NEWS ALERT

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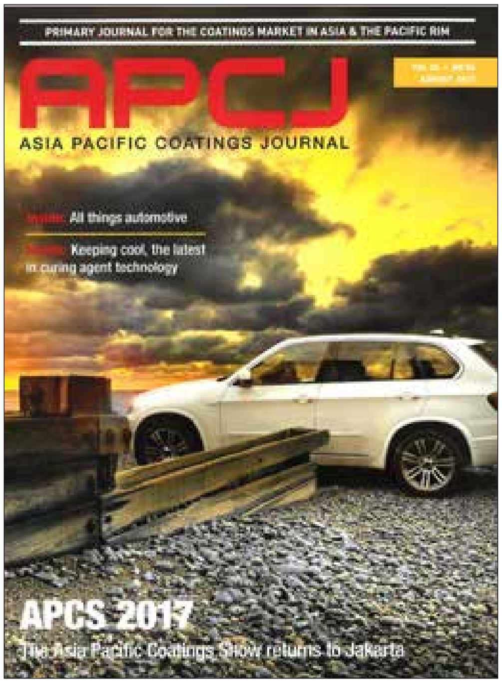
Cortec® High Performance VCI Water-Based Coatings Article Published in Strategic Asia Pacific Coatings Journal



Cortec's Director of Sales for High Performance Coatings & Additives, Markus Bieber, was recently honored by the publication of his paper on high performance water-based coatings in the August 2017 edition of Asia Pacific Coatings Journal (APCJ). This bi-monthly journal has been published for more than 22 years and describes itself as "the only dedicated coatings publication that covers the ASEAN region, from India to Australia." With the notable growth of the Asian coatings market, this is a significant field in which to gain exposure.

Bieber presented his paper on "High performance water-based coating enhanced with nano vapour corrosion inhibitors" earlier this year at the 2017 European Coatings Show Conference. After becoming aware of the paper, APCJ requested special permission to republish the paper in its journal.

Bieber's paper says that health and environmental advantages have been encouraging the formulation of water-based corrosion inhibiting coatings using nano vapour phase corrosion inhibitors (VCIs). These small particle VCIs are important alternatives to traditional heavy metal inhibitors that negatively impact the environment and are carcinogenic. The article says VCIs use smaller particles and provide more thorough surface protective coverage, without the adverse effect of traditional inhibitors.

The paper presents findings of experimentation to evaluate and find an optimal nano VCI inhibitor package that would pass 1,000 hours of salt fog testing (according to ASTM B117) at less than 2 mils DFT in a waterborne acrylic. The paper notes that this usually cannot be done without using coatings that have inhibitors that are toxic or not environmentally friendly. Testing found that a combination of nano VCIs and non-toxic metal complex inhibitors had a synergistic effect to make this possible at less than 1.5 mils. The paper concludes by stressing the further cost, materials, time, and labor saving advantages of being able to apply such VCI coatings direct to metal with reduced cleanup requirements thanks to environmentally friendly characteristics.

Continued.....

Markus Bieber, Cortec Corporation, discusses how the combination of nano VCIs and non-toxic metal complex inhibitors form a synergistic effect that allows water-based acrylics to reach 1000hr of salt fog testing

High performance water-based coating enhanced with nano vapour corrosion inhibitors

The use of single component water-based coatings for protection of metal substrates continues to grow due to their low odour, health and safety advantages, easy clean-up and environmental friendliness. Nevertheless, the challenge continues to find alternatives to the traditional chromate, zinc or similar heavy metal type corrosion inhibitors, which tend to rely on passivation or sacrificial cathodic protection[4].

Additionally, ongoing regulatory developments, which require lower VOCs and elimination of carcinogenic materials continue to tighten the usage of products containing these heavy metals, thus, forcing the need for alternative technologies. The use of nano vapour phase corrosion inhibitors (VCIs) provide an attractive alternative by adsorbing onto the metal substrate and filling the voids or micro-crevices of the substrate and preventing corrosion from starting or growing once the surface of the coating has been damaged. This technology has been proven effective in single component water-based coatings at dry film thickness (DFTs) of 1mil (25μm)[2,5].

FOUR LEARNING OBJECTIVES

1. How VCIs work in a coating

VCIs are formulated into a coating through a complex development process, which involves determining chemical compatibility of the VCIs with the other components of the coating, such as the resin, solvents, pigments and other additives used for a variety of reasons. VCIs work by adsorbing onto the metal surface in a non-reactive attractive capacity, in other words, they are attracted to the metal through the particle charge[1].

2. How VCIs compare to traditional inhibitors

VCIs compare with traditional inhibitor systems by using smaller particles, as well as relying not only on contact inhibition but also vapour phase inhibition, providing more complete coverage and protection of the surface. This is illustrated in **Figure 1**. The larger platelets are representative of traditional inhibitors, which are unable to fill the micro-crevices, leaving gaps where corrosion can start and/or grow[3].

3. What type of coating systems can use VCIs

VCIs can be used with most coating systems. There are many variations of VCIs and the key is to choose the correct VCI for the corresponding coating system by checking compatibility, effectiveness and processability.

4. The environmental advantages of VCIs over traditional inhibitors

Traditional inhibitors containing heavy metals are becoming increasingly more regulated and often are no longer allowed to be used, due to the negative impact they have on the environment and as carcinogens for workers exposed to them. The environmental advantages of using VCIs are that they are non-toxic, do not contain heavy metals and have no adverse effect due to their low usage concentrations.

VCIs have long been used in other products, such as PE films, foams, powders and liquids to provide a vapour phase of corrosion protection without impacting the environment.

Figure 1.

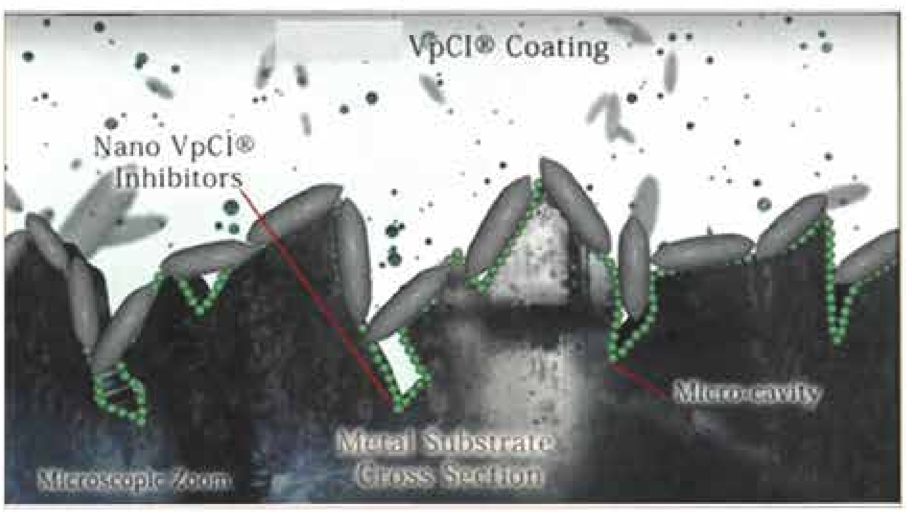


Table 1. List of coating formulations				
Sample #	Description	Corrosion inhibitor	% of total formula wt	Coating thickness (mils)
1	Control	D	0	0.9-1.2
2	Exp 1	A	3	0.9-1.2
3	Exp 3	A+C	5	0.9-1.2
4	Exp 2	B	3	0.9-1.2
5	Exp 4	B+C	3	0.9-1.2

Corrosion inhibitor detail	
Corrosion inhibitor	Description
D	Organic/inorganic corrosion inhibitor
A	Amino carboxylate salt
A+C	Amino carboxylate salt + nano inhibitor
B	Liquid sol gel
B+C	Liquid sol gel + nano inhibitor

Table 2. ASTM B117, 168hr salt fog resistance

Sample #	Film thickness (Mils)	Corrosion rating	Scribe rust
1	0.9-1.2	5	5
2	0.9-1.2	8	5
3	0.9-1.2	9	9
4	0.9-1.2	8	8
5	0.9-1.2	10	10

ASTM D 1654-92 Procedure B rating of unscribed areas
10 = no corrosion, 5 = 11-20% corrosion 0 = 75% + corrosion
ASTM D 1654-92 Procedure A rating of failure at scribe
10 = no creepage, 5 = 0.125-0.1875in, 0 = 0.625+in

Table 3. ASTM B117, 700hr salt fog resistance

Sample #	Film thickness (Mils)	Corrosion rating	Scribe rust
1	0.9-1.2	1	0
2	0.9-1.2	8	5
3	0.9-1.2	8	8
4	0.9-1.2	8	5
5	0.9-1.2	10	9

Table 4. ASTM B117, 1000hr salt fog resistance

Sample #	Film thickness (Mils)	Corrosion rating	Scribe rust
1	0.9-1.2	0	0
2	0.9-1.2	5	2
3	0.9-1.2	3	4
4	0.9-1.2	3	4
5	0.9-1.2	9	9

EXPERIMENT

This study examines the effectiveness of various types of corrosion inhibitors in a waterborne styrenated acrylic coating, based on salt fog results, (ASTM B117). All of the samples were made using high speed dispersion.

Each coating was applied in triplicate on 4in x 12in cold rolled steel (CRS) panels, (SAE 1010), using a 40RDS draw down bar. This produced a dry film thickness of 1.0mils +/- 0.2mils.

A list of samples prepared is shown in **Table 1**.

Testing Procedures

Panels were prepared according to ASTM B117 and allowed to cure at ambient temperature for seven days. After the curing cycle, the panels were scribed with a single diagonal scribe per method described in ASTM D1654. All of the edges and backs of the panels were taped to prevent any corrosion creep from uncoated surfaces.

Panels were then placed in a 5% NaCl salt fog chamber, per ASTM B117. The test panels were checked periodically for blisters, creep from scribe and degree of rusting.

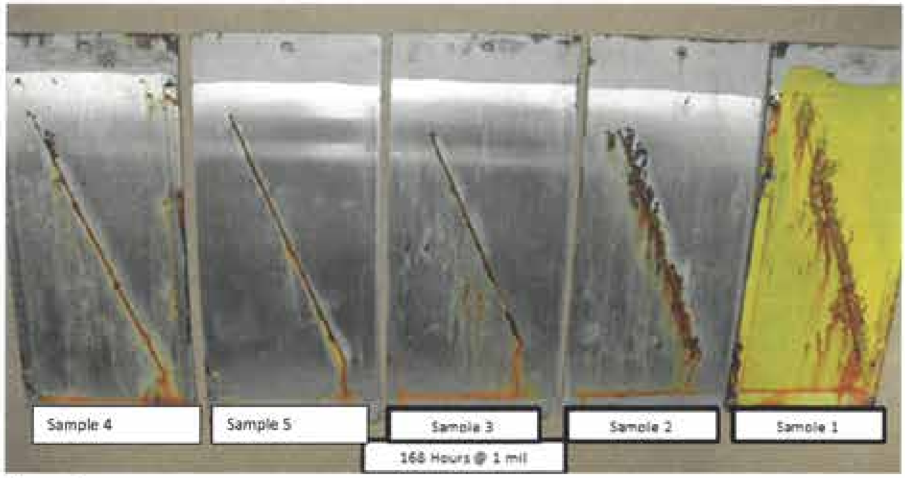


Figure 2.

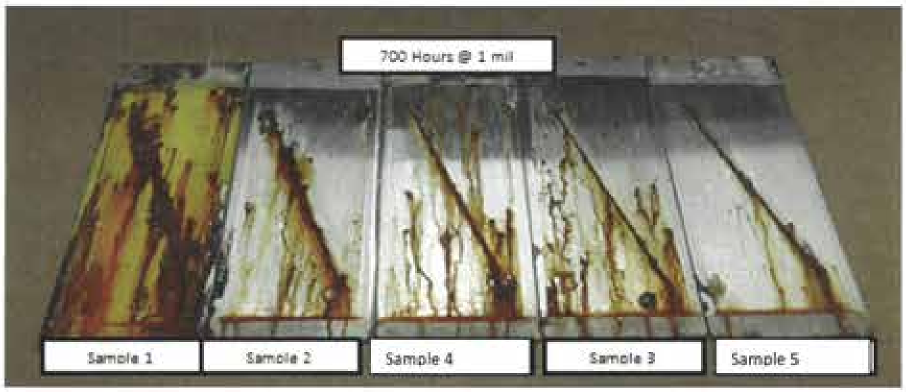


Figure 3.

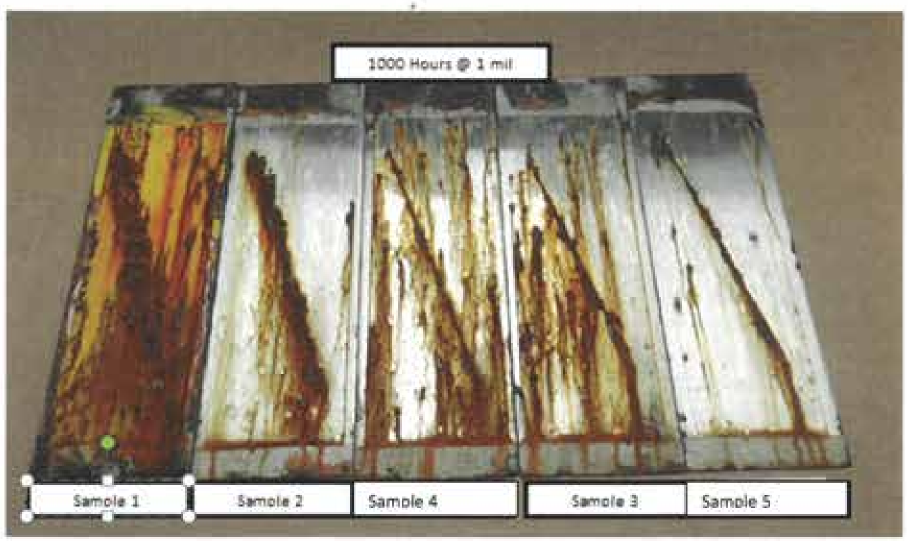


Figure 4.

Results

The purpose of this experiment was to investigate the effectiveness of nano VCIs when added to waterborne acrylics. The ultimate goal was to achieve 1000hr in a salt fog chamber, (ASTM B117), on CRS, with a high gloss clearcoat of less than 2.0mils DFT.

Normally this kind of performance can only be achieved with highly pigmented coatings using corrosion inhibitors that are toxic or, at the very least, not environmentally friendly.

The control panels failed at approximately 168hr in the salt fog cabinet, as can be seen in **Figure 2**.

CONCLUSION

With worldwide corrosion costs in excess of US$100bn, there is a need, for environmentally friendly, low VOC, waterborne coatings that can be applied at a thin film thickness, (1.0mils), which provide excellent corrosion protection.

This paper shows, through research, that the combination of nano VCIs and non-toxic metal complex inhibitors forms a synergistic effect that now allows for water-based acrylics to reach 1000hr of salt fog testing at less than 1.5mils (ASTM B117). The DTM (direct to metal) aspects of these coatings results in direct cost savings by reducing the amount of material needed, reducing the application time and labour due to fewer coats and finally reducing the time and expense of equipment clean-up due to the environmentally friendly nature of the waterborne systems. Applications range widely from equipment to vehicles to infrastructure. ■

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Flexcrete coatings chosen for HQ building in Taiwan

Protective coatings manufactured by UK-based Flexcrete Technologies Limited have been used to protect the external walls of an impressive new headquarters building for Pauian Archiland, a Taiwan-based company.

The multi-storey building is located in Taipei and is owned by Pauian Archiland, which operates across a number of market sectors including architecture and construction, design and engineering, logistics, advertising, restaurants and sports. The company even owns a semi-professional basketball team known as the Pauian Archiland Basketball Team, which plays in the Super Basketball League of Taiwan.

The new HQ is glass-fronted and also composed of concrete construction. A durable, aesthetic, anti-carbonation coating was required for application to the new concrete walls totalling 2400m^2 to provide them with effective weatherproofing properties and protection against carbon dioxide diffusion. The coating needed to be able to withstand harsh climatic conditions, with hot, humid summer months and typhoon conditions between June and October.

Flexcrete's distributor in Taiwan, Parallel Industrial Co Ltd, recommended a Flexcrete coatings package in order to enhance the exterior of the building. Flexcrete's Monodex coatings were specified as they offer decorative, anti-carbonation protection and can extend the life expectancy of both newly constructed and existing buildings.

With water-based, low hazard, high build formulations, they are ultra-fast drying, enabling two coat applications on the same day even in inclement weather conditions. They incorporate an active in-film fungicide, which inhibits the growth of mould, fungi and lichens and remains unaffected by exposure to direct sunlight, ensuring buildings maintain a bright, clean appearance for many years.

In order to achieve the required appearance, the first coat comprised Monodex Textured – a highly engineered, waterborne, single component, acrylic-based decorative wall coating with an attractive textured finish. Following this, a coat of Monodex Ultra was applied. Monodex Ultra is an elastomeric, water-based coating with a smooth finish. Like Monodex Textured, it provides excellent protection against carbonation and water ingress. Its vapour permeable nature allows damp substrates to breathe and dry out without blistering of the coating. Both coats were applied by spray to achieve a high quality finish.

Monodex Textured and Monodex Ultra are both CE-Marked in accordance with the demands of EN 1504 Part 2 and can be relied upon with absolute confidence. They are available in a range of both standard and special colours, of which grey was chosen for this project.

www.flexcrete.com ■