conducted tests of G60, G90, and primed steel deck in contact with ACQ and Copper Azole preservative-treated lumber and also evaluated the corrosion performance with a barrier between the pressure (preservative) treated lumber and the steel specimens. The barriers were 30 pound felt paper and water/ice shield. Using the AWPA procedure E12 “Standard Method for Determining Corrosion of Metal in Contact with Treated Wood”, the SDI found the following:

“The results of this study found that the use of water and ice shield material was most effective in preventing a corrosive reaction between any of the steel products tested and either type of pressure treated lumber. Effectively, there was no surface

damage where the water/ice shield contacted the metal or painted surfaces. The use of 30 pound roofing felt was somewhat effective in minimizing the corrosion of the various steel products, but does not appear to offer substantial improvement over direct metal to wood contact. Direct contact with the pressure treated lumber grades had the anticipated effect of corrosion on both the galvanized products and the painted steel materials in that the zinc coating and/or the paint and the base steel were damaged by direct contact with the treated lumber.”⁽⁸⁾

As a result of this research, the Steel Deck Institute recommends a barrier of water-and-ice shield or equivalent be used between pressure treated lumber and steel deck products or accessories.

Summary

Based on the information and testing experience gathered from a variety of sources, it is clear that the use of any of commercially available copper-containing preservative-treated lumber in direct contact with certain metal products could lead to accelerated corrosion and affect the long-term integrity and performance of a metal roof or wall system. The most effective way to avoid corrosion is to ensure that the treated lumber used is either manufactured using the newer carbon-based preservatives (Ecolife® or PTI), micronized copper preservative (MCA or MCO) treatment or that there is a separation between the metal roof or wall panel and the pressure (preservative) treated wood with some type of barrier material. (The preservative-treated lumber manufacturer should always be contacted to verify that the material may be used in contact with the intended metal components.)

The Metal Construction Association suggests that, unless specifically treated with metal-free preservatives or some of the newer technologies, copper-containing preservative-treated lumber should be separated from metal roof or wall panels and accessory materials by a barrier membrane material between the metal panel and

the wood substrate. In those installations, the choice of compatible metal fasteners is also critical to the integrity of the metal roof or wall assembly.

The Metal Construction Association will continue to monitor the recommendations from the wood preservative industry before and inform the market as further developments are made and validated.

References

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- (6) *Pressure-Treated Wood for Post-Frame Construction*, published by the National Frame Building Association.
- (7) *The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing* published by the National Roofing Contractors Assoc., 2014.
- (8) *Steel Deck Products in Contact with Pressure Treated Lumber*, Steel Deck Institute Position Statement, August 2006.

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- Technical guidance
- Product certification
- Educational and awareness programs
- Advocating for the interests of our industry

- Recognition of industry-achievement awards
- Monitoring of industry issues, codes and standards
- Research to develop improved metal construction products
- Promotional and marketing support for the metal construction industry
- Publications to promote use of metal wall and roof products in construction

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