

The **LEADING** Edge

Record Number Of NACE Reviewed Cortec® Papers Presented at NACE CORROSION 2015

Cortec® first became involved with NACE in 1979 and has been continually engaged over the years as NACE has grown to serve nearly 33,000 members in 116 countries.

This year, Cortec® submitted a record number of seven papers to NACE for review; all of which were presented at CORROSION 2015. Cortec's founder and CEO Boris Miksic, FNACE along with Dr. Behzad Bavarian lead the company with three papers; two papers were written by Ming Shen, one by Robert Kean, and one by Eric Uutala.

NACE CORROSION 2015 included 7,000 corrosion professionals and 450 exhibiting companies focused on the prevention of corrosion worldwide.

NACE International was established in 1943 by eleven corrosion engineers from the pipeline industry as the "National Association of Corrosion Engineers." The founding engineers were originally part of a regional group formed in the 1930's when the study of cathodic protection was introduced. Since then, NACE International has become the global leader in developing corrosion prevention and control standards, certification, and education.

Here is the list of technical papers presented this year:

- **Comparison of the Corrosion Protection Effectiveness of Vapor Corrosion Inhibitors and Dry Air System**™ by Dr. Behzad Bavarian, Yashar Ikder, Babak Samimi, Lisa Reiner, and Boris Miksic, FNACE
- **Evaluating Efficacy of Volatile Corrosion Inhibitors versus Traditional Methods for Preservation of Industrial Equipment and Operational Spare Parts**™ by Eric Uutala, Cliff Cracauer, and Boris Miksic, FNACE
- **Comparison of the Corrosion Protection Effectiveness of Vapor Corrosion Inhibitor and Nitrogen Blanketing System**™ by Dr. Behzad Bavarian, Jia Zhang, Lisa Reiner, and Boris Miksic, FNACE
- **Multifunctional Hydrocarbon Cleaning Package: Removing, Degrading, and Protecting**™ by Ming Shen, Ali Bayane, Diana Di Marco, Margarita Kharshan Ph.D., Liz Austin, and Brian Benduha
- **Improved Packaging Materials Made from Barrier Coated Paper Incorporating Vapor Phase Corrosion Inhibitors**™ by Robert Kean Ph.D., Margarita A. Kharshan Ph.D., and Boris Miksic FNACE
- **Investigation of Bio-Based Aromatic Acids as Corrosion Inhibitor**™ by Ming Shen, Alla Furman, and Rita Kharshan Ph. D.
- **Protection Effectiveness of Vapor Corrosion Inhibitor for Corrosion Under Insulation**™ by Dr. Behzad Bavarian, Babak Samimi, Yashar Ikder, Lisa Reiner, and Boris Miksic, FNACE



THE WORLDWIDE CORROSION AUTHORITY



March 15-19, 2015 | Kay Bailey Hutchison Convention Center | Dallas, TX

Corrosion Basics

Corrosion Inhibitors

An inhibitor is a substance that slows down a chemical reaction (in the present context, a corrosion reaction). Corrosion inhibitors are commonly added in small amounts to acids, cooling waters, steam, and many other environments—either continuously or intermittently—to reduce the intensity of corrosion that might otherwise threaten the intended design life of a structure.

The use of chemical inhibitors to decrease the rates of corrosion processes is quite varied. In the oil extraction and processing industries, corrosion inhibitors have always been considered to be the first line of defense against corrosion. A great number of scientific studies have been devoted to the subject of corrosion inhibitors. Nevertheless, rules, equations, and theories to guide inhibitor development and use are very limited. Most of what is known has grown from trial-and-error experiments, both in the laboratories and in the field. The degree of corrosion protection may not be proportional to the amount of inhibitor in all concentrations. Therefore, it is always important to evaluate the concentration of inhibitor that provides the optimal ratio of benefits to cost.

Some inhibitors retard corrosion by adsorption to form a thin, invisible surface film only a few molecules thick; others form visible bulky precipitates that coat the metal and protect it from attack. Another common mechanism consists of causing the metal to corrode in such a way that a combination of adsorption and corrosion product forms a passive layer.

Other types of inhibitors either cause conditions in the environment to be more favorable for the formation of protective precipitates or remove an aggressive constituent from the environment. Corrosion inhibitors have grown to be one of the most universal methods of combating corrosion. Inhibitors that function by different mechanisms are often combined in commercial formulations.

Control of corrosion by inhibition may be desirable for several reasons:

- To extend the life of equipment
- To prevent shutdowns
- To prevent accidents resulting from brittle (or catastrophic) failures
- To avoid product contamination
- To prevent loss of heat transfer
- To preserve an attractive appearance

Potential savings for each of these goals must be evaluated to determine if a program of corrosion inhibition will be economically justified. Because costs are sometimes difficult to estimate, the best method is to obtain data on maintenance, replacements, and repairs/reconditioning from the past history of either the system that is to be protected or similar systems.

There are several costs associated with the use of inhibitors. In fact, the cost of one or more of the following must be factored into any economic evaluation of corrosion inhibition:

- Installation of injection equipment
- Maintenance of injection equipment
- Purchase of inhibitor chemical(s)
- Monitoring inhibitor concentration(s)
- System changes to accommodate the inhibitor
- System cleaning
- Waste disposal
- Personnel safety equipment

In cases where major shutdowns can be avoided through the use of inhibitors, the economic advantages of inhibition undoubtedly will be clear. Other cases will require detailed economic evaluations.

This article is adapted by MP Technical Editorial Norm Moriber from *Corrosion Basics—An Introduction*, Second Edition, Pierre R. Roberge, ed. (Houston, TX: NACE International, 2006), pp. 521-522.

New Products

MilCorr® FR VpCI® Shrink Film

MilCorr® FR VpCI® Shrink Film, is a heavy duty shrink film that protects multimetal with Cortec's unique Vapor phase Corrosion Inhibitors (VpCI®). The flame retardant and UV (ultraviolet) inhibitor addition makes Milcorr® FR Shrink Film extra durable, providing flame retardancy and UV protection for application in severe outdoor climates. Parts packaged in this premium film are well protected for extended periods of time in harsh outdoor or indoor environments, such as salty air, moisture, and aggressive industrial surroundings.

MilCorr® FR VpCI® Shrink film can replace conventional rust preventatives such as oils or desiccants. Parts protected by MilCorr® are ready to use without having to be cleaned or degreased, saving time and money.

The VpCIs in the film vaporize and condense on all metal surfaces within the enclosed space, and diffuse to every surface of your parts, exterior as well as void spaces and recessed areas. Your valuable equipment gets complete protection during storage or shipping, virtually eliminating any rust claims.

Milcorr® FR VpCI® Shrink Film will shrink using a wide variety of shrinking tools, including electric and propane heat guns.

Typical shrink temperature: 340-440 °F (171-227 °C)

Typical sealing temperature: 240-320 °F (116-160 °C)

Cortec® products offer total turnkey preservation for long-term outdoor storage.

UV Weathering Testing (ASTM G 53-93)

No corrosion or degradation of the film was observed after 3+ years of exposure

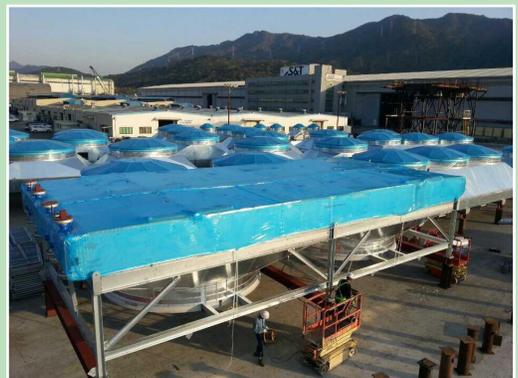
Water Vapor Transmission Rate Testing (ASTM F-1249, 100% RH, 1000F (37.80C))

WVTR g/(100in ² •day)		WVTR g/(m ² •day)	
Sample 1	Sample 2	Sample 1	Sample 2
0.0833	0.0829	1.29	1.28

Flame Retardancy Testing (NFPA 701-2010. Test #2): Pass

Mechanical Property Testing

Property		Test Method	Units	MilCorr
Caliper		ASTM D6988	mil	10.00
Breaking Factor	MD	ASTM D882-02	lbs/in	26.1
	TD			25.5
Tensile Strength at Break	MD	ASTM D882-02	psi	2607.7
	TD			2553.4
Elongation at Break	MD	ASTM D882-02	%	725
	TD			789
Yield Strength	MD	ASTM D882-02	psi	896.6
	CD			1547.1
Tear Strength	MD	ASTM D1922-06a	mN	19463.0
	CD			29571.3
Dart Drop Impact Resistance		ASTM D1709-04, Test Method A	grams	1166



BioCorr® ATF Rust Preventative

BioCorr® ATF Rust Preventative is designed for transmission parts during their production, transportation, and storage. It doesn't cause parts to stick to each other and is suitable for robotic operated production lines. BioCorr® ATF Rust Preventative is an oil-in-water emulsion that provides multi-metal protection. Unlike oil rust preventative, this product leaves a dry film on the surface of the protected metal that is virtually undetectable. This feature helps to create a clean workplace and prevents material waste.

BioCorr® ATF Rust Preventative can provide up to two year protection for indoor storage, or during shipment when combined with VpCl® packaging materials. It is VOC-free and biodegradable; eliminating expensive disposal costs associated with oils. BioCorr® ATF Rust Preventative is a ready-to-use product that can be applied by dipping or spraying.

Coming Soon

VpCl®- 643

VpCl®-643 is a unique combination of biodegradable corrosion inhibitor and oxygen scavenger. It is designed to protect ferrous and non-ferrous metals from chloride attack in fresh water, salt water, brine, and other highly corrosive solutions containing dissolved halogens.

VpCl®-643 is particularly effective in mitigating corrosion during hydrostatic testing using sea water, in closed circuit cooling or heating systems containing brine or water, and in desalination plants. VpCl®-643 is economical and effective at low dosages. For protection above 95%, the dosage is 400-500ppm in cooling or heating system where chloride is 3% or more; the dosage is 500-700ppm in hydrostatic testing using sea water.

VpCl-643 offers multimetal protection and is a "green" replacement for nitrite, chromate, or hydrazine-based formulations.



VpCl®- 280

VpCl®-280 is a fast drying, versatile, industrial finishing enamel for manufacturers of metal products. This enamel offers a quick dry time, high gloss, and good color and gloss retention. It is ideal for industrial OEM users, including agricultural and construction equipment. Regulatory benefits include very low levels of VOC and Hazardous Air Pollutant Solvents.

FEATURES

High Gloss (90+ @60°)
2.8 VOC
Non-reportable HAPS
Fast drying (30-60min)

PERFORMANCE CHARACTERISTIC

(Typical, tested on B-1000 panels at 1.5-2.0 mils DFT)

Crosshatch Adhesion	5B
Salt Spray	336hrs -Pass
Humidity	168hrs -Pass
Wet Adhesion	166hrs -Pass
Xenon (white and black)	1144hrs <5% loss of gloss



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