



ArcelorMittal

Magnelis®

High-level corrosion protection in agricultural environments



Magnelis® is an exceptional steel coating which provides superior corrosion protection. Steels coated with Magnelis® are highly suitable for agricultural equipment, agricultural buildings, silos, animal confinement and greenhouses.

Farming equipment and buildings are often at risk of accelerated corrosion due to condensation and/or the aggressive atmospheres found in agricultural buildings. These conditions can include aggressive pH levels (especially alkaline), high humidity and high concentrations in corrosive chemicals such as ammonia.

The surrounding environment can also play a part, particularly if the building is located in a marine or tropical climate. These factors can impact equipment durability, agricultural building or silo's structural integrity, as well as its external appearance.

What is Magnelis®?

Thanks to its unique composition, Magnelis® provides an unprecedented level of surface and cut-edge corrosion protection, even in the most hostile environments.

Magnelis® is produced on a continuous hot dip galvanizing line. The molten bath has a unique zinc-based composition, which includes 3.5% aluminum and 3% magnesium.

This innovative coating alloy, compatible with high strength steels, is an ideal solution for durable tubes, frames, structures, ducts, supports, containers, wall panels, roofing, and accessories in agricultural environments and silos.

What is unique about Magnelis®?

- Corrosion protection - sacrificial and barrier
- Self-healing effect/cut-edge and scratch protection
- Very good corrosion protection in aggressive environments
- Improved protection of welded zone

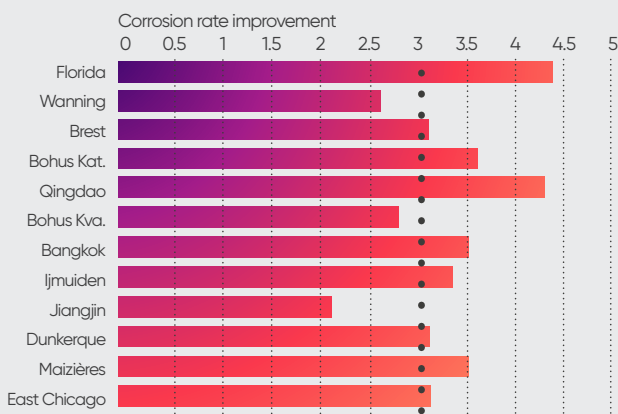
More than a thousand Magnelis® samples have been exposed to a variety of different environments around the world in outdoor tests. Every test has confirmed the optimal protection provided by Magnelis® against long-term corrosion.

Magnelis® offers at least twice the corrosion resistance of continuously hot dip zinc coated steel in all types of environments. In very aggressive environments, the performance of Magnelis® is even higher.

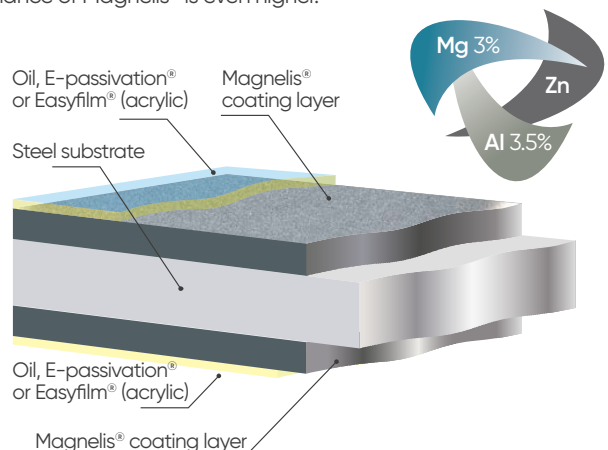
Key role of magnesium:

3% of Mg in the composition of the metallic coated steel ensures a stable barrier effect on the coating surface and significantly reduces the corrosion rate

Improvement factor between Magnelis® and continuously hot dip zinc coated steel in field testing

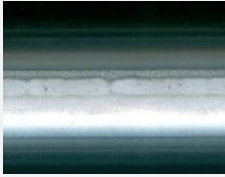
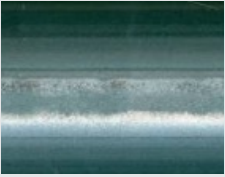
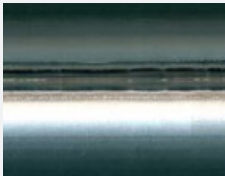
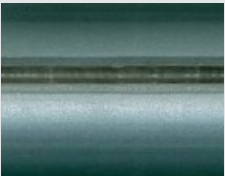
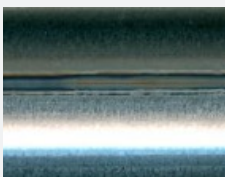

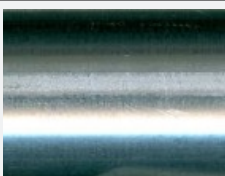
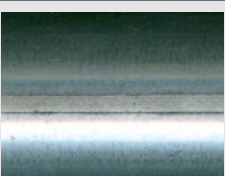


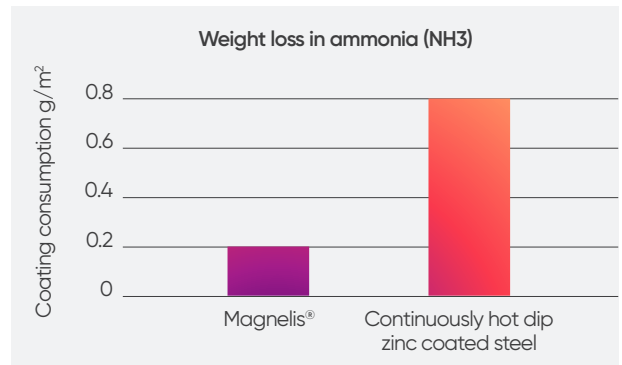
Average improvement: ~ 3 compared to continuously hot dip zinc coated steel



Magnelis® testing in agricultural environments

Lab tests - Magnelis® & continuously hot dip zinc coated steel flat samples & tubes Resistance to ammonia (NH₃)

Sample	Before NH ₃ -test	After 24h NH ₃ -test
Sample 1 Magnelis® with Al-Zn weld reprotection		
Sample 2 Magnelis® with no weld reprotection		
Sample 3 Continuously hot dip zinc coated steel with no weld reprotection		
Sample 4 Continuously hot dip zinc coated steel with Al weld reprotection		



Flat samples were put into 5 wt% ammonia in water solution at 20°C for 24 hours, then rinsed with water and weighed again

- No major changes were seen in the surface appearance of the samples.

The same test was also done on tubes.

- No major changes were seen in the surface appearance of the tubes.

- Magnelis® tubes lost around 4 times less weight (between 0.11 and 0.21 µg/cm²) than continuously hot dip zinc coated steel tubes (between 0.42 and 0.78 µg/cm²)

Magnelis® has demonstrated excellent behavior in 5% ammonia in water, 24 hour immersion test



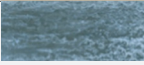


- Magnelis® ZM120 tubes (10 microns coating) samples 1 & 2

- Continuously hot dip zinc coated steel tubes G90 (20 microns coating) samples 4 & 5

- Magnelis® with half the coating thickness performed better than continuously hot dip zinc coated steel

Resistance to humidity

To simulate hot and humid environments such as greenhouses, we use a 3CT cyclic corrosion test, which includes testing at 104°F (40°C)/95% relative humidity and 68°F (20°C)/70% relative humidity.

	Magnelis® 20 microns	Continuously hot dip zinc coated steel 20 microns
1 cycle		
6 cycles		
52 cycles		removed after 6 weeks (42 cycles)

Continuously hot dip zinc coated steel samples exhibited significant red rust after only 6 cycles of cyclic corrosion testing whereas **Magnelis® exhibit no red rust until 52 cycles.**

Resistance to scratches

Material	Coating hardness (HV)
Continuously hot dip zinc coated steel	64
Magnelis®	141

Coating hardness has a direct impact on the abrasive wear resistance of the coating.

Magnelis® behaves better than continuously hot dip zinc coated steel in agricultural environments thanks to its higher scratches resistance.

Field tests

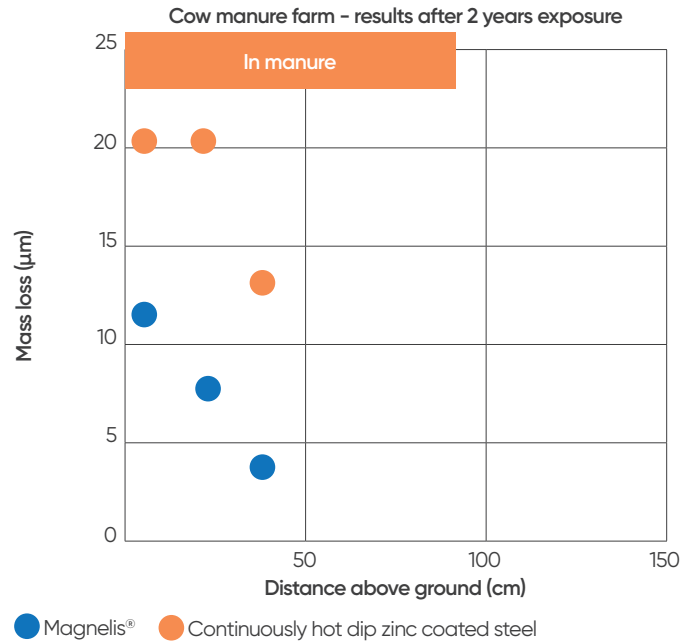
Magnelis® was tested in actual farms in collaboration with the French Corrosion Institute, an external independent laboratory.



Test conducted in a cow farm - manure storage area

Cow farm - manure results:

Magnelis® and continuously hot dip zinc coated steel samples were placed for 2 years at different depths in cow manure



At equivalent depths in cow manure, continuously hot dip zinc coated steel corrosion was 2 to 3 times higher than Magnelis®

Results in a pigsty:

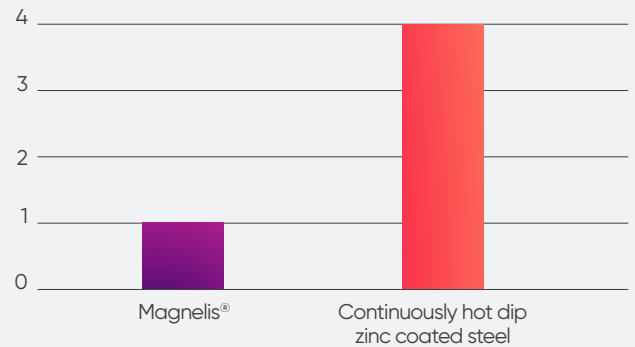
Samples placed for 4 years near pigs



Test conducted in a pigsty

Pigsty - results after 4 years of exposure

Relative mean coating thickness consumption



Regardless of the thickness of the coatings, continuously hot dip zinc coated steel is consumed 4 times faster than Magnelis®

The superior performance of Magnelis® in agricultural environment is confirmed by farm field testing.

Magnelis® applications

Thanks to its high durability, high abrasion resistance, combined with a wide product range (from 0.016 up to 0.236 inches), Magnelis® is an ideal material for agriculture and farming. It can be used for a wide range of applications, such as: silos, barns, green house structures, vineyard poles, poultry equipments and water tanks.

Coating designation	ASTM A1046M	ZMM90	ZMM120	ZMM180	ZMM300	ZMM450	ZMM600
	ASTM A1046	ZM30	ZM40	ZM60	ZM100	ZM140	ZM210
Coating mass (total both sides)	g/m ²	90	120	180	300	450	620
	oz/ft ²	0.30	0.40	0.60	1.00	1.40	2.00
Coating thickness	µm/per side	7	10	14	24	36	50
	mils/side	0.28	0.38	0.55	0.94	1.41	1.95
Surface treatment	E-Passivation® (CrVI-free), Easyfilm® (acrylic), Oiled						
Thickness	0.016 to 0.236 inches (0.4 to 6.0 mm)						
Width	Up to 66 inches (1680 mm)						
Steel grades*	CS Type A, B and C Grades 50 up to 100 (including high-elongation grades)						

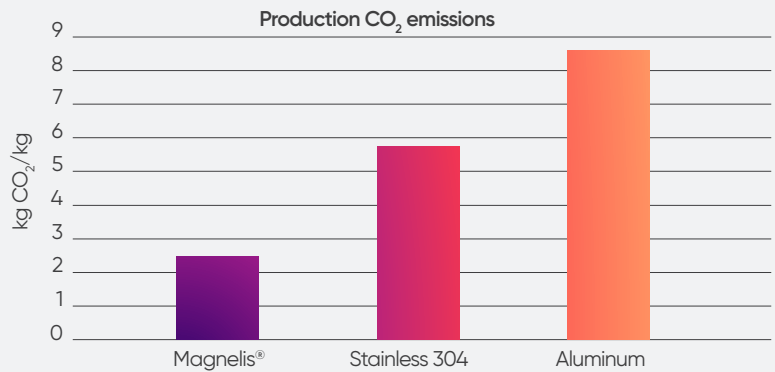
* Contact us for detailed feasibility, other coating weights on request.

XCarb®

Recycled and renewably produced

Magnelis® also results in lower environmental impact during its production, its use and its end-of-life.

Magnelis® is REACH compliant and infinitely recyclable. Furthermore, Magnelis® is available as XCarb® recycled and renewably produced steel with a CO₂ footprint that is 70% lower than steel produced via the conventional blast furnace route.



Magnelis® has a lower produced environmental impact than other highly durable materials such as stainless steel or aluminum

Magnelis® vs. continuously hot dip zinc coated steel

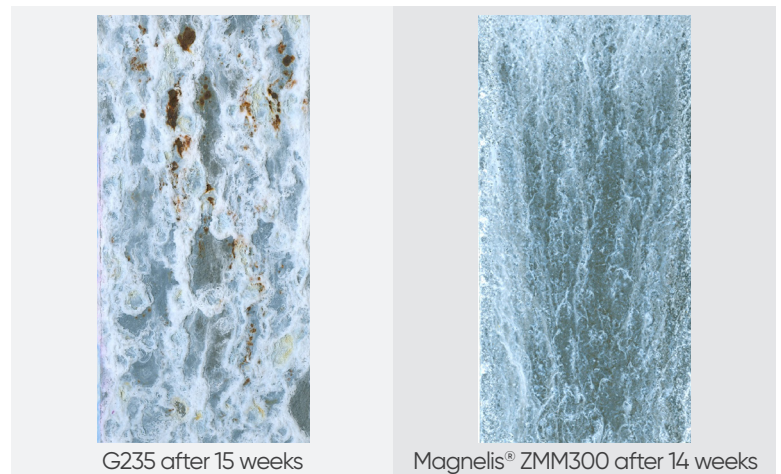
Thanks to its unique composition, Magnelis® is confirmed to perform in average 3 times better than continuously hot dip zinc coated steel.

Continuously hot dip zinc coated steel according to ASTM A653	Magnelis® according to ASTM A1046M (Type 2)
G90	ZMM120
G185	ZMM250
G235	ZMM310

Choosing Magnelis® means:

- Improved cut-edge protection
- Better workability (forming, welding, painting)
- Maintenance cost reduction
- Better protection after deformation

Samples after salt spray testing according to ASTM B117 standard



Visit the Magnelis® homepage at industry.arcelormittal.com/magnelis



Any questions?
Ask them via our contact form on industry.arcelormittal.com/getintouch



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