



Corrosion Performance of Metallic Coated Steels



ArcelorMittal

Galvalume™ is a metallic coated steel product that has proven its superior performance as a building material in extended field tests across a diverse range of corrosive environments. The coating – an alloy composed of 55% aluminum and approximately 45% zinc by weight – is applied to both sides of a cold-rolled steel sheet using a precise, continuous hot-dip process. The resulting product provides the barrier protection and extended durability of aluminum with the galvanic protection of zinc.

Corrosion Performance of Galvanized (GI), Galfan™ (GF), Galvalume™ (GU) and Magnelis™ (ZM)* Metallic Coated Steels



After 27 years, polyester pre-painted Galvalume steel (right) withstands harsh environments and remains corrosion free, while polyester pre-painted Galvanized steel (left) succumbs to visible corrosion.

Bare or painted, the measure of any metallic coated steel's durability is its resistance to corrosion. Metallic coated steels offer two important layers of protection to the underlying steel.

The first layer of defense is the barrier protection. For zinc-rich coatings, as is the case with Galvanized, Galfan and Magnelis, the coating provides an impervious barrier to the steel substrate. However, since zinc is highly reactive it also oxidizes and corrodes (although more slowly than the steel) and eventually over many years erodes away. Coatings containing aluminum, on the other hand, form a much more durable oxide layer. For example, Galvalume's high aluminum content means more aluminum oxide is formed, resulting in a more stable, more tightly adhering and more non-corroding barrier.

The second layer of defense is the galvanic protection. Zinc essentially sacrifices itself (oxidizes) to protect the steel substrate. Therefore, the more zinc, the greater the protection.

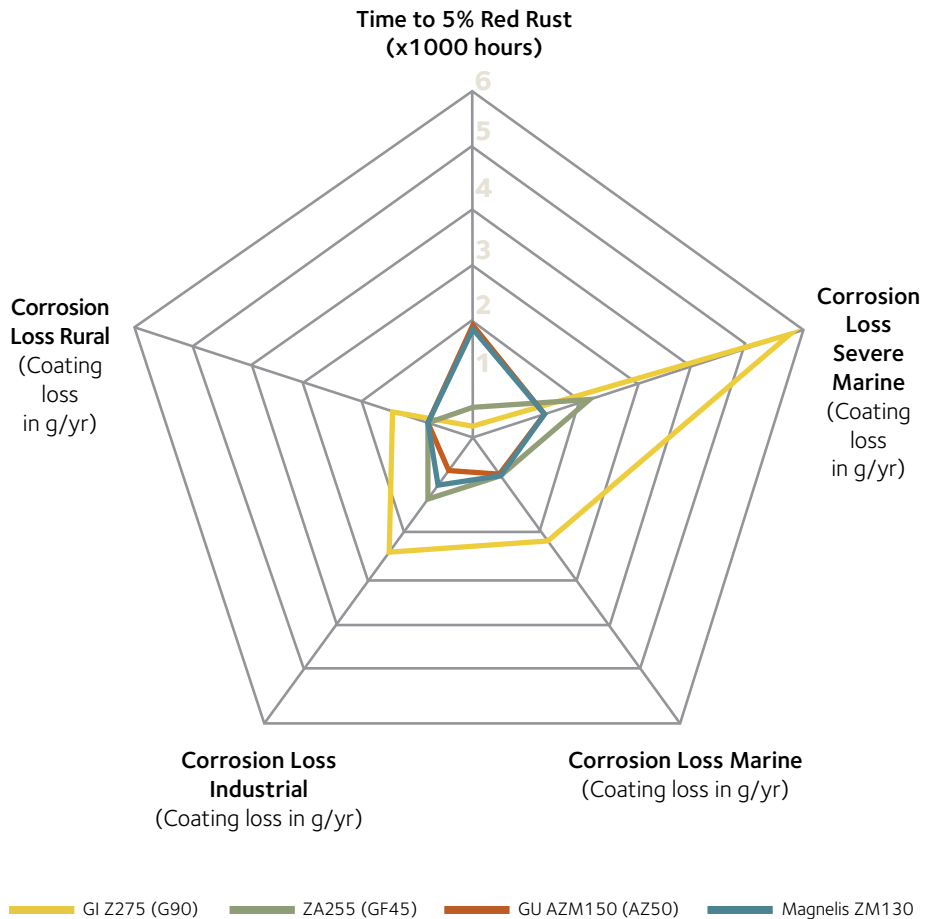
Now, consider the life of a Galvalume coating. It clearly exhibits less galvanic protection than a galvanized coating. However, being less galvanic in nature, a Galvalume coating is less reactive. This is one reason why the life of this coated product is considerably longer in most cases than a galvanized coating of comparable thickness. This behaviour of a 55% aluminum zinc alloy coating is the reason why it is being used successfully for bare roofing applications.

TEST #1: Flat Surface Corrosion

Galvalume outperforms in all macro environments.

In accelerated and natural exposure testing that focuses on the as-produced flat surface of the strip, bare Galvalume outperforms all similar bare metallic coated steels in all macro environments. However, there are specific niche applications where

it should not be used, particularly alkaline (basic) environments such as against wet concrete and for animal confinement. The high aluminum content in the Galvalume coating provides superior protection in acidic environments (acid rain) making it a superior choice in industrial applications.



* Magnelis™ is a new ZnAlMg coating developed by ArcelorMittal.

(Similar coating thicknesses)

TEST #2: Cut Edge Corrosion

Galvalume resists cut edge and scratch corrosion.

Cut edges of bare or pre-painted metallic coated steels will show red corrosion rather quickly when exposed to the environment. While expected, this is not an indication of the durability of the material. Any exposure of the underlying steel, due to a cut edge or severe scratches, will not result in corrosion of the steel until the adjacent metallic coating has been consumed. A little time is needed before the metallic coating can work its magic and "flow" over these cut edges to protect them from further corrosion. How effectively each type

of metallic coated steel does this largely depends on the thickness of the material and width of the scratch. In the case of products used in cladding and roofing applications it becomes a non-issue. Cladding designs tend to hide cut edges, which reduce corrosion.

Of the other three coating types, Magnelis most effectively suppresses cut edge corrosion on heavy gauge materials (>2mm/.079").



Scribe on polyester pre-painted Galvanized steel roof after 28 years of industrial exposure.



Scribe on polyester pre-painted Galfan steel roof after 28 years of industrial exposure.



Scribe on polyester pre-painted Galvalume steel roof after 28 years of industrial exposure.

TEST #3: Long-Term Performance In Natural Exposure

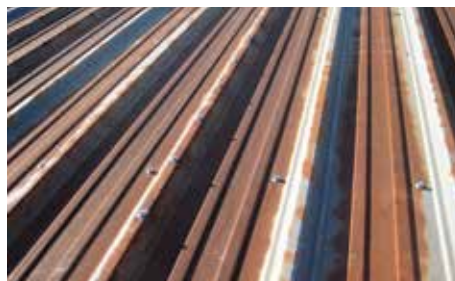
Galvalume continues to show excellent durability and superior corrosion resistance in a variety of environments in both bare and painted applications.

After more than 25 years of exposure testing in Canada and even longer in the U.S., covering a range of environments from severe marine to industrial to rural,

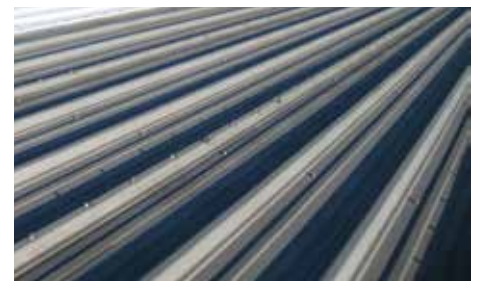
Galvalume sheet steel has been proven to have at least twice the service life of galvanized steel. And also significantly outperforms Galfan. The photos below show Galvalume, Galvanized and Galfan products on the same roof in an industrial environment after 28 years of exposure. The images speak for themselves.



Bare Galvanize steel roof after 28 years of industrial exposure.



Bare Galfan steel roof after 28 years of industrial exposure.



Bare Galvalume steel roof after 28 years of industrial exposure.

Which metallic coating offers the best protection against corrosion?

The answer to this question depends entirely on the specific application. That said, Galvalume always deserves serious consideration. Comparative testing by many producers around the world continues to show the superior performance of Galvalume in the majority of environments. At ArcelorMittal Dofasco, our research teams investigated the attributes and performance of Galvalume more than 25 years ago. Our work determined that Galvalume would outperform both Galvanized and Galfan and its proven performance enables us to provide a 25-year warranty on this remarkable product.

This field of technology has many aspects that cannot be fully addressed in a product piece such as this. If you have further questions on this very extensive subject, please contact your ArcelorMittal sales representative.

	Surface Protection (bare)*	Protection (painted)*	Corrosion Performance in Alkaline Environments	Cut Edge Performance (bare)*	Cut Edge Performance (painted)	Coating Formability*	Long Term Performance in Natural Exposure (bare)*	Metallic Appearance Retention (unpainted)*	Electric Resistance Welding	Temperature Resistance	Solar Heat Reflectivity*
Galvanized (GI)	+	+	+	++	++	++	+	++	++	+	+
Galfan™ (GF)	++	++	+	++	++	+++	+	+	+	+	+
Galvalume™ (GU)	+++	+++	-	+	+++	+	+++	+++	+	++	+++
Magnelis™ (ZM)	+++	pre-paint not available	+	+++ t>2mm	pre-paint not available	+	insufficient data	+	+	+	+

*Represents attributes required by construction building products

The world's leading steel company

ArcelorMittal is the number one steel company in the world with 260,000 employees in more than 60 countries and an industrial presence in 27 countries across Europe, the Americas, Asia and Africa.

The company holds large captive supplies of raw materials and leadership positions in all major global customer segments: automotive, construction, household appliances and packaging.

At the heart of ArcelorMittal's strategy is our commitment to sustainable development and our ambitions to be a benchmark for economic performance, labour relations and social responsibility. Our vision is "To be the World's Most Admired Steel Company."

ArcelorMittal Dofasco

Box 2460, 1330 Burlington St East
Hamilton, ON L8N 3J5
Canada

T 1-800-816-6333

E customer-inquiries.dofasco@arcelormittal.com

ArcelorMittal USA

1 South Dearborn St
Chicago, IL 60603
USA

T 1-800-422-9422

E constructioninquiries@arcelormittal.com

www.arcelormittal.com



ArcelorMittal Dofasco steel is certified to Ecologo^M standard CCD-150 "Steel for Use in Construction Products"



Building products made with ArcelorMittal Dofasco steel promote a healthy indoor air environment.

TM - ArcelorMittal (Logo/Slogan) is a trademark of ArcelorMittal.
TM - Solutions in Steel is a trademark of ArcelorMittal Dofasco.
TM - Galfan is a trademark of Galfan Technology Centre.
TM - Magnelis is a trademark of ArcelorMittal.

TM - Galvalume and Galvalume Plus are trademarks of ArcelorMittal in Canada, and are trademarks of BIEC International Inc. in the United States.

Our product is steel. Our strength is people.[®]
February 2013