Innovation MgO

Technical Bulletin

Corrosion Resistance of MgO Panels

Background

Two types of magnesium oxide (MgO) cement panels prevail in today's market: magnesium oxychloride (MOC) and magnesium oxysulfate (MOS). These variants are differentiated based on the type of reactant salts used in panel production.

$$\text{MgO} + \text{Reactant Salt Brine} \rightarrow \begin{cases} (MgCl_2 + H_20) & \text{MOC} \\ \text{or} & \\ (MgSO_4 + H_20) & \text{MOS} \end{cases}$$

Concerns of MgO panels on exterior walls causing corrosion of metal fasteners and studs originate from past project failures involving poorly formulated MOC panels installed without weather protection. Because of these past failures, MOS panels gained popularity with claims of being "chloride free" and "corrosion resistant".

In fact, MOS panels have the same risk of corrosion as MOC panels when these two conditions occur:

1. The MgO panel is poorly formulated; and,
2. Improper installation on exterior walls causes continual water or moisture intrusion.

Research and development by the MgO industry has progressed immensely in recent years. This work has yielded new codes and standards, modern formulations, and installation practices that yield high quality boards without any greater risk for corrosion than the sheathing products they replace, such as wood and gypsum.

Corrosivity of Low Quality MgO Panels

Corrosion is largely attributed to unreacted salts, a condition that is preventable under proper material formulation and stringent manufacturing quality practices.

Whether the board is chloride-based or sulfate-based has little bearing on corrosion resistance. Instead, corrosion risks stem from intrinsic factors in the manufacturing process regarding mix design, curing conditions, dominant hydration products, and corresponding chemical stability.

A second cause results from the absorption and capillary transport of excess water during panel installation and post construction. In these instances, an MgO panel's corrosivity is governed by matrix porosity, fillers, and additives – not the reactant salt. Improper installation and prolonged unprotected exposure are the most common culprits.

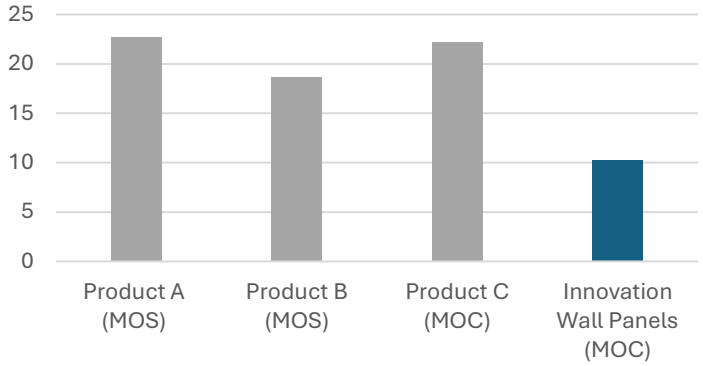

Fig. 1. Water absorption by ½" MgO wall panels in accordance with AC386 and ASTM C1185

As with other materials such as gypsum and wood, MgO panels are inherently hygroscopic, meaning they adsorb moisture from the ambient air. Panels with high levels of unreactive salts show aggressive adsorption. These salts dissolve into this coalescing moisture, forming corrosive saline solutions that are ultimately expressed on the panel's surface. This is known as deliquescence or "weeping" and is observed in poorly formulated MOC and MOS products. This is the phenomenon that has drawn attention to past failures that were ultimately traced to flawed formulations and lack of quality practices.

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Proper Moisture and Water Management
Quality MgO panels resist degradation due to intermittent water exposure during construction and proper in-service use. Magnesium oxide also safely stores water vapor while enabling effective drying. When used in exterior wall applications, MgO panels, like wood and gypsum products, should be protected by a code-approved water resistant barrier (WRB). Quality practices also include treatment of panel joints and fastener heads. Doing so is a critical step for ensuring proper moisture management and long service life.

How is Corrosion Resistance Determined?
Criteria for corrosion resistance of MgO panels are detailed in AC386. These methods follow AWPA E12 guidelines for determining compatibility with common construction metals, including fasteners. For code acceptance, the panel must demonstrate corrosion resistance of ≤ 20 mils/year for Severity Rating 1 as well as for Severity Rating 2 or 3, depending on intended use. The explicit requirement for Severity Rating 1 addresses intrinsic resistance in addition to potential deliquescence.

END USE SEVERITY RATING	TEST CONDITIONS
1	90°F (32°C) and 90-percent relative Humidity for a minimum of 366+/- 6 hours. No visible moisture should be observed during the period.
2	Water-spray testing in accordance with ASTM B117 for a period of 366 +/- 6 hours. Water type: distilled water.
3	Water-spray testing in accordance with ASTM B117 for a period of 366 +/- 6 hours. Water type: saltwater.

See AC386 Appendix A for additional information

Steps to Ensure Quality MgO Panels
Selection of MgO panels should be based on proper documentation such as code listings and evaluation reports for their intended use and anticipated exposure. Like many other building products, not all MgO panels are formulated for noncombustible construction requirements or coastal environments. Select suppliers and manufacturers that provide detailed evidence of their abilities to meet rigorous manufacturing standards – such as AC386 and the newly added Corrosion Standard found in Appendix A. Suppliers should also demonstrate adherence to third-party quality assurance programs as validation of formulation consistency and criteria compliance.

Corrosion Potential of Innovation MgO
In completing its ICC-ES Evaluation Services Report (ESR), Innovation MgO™ 1/2" Wall Panels passed the newly established industry standards for corrosion testing of MgO panels by meeting the AC386 criteria of less than 20 mils per year – a litmus test for many exterior sheathing panel products including fire-retardant treated wood materials.

The corrosion test results validate the approved use of Innovation MgO Wall Panels for homes and buildings in coastal environments. In fact, panels are approved for all exposure conditions with no limitations in wet conditions. Short-term and intermittent water exposure will not damage the panels during and after construction, saving valuable time and money when compared to wood and gypsum panels.

Evaluation of Corrosion Effects for Innovation MgO 1/2" Wall Panels in Contact with Common Construction Metals

END USE	METAL TYPE
Interior Walls, Exterior Walls in Non-Coastal Regions, Interior Wet Areas, or Exterior Walls in Coastal Regions	G90 (Z120) Zinc-coated Galvanized Cold-Formed Steel (ASTM A653)
	G60 (Z180) Zinc-coated Galvanized Cold-Formed Steel (ASTM A653)
	G40 (Z275) Zinc-coated Galvanized Cold-Formed Steel (ASTM A653)
	85-15 Red Brass
	2024-T3 Aluminum Alloy

See ESR-5418 for additional information

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