ADDAPT
Chemicals BV

for tomorrow's
Technology

Protective Coating Additives

for tomorrow's
World

Introduction

Protective coatings for light-, mid- and heavy duty applications usually consist of traditional primer and topcoat systems. For many years, these multi-coat systems have proven to be very effective. But latest trends in the coating market show growing interest and demand in mono-coat systems. These so-called direct-to-metal (DTM) systems eliminate several applications steps. These systems are also able to reduce cost by saving the amount of raw material. DTM systems, however, do not yet exhibit the desired properties required for heavy-duty systems thereby limiting them to lighter duty systems.

ADDAPT offers several additives for DTM coatings, improving coating properties allowing them to be used for heavier duty systems. This brochure covers the following products that enhance your (current) DTM formulations:

- Adhesion can be challenging for DTM coatings especially for acrylic resins. Adhesion plays also an important role in the protection of the metal substrates. Poor adhesion leads to exposure of moisture and oxygen and eventually, corrosion which causes the failure of metals. **VeoPox™ - adhesion promoters** improve adhesion through a novel class of hybrid polymer technology. Hybrid polymers are prepared by bringing together different polymer functionalities to create polymers with beneficial properties of the combined chemistries.

- Corrosion is an undesirable process, as it usually leads to the destruction of metals. **Anticor™ - corrosion inhibitors** passivate metal substrates by their unique chemical structures. These inhibitors contain metal-affinic groups and hydrophobic tails; upon formation of a passivation layer, it improves the barrier properties of the coating and ensuring long term corrosion protection.

- Flash rust is a fast forming corrosion type which occurs when bare iron is exposed to water and oxygen. Depending on the type of iron, spots or complete areas can turn into orange-brown coloured stains within minutes. **Ferrocor Flash™ TN - flash rust inhibitor** prevents the access of moisture and oxygen to iron substrates through the coating and stops flash rust.

In order to protect already rusted metal surfaces, a protective primer layer can be applied to inhibit further corrosion and enables an easy recoat. **Anticor™ RCP - rust conversion primer** combines excellent rust converting properties with strong adhesion to metals. It consists of an acrylic resin – epoxy hybrid blend with rust converting additives. Anticor™ RCP can be applied directly onto rusted substrates to convert the rust into an anticorrosive complex and thus passivating the substrate for further corrosion.

Application of ADDAPT® additives in DTM coatings

VeoPox™ can be used as additives giving excellent adhesion and corrosion protection in systems like:

- Solvent-based systems/high solid/solvent-free systems cured by peroxides or driers
- Solvent-free UV-curable systems
- Alkyd emulsions
- (Self-crosslinking)-acrylic, styrene/acrylic binders

It is also possible, for those skilled in the art, to incorporate VeoPox™ in acrylic, styrene/acrylic, and VeoVa™ polymer dispersions via mini emulsion/mass transfer techniques creating even more interesting chemical hybrid systems for water-based DTM applications.

Anticor™ corrosion inhibitors and Ferrocor Flash™ TN are readily soluble or dispersible in water. These additives can be used in various waterborne resin systems, such as (self-crosslinking) acrylics and styrene/acrylics.

The formulation below shows a high-performing DTM formulation with several ADDAPT® additives. **More starting point formulations are available upon request.**

	Component	Function	%
1	Demineralised water		6.13
2	Acticide LA1209	Biocide	0.10
3	**ADDISP™****	**Dispersant**	**0.55**
4	**CODIS™ 95**	**Neutralisation agent**	**0.05**
5	**Foamstop™ VF 35N**	**Defoamer**	**0.18**
6	Tronox CR826	Titanium dioxide	17.01
7	Calcium carbonate (5µm)	Filler	6.74
8	**VeoPox™**	**Adhesion promoter**	**4.09**
9	(Styrene)- acrylate emulsion	Binder	55.11
10	Glycol (ether)	Co-solvent	2.56
11	Rheovis mix*	Thickening agent	5.11
12	**Ferrocor Flash™ TN**	**Flash rust inhibitor**	**1.02**
13	10% Oxycoat 1101	Drier	1.02
14	**Foamstop™ VF35N**	**Defoamer**	**0.31**
15	Demineralised water		5.13
16	**Anticor™**	**Anti-corrosion agent**	**1.00**
	Total		**100.00**

* mix consist of 12.5% Rheovis PE1320, 4.2% Rheovis PU1214, 83.3% Water
** ADDISP™ 600N or 950

	Typical properties	Unit	
	Density	g/cm^3	1.23
	Viscosity (25 °C, 50 RPM)	KU	90-100
	PVC	%	21

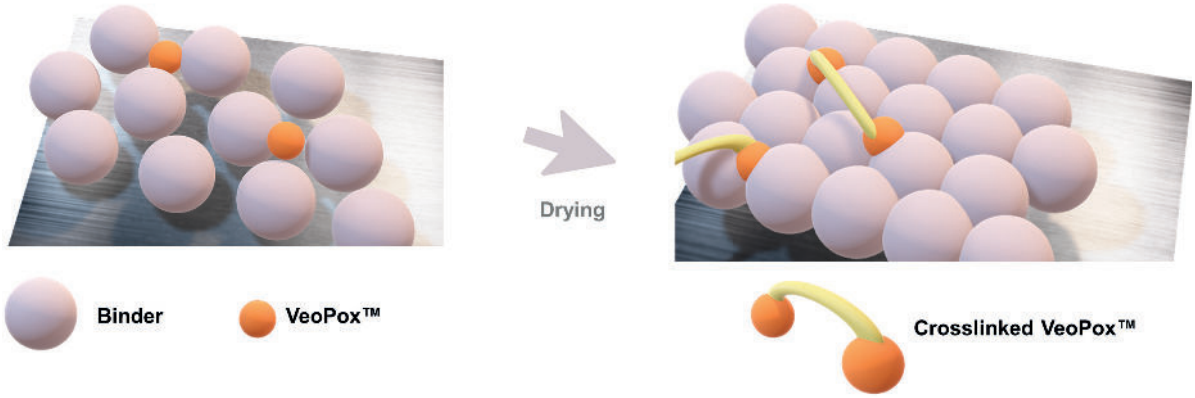
VeoPox

Improve DTM coating performance with VeoPox™

VeoPox™ is a reactive hybrid precursor that consists of fatty acid, phosphate and methacrylate modified bisphenol A- or F- based epoxy resin with VeoVa™ 10 reactive diluent.

The phosphate moiety in VeoPox™ improves the adhesion of waterborne coatings to metal substrates through non-covalent bonding interactions with the surface. The modified bisphenol A or F epoxy resins provide improved chemical resistance, enhanced impact strength and impact toughness. The fatty acid improves the toughness of the coating. The VeoVa™ 10 reactive diluent imparts low surface tension, pigment affinity, hydrophobicity and UV resistance.

Besides the improvement of adhesion by bonding interactions of VeoPox™ to metal, it also provides an improvement in the film-forming properties. Binders, typically, form a film upon packing of particles. Followed by coalescence of particles and eventually, a continuous film is formed. During film formation polymers will entangle, the presence methacrylate groups in combination with reactive diluent VeoVa™ 10 further improves the crosslink density. The crosslinking process is accelerated by the presence of a drier. This eventually leads to enhanced film-forming properties and chemical resistance of the coating.



Schematic depiction of VeoPox mechanism during the film formation process

Main mechanisms of VeoPox™ that aids the performance of a protective coating:

- Increasing crosslink density by the methacrylate groups and VeoVa™ 10
- Enhance adhesion to metal by phosphate moieties
- Better chemical resistance upon incorporation of bisphenol based epoxy resin
- Increase corrosion resistance due to increasing coating hydrophobicity

Key products

VeoPox™ 2 is a fatty acid, phosphate and methacrylate modified bisphenol A based epoxy system with VeoVa™ 10 as a reactive diluent. Bisphenol A based epoxies are the workhorse for the majority of epoxy coatings for steel. It is used extensively because of its excellent adhesion, toughness, wear resistance and chemicals resistance.

VeoPox™ 3 is a fatty acid, phosphate and methacrylate but modified with a bisphenol F based epoxy system with VeoVa™ 10 as a reactive diluent. bisphenol F resins are gaining steadily ground in civil engineering applications due to their improved chemical resistance properties, impact toughness and impact strength. Relatively to bisphenol A resins, bisphenol F types show lower viscosity.

VeoPox™ 2S and **VeoPox™ 3S** are the silane-modified version of VeoPox™ 2 and VeoPox™ 3 respectively. It is a fatty acid, phosphate modified bisphenol A or F epoxy resin with reactive functionalities. It gives excellent adhesive and anti-corrosion properties to metal surfaces.

VeoPox

Key advantages of VeoPox™

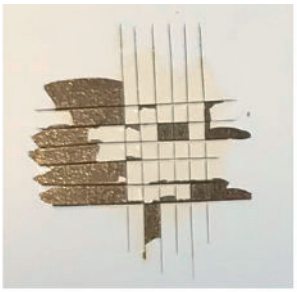
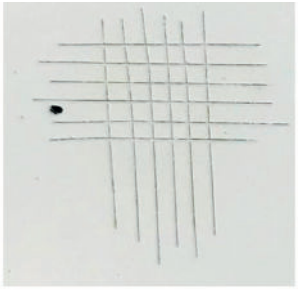
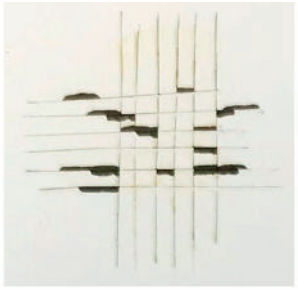
VeoPox™ can be incorporated in several ways, i.e. post addition to your formulation or during emulsion polymerisation. Through the incorporation of VeoPox™ in the protective layer, it provides the following benefits for your system:

- Minimise blistering of coating
- Excellent anticorrosive performance
- Protection of several metal substrates
- Great compatibility and synergy with the Anticor™ range

Improve coating adhesion

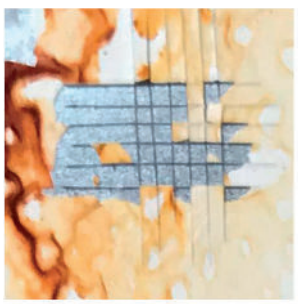
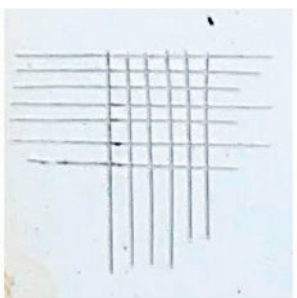
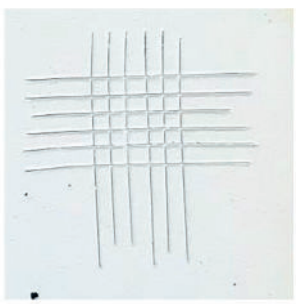
VeoPox™ provides excellent adhesion to metal substrates. It can withstand various circumstances, from mild humid to highly corrosive conditions.

1K Waterborne acrylic coating, DFT 50 micron, CRS

ISO 2409 after 1 hour waterspot (demiwater) test		ISO 2409 after 1 hour waterspot (5% NaCl) test	
			
Blank	4% VeoPox™ 2S	Blank	4% VeoPox™ 2S

Adhesion of coating with VeoPox™ 2S and VeoPox™ 3S is maintained, even after extensive exposure to salt spray.

1K Waterborne acrylic coating, DFT 100 micron, CRS

ISO 2409 after 1000 hours ISO 9227 salt spray test		
		
Blank	4% VeoPox™ 2S	4% VeoPox™ 3S + 1% Anticor™ A40

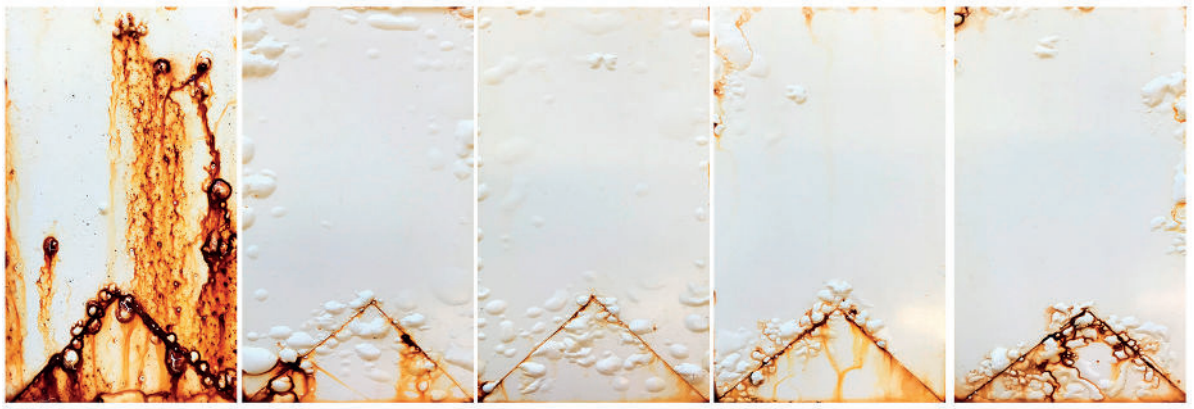
VeoPox

Reduce blistering and increase anticorrosive properties

Typical DTM coatings often start corroding and blistering under extreme conditions. VeoPox™, however, is able to improve film-formation of coatings. This results in improved resistance against blister and corrosion formation under humid and corrosive conditions. Salt spray exposure of 1440 hours (60 days) can be achieved with VeoPox™ without the formation of severe corrosion and blisters in the coating.

1K Waterborne styrene-acrylic coating, DFT 110 micron, CRS

ISO 9227 Salt spray test after 1443 hours

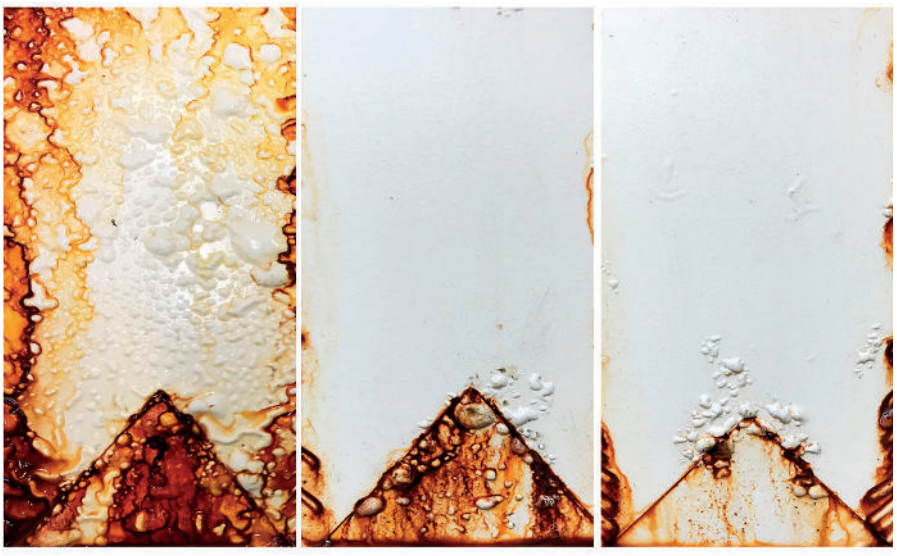


Blank | 4% VeoPox™ 3 | 4% VeoPox ™ 2 | 4% VeoPox™ 3S | 4% VeoPox™ 2S

The anticorrosive properties of coatings are enhanced and the use of anti-corrosive pigment is not necessary. VeoPox™ and Anticor™ work synergistically well, improving performance by a great amount.

1K Waterborne acrylic coating, DFT 100 micron, CRS

ISO 9227 Salt spray test after 1000 hours



Blank | 4% VeoPox™ 2S | 4% VeoPox™ 2S+ 1% Anticor ™ A40

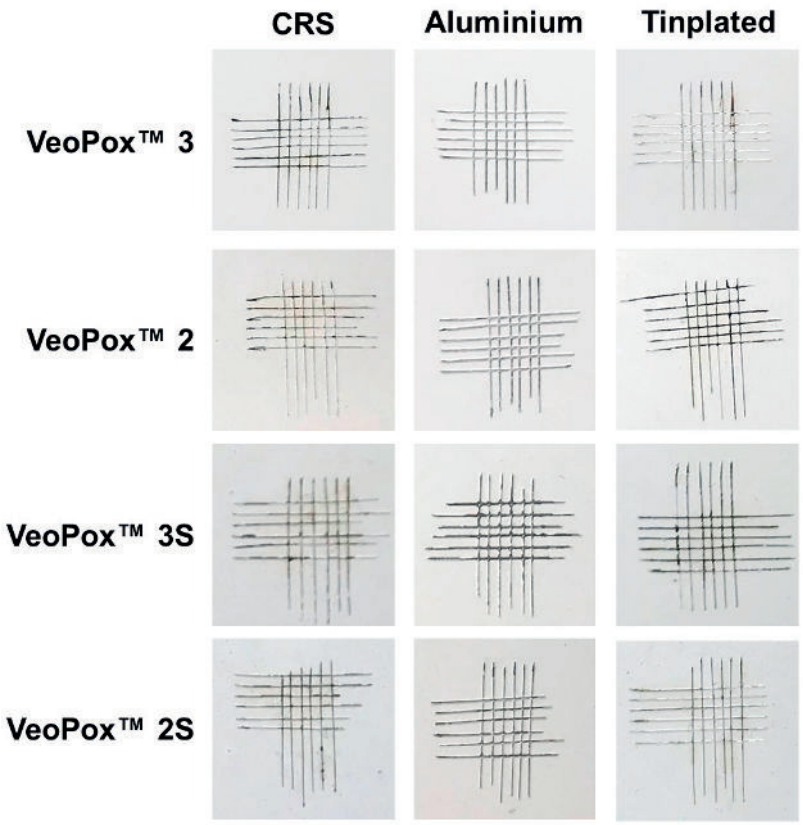
VeoPox

Multi-metal protection

VeoPox™ is a versatile adhesion promoter. Besides adhesion improvement of ferrous substrates, adhesion to other substrates such as aluminium and tinplated steel is also possible.

1K Waterborne acrylic coating, DFT 40 micron

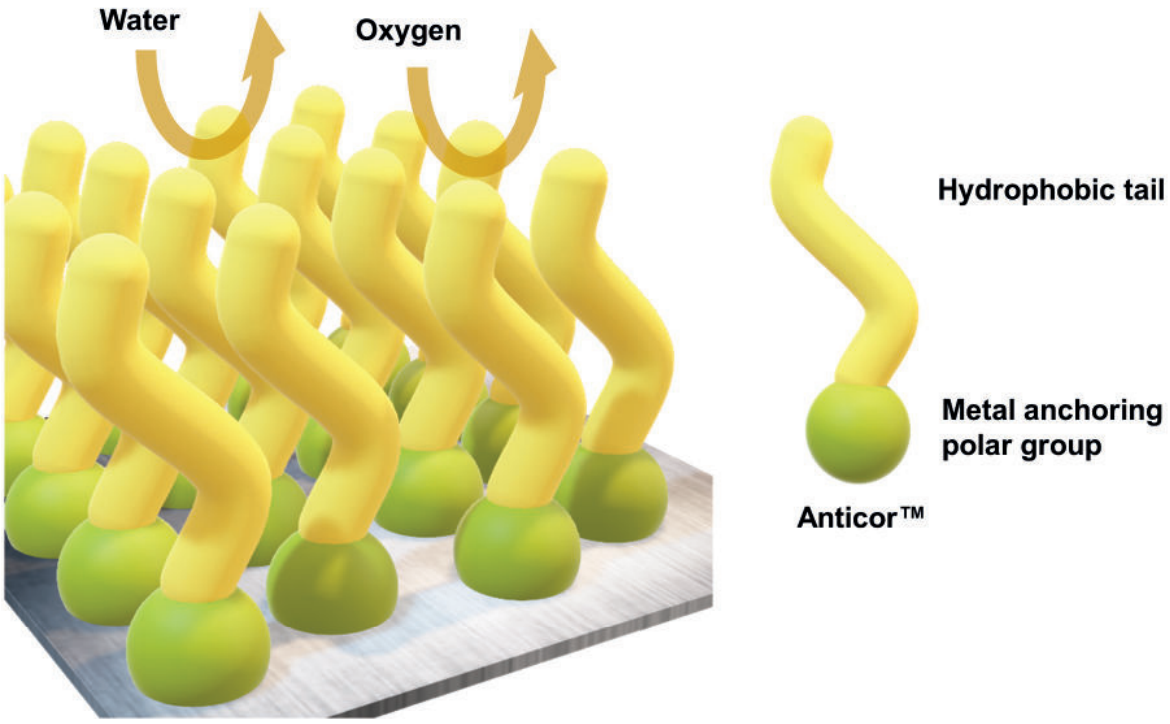
ISO 2409 after 1 hour waterspot (demiwater) test



Anticor

Improve anticorrosion performance with Anticor™

The Anticor™ F and P-series corrosion inhibitors are phosphate ester based anticorrosion agents that inhibits corrosion formation by passivation of the metal substrate. Its hydrophobic tail improves the barrier properties of the coating, and therefore, preventing water and oxygen from migrating to the metal surface. This will eventually inhibit the formation of corrosion.



Schematic illustration of the Anticor™ mechanism in a coating system

Key products

Anticor™ A40 is a label-free and biodegradable corrosion inhibitor. It gives outstanding rust prevention of ferrous substrates in both acidic and alkaline water-based systems. Anticor™ A40 can also be used for direct-to-metal coatings to protect iron-containing substrates from corroding.

Anticor™ A65N is a water-based ferrous corrosion inhibitor based on organic acids and silane technology. This inhibitor shows high compatibility and synergy with VeoPox™ in DTM coating systems.

Anticor™ C6N is based on a mixture of phosphate ester and surface-active ingredients that gives excellent passivating properties of various metal substrates. It is soluble in oil and dispersible in water.

Anticor™ FA-N is a mixture of surface tension active and phosphonate derivatives. It is a hydrophobic corrosion inhibitor with very good (self) emulsifying properties. Easy incorporation into formulation. It gives good gloss development and anticorrosive properties.

Anticor™ PQ is an oil-soluble multi-metal corrosion inhibitor based on phosphate ester technology. Suitable additive for usage in high gloss coatings, it also improves barrier properties through its hydrophobic component.

Anticor

Key advantages of Anticor™

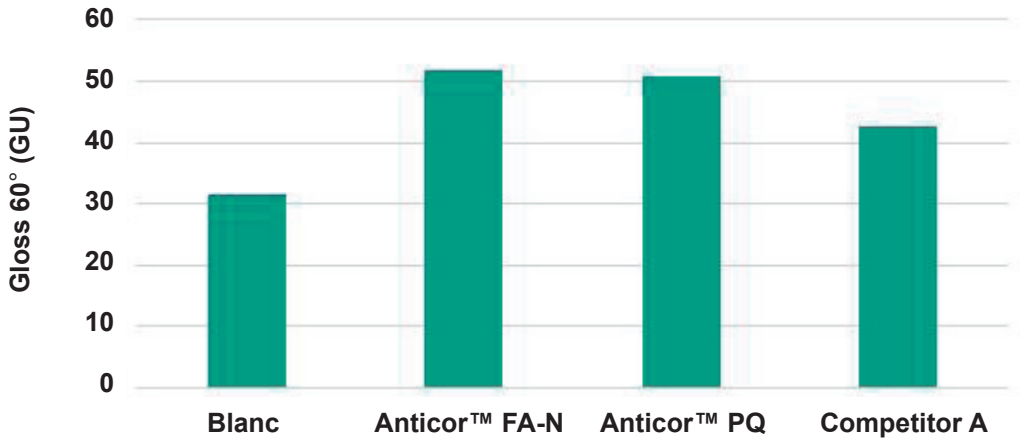
ADDAPT Chemicals offers a wide range of Anticor™ corrosion inhibitors for protective coatings. Application of Anticor™ in a DTM coating is beneficial in several ways:

- Improves gloss development
- Improves film forming properties
- Excellent anticorrosive performance
- Low to non-VOC inhibitors
- Efficient at low dosage

Excellent gloss development with Anticor™

Gloss development of coatings with Anticor™ F and P-series can be increased without altering its performance.

1K Waterborne styrene-acrylic coating, DFT 100 micron, CRS



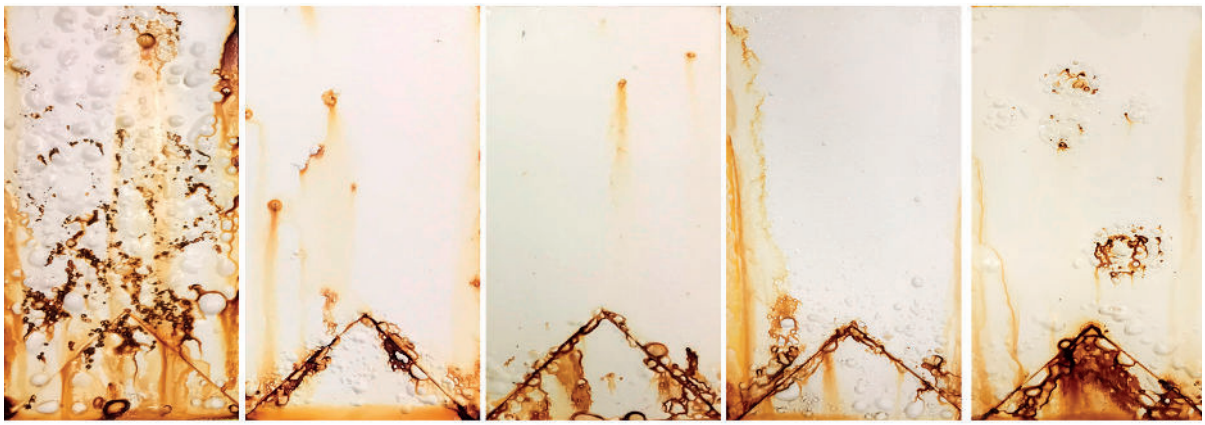
Anticor

Reduce blistering and increase corrosion protection

The hydrophobic characteristics of Anticor™ increase barrier properties of the coating. Metal substrates are well protected against corrosion formation.

1K Waterborne styrene-acrylic coating, DFT 100 micron, CRS

ISO 9227 Salt spray test after 500 hours

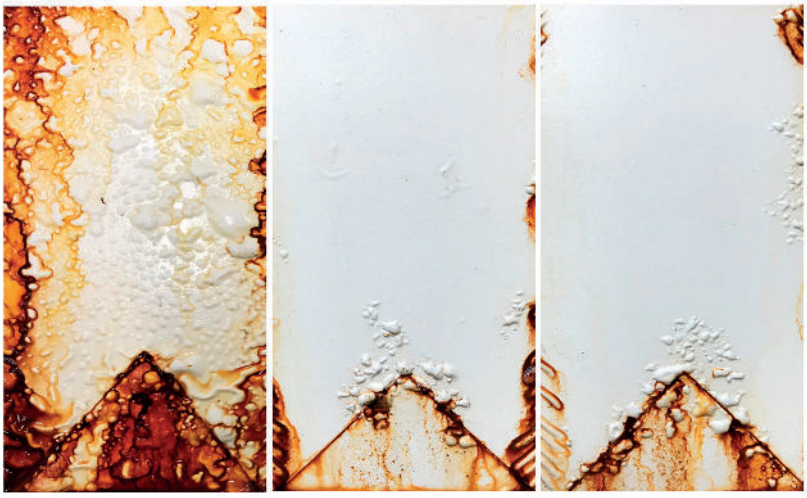


Blank | Anticor™ FA-N | Anticor™ C6N | Anticor™ PQ | Competitor A

The performance of DTM coatings is increased tremendously with Anticor™ A40 or Anticor™ A65N in combination with VeoPox™. Corrosion formation is almost completely inhibited with the usage of these additives.

1K Waterborne acrylic coating, DFT 100 micron, CRS

ISO 9227 Salt spray test after 500 hours



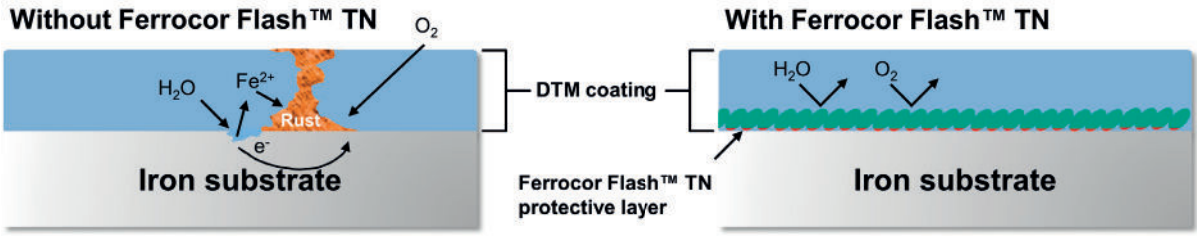
Blank | 4% VeoPox™ 2S + 1% Anticor™ A40 | 4% VeoPox™ 2S + 1% Anticor™ A65N

Separate Anticor™ brochure is available for additional information.

Ferrocor Flash™ TN - Flash rust inhibitor

Ferrocor Flash™ TN is a water soluble flash rust inhibitor based on a blend of phosphate esters and organic acid salts. The term 'flash rust' is used for a fast forming corrosion type which occurs when bare iron is exposed to water and oxygen. Depending on the type of iron, spots or complete areas can turn into orange-brown coloured stains within minutes.

Flash rust formation process



By incorporating Ferrocor Flash™ TN into the DTM coating formulation, its active ingredients migrate to the metal and form a protective barrier onto the metal surface, inhibiting the flash rusting process.

Key advantages of Ferrocor Flash™ TN

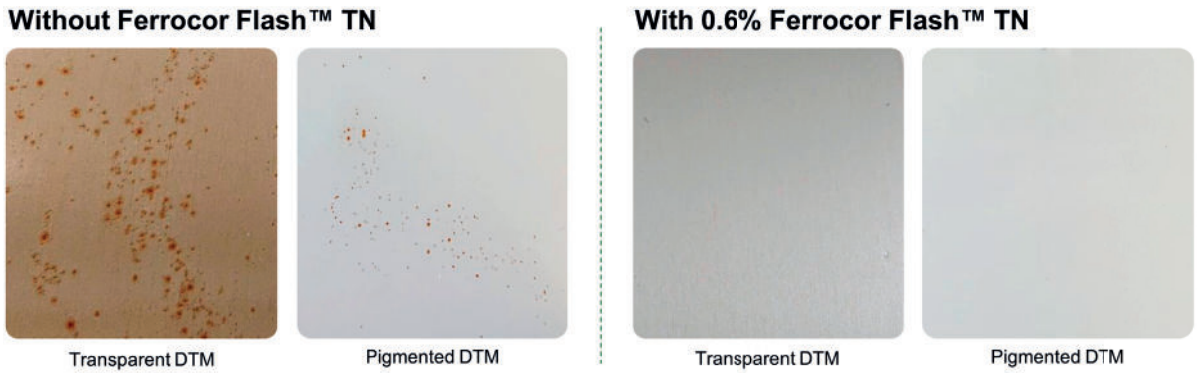
When Ferrocor Flash™ TN is added to protective coatings it will provide the following benefits:

- Efficient flash rust inhibitor
- Great long-term anticorrosive properties
- Easy to handle and use liquid
- Nitrite and nitrate-free inhibitor

Ferrocor Flash™ TN can be used in both transparent and pigmented DTM systems.

1K Waterborne styrene-acrylic coating, DFT 100 micron, CRS

Flash rust in DTM coatings

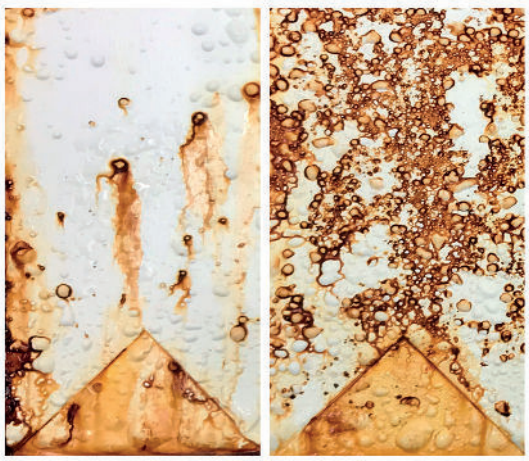


Ferrocor Flash TN

Additional long term corrosion inhibition is achieved with Ferrocor Flash ™ TN as demonstrated by the salt spray test.

1K Waterborne styrene-acrylic coating, DFT 100 micron, CRS

ISO 9227 Salt Spray test after 500 hours

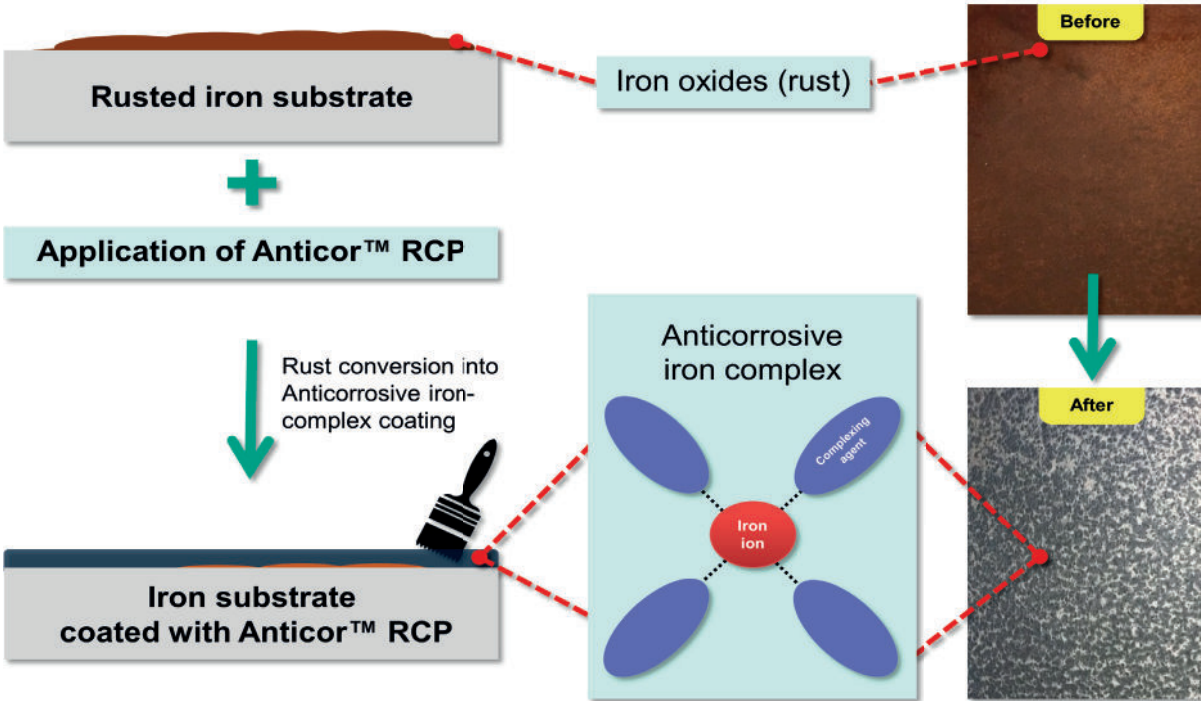


Ferrocor Flash™ TN Competitor B

Anticor™ RCP - Rust converting primer

Anticor™ RCP is a rust conversion primer that combines excellent rust converting properties with strong adhesion to metals. It consists of an acrylic resin – epoxy hybrid blend with rust converting additives. Anticor™ RCP can be applied directly onto rusted substrates to convert the rust into an anticorrosive complex and thus passivating the substrate for further corrosion.

Anticor™ RCP rust conversion process

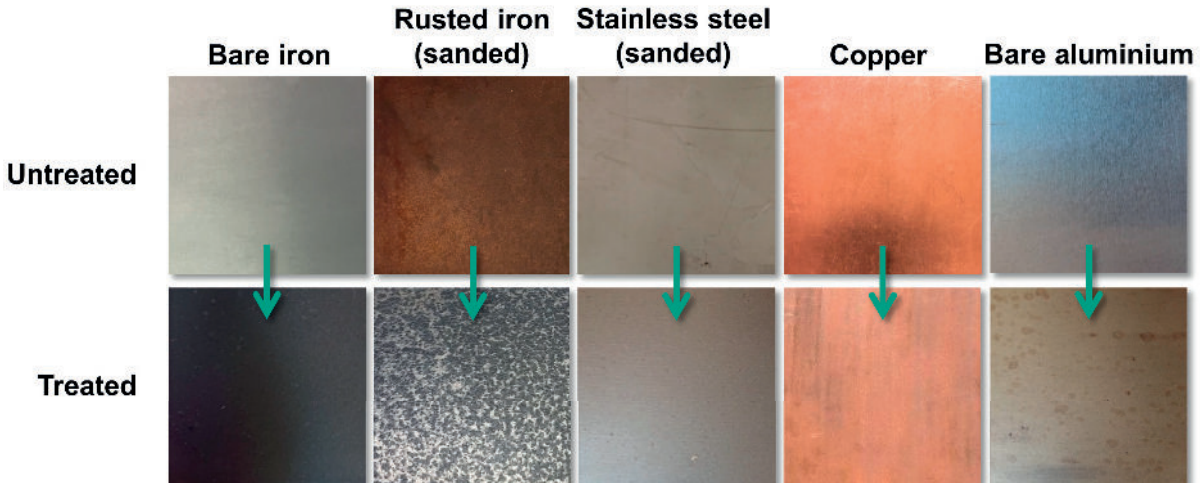


The dry Anticor™ RCP coating is durable, waterproof and strongly bonded to the substrate due to the incorporation of VeoPox™ technology.

Application and properties

Besides rusted iron surfaces, Anticor™ RCP also adheres to various metals such as (stainless) steel, copper, aluminium, etc.; but also to pre-treated coatings.

Anticor™ RCP on various metals



Separate Anticor™ RCP brochure is available for additional information.

CONTACT INFORMATION

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Liability
All recommendations for the use of our products, whether given by us in writing, oral, or to be implied from the results of tests carried out by us, are based on the current state of our knowledge. Under no circumstances shall Seller be liable for incidental, consequential or indirect damage for alleged negligence, breach of warranty, strict liability, tort or contract arising in connection with product(s). Seller's sole liability for any claims shall be Buyer's purchase price. Data and results are based on controlled lab work and must be confirmed by Buyer by testing for its intended conditions of use. The product(s) has/have not been tested for, and is/are therefore not recommended for, uses for which prolonged contact with mucous membranes, abraded skin or blood is intended, or for uses for which implantations within the human body is intended.