

The

LEADING



Environmentally Safe VpCI/MCI Technology

January 2005

Welcome to the Winter Edition of Leading Edge!

**WISHING YOU AND YOUR FAMILY
A JOYOUS AND HAPPY NEW YEAR!**

IT'S A NEW 2005 YEAR

Dear friends,
Our newsletter is a way to stay in touch with you - the extended family and friends of Cortec. As witnessed by the mailing list for this edition, our family extends from coast to coast, including every state in the Union and covering countries in five continents.

"The Leading Edge" also affords us an opportunity to share with you the accomplishments Cortec's laboratories have achieved in the past year, and the challenges we face in the year ahead.

First of all, we would like to thank all of you for making 2004 a great year for our Company.

We hope you all had an enjoyable holidays and that once again Santa filled your stockings to the brim!

Let's jump start this new year, which promises to be powerful and exciting for all of us.



In this edition we are introducing nine products and means of delivery. We are also sharing: new technologies, our influence on sales through Trade shows, important news in the laboratories, and finally a Q&A section on electrochemical methods.

Have fun!

Margarita Kharshan
Laboratory Director

NEW PRODUCTS AND CURRENT EVENTS IN THE WORLD OF CORTEC COATINGS

New Anticorrosion Additives for Coatings

Recently two new organic liquid corrosion inhibitors have been developed that boost the corrosion protection of paint and coatings with reduced levels of toxicity. The new additives, called M-109 and M-110, offer effective protection in a broad spectrum of both solvent based and some waterborne coatings. In comparison to inorganic pigment inhibitors, M-109 and M-110 do not exhibit any reactivity to resins or contribute to settling. Both products are easy-to-blend liquids that can be post added into clear and pigmented coatings at a low 1 to 2% level.

The new inhibitors have been designed to reduce the toxicity of paints that use zinc phosphate and other toxic inorganic pigments. As environmentally friendly inhibitors, M-109 and M-

NEWSWORTHY

A New Technology

Cortec was recently awarded a STTR research grant by the US Army. In cooperation with the University of California, Irvine, Cortec is learning a new method of controlling corrosion. The grant is to investigate the use of a bacterial biofilm capable of providing corrosion protection to the metal surface of aircraft and other military equipment.



Art Ahlbrecht, Vice President of R&D

The research grant was activated on October 1st and lasts six months and as the year ends we are halfway through the project. At Cortec we are investigating adhesive films as carriers for the biofilm bacteria. Dr. Peggy Arps at the University of California (Irvine) is screening bacteria for activity and corrosion inhibition on aluminum. The most effective bacteria will be incorporated into adhesives and aerosols as a means of

imparting corrosion protecting biofilms to aluminum.



Bruce Bear, Analytical Chemist

This STTR project enables the laboratory to acquire new technology to be used in the development of corrosion control products.

110 do not contain any zinc, phosphates, chromates, or barium compounds allowing them to comply with environmental regulations.



Utilizing M-109 and M-110 enables formulators to afford corrosion protection for a wide variety of ferrous metals, including steel, stainless, galvanized, cast iron and non-ferrous metals such as aluminum, and solder. M-109 is also effective for copper and bronze. In many instances, the new products will provide the same or better levels of corrosion protection than today's more toxic ingredients.

New Testing Data

by Greg Hocking, Technical Service Engineer

The lab would like to take a few paragraphs to discuss two projects involving some of the most popular and established Cortec coating products. While Cortec has continued its customary approach to product-line growth - formulating many new coatings for unique specifications and niche applications - we want to highlight the continued performance of some of our "workhorse" products.

The first was a study performed at the request of a customer with a specific need. They desired simple, one coat, water-based coatings to pro-

vide long term protection to galvanized steel in harsh salt conditions. Test panels were prepared, cured, scribed and then entered into the ASTM B-117 Salt Spray Chamber. After 1,000 hours of exposure the panels were removed and evaluated via the ASTM D-1654 and D-3359 methods. *

The panels which far outperformed the rest was the combination of VpCI-374

Grey primer top-coated with VpCI-386 Black. The panels, ranging in total final dry film thickness of 4.5-6.0 mils, each scored a 7 rating at scribe, a 9

rating in the unscribed areas, and a 5B adhesion. This represents a 1-2 mm creepage from the scribe, 2 to 3 percent failure in unscribed areas, and the best possible adhesion rating; three extremely good results for 1,000 hour protection of galvanized steel in B-117 Salt-Spray conditions.

The second project is an exciting independent, two-year outdoor exposure project positioned off the coast of Southern Florida, which is nearing completion. Multiple different Cortec coating systems were prepared on both carbon steel and aluminum panels and then sent to Q-Panel Weathering Research, in Homestead, FL, for



*Greg Hocking, Technical Service Engineer (left)
Brian Wuertz, Technical Service Supervisor (right)*

*D-1654, "Method for Evaluation of Coatings Subjected to Corrosion
D-3359, "Measuring Adhesion by Tape Test"

exposure testing. The panels have been subjected to thousands of “real-world” hours of intense solar radiation, wet/dry cycles, and high sea-salt exposure (not to mention a few hurricanes). The projects fourth and final Q-Panel evaluation period is due in January of 2005. Please stay tuned early in the year for a comprehensive report detailing the results of this project.

Special Application of VpCI-396

It is not enough to boast some of the best products in the world, it is also necessary to prove it to the customers.

Especially effective way to provide this proof is by testing in accordance to procedures which are standard in regions specific to our vast sales force.

Recently a request came from one of our Russian distributors. A customer was interested in VpCI-396, a moisture cure urethane-based coating. However, they wanted it to be evaluated according to the Russian Standards.

Electrochemical testing of coatings is included in many Russian standards - ‘GOSTs’ (Russian equivalent of ASTM system in United States). The submitted ‘GOST’ contained the procedure for testing the adhesion of a coating utilizing cathodic polarization.

According to this procedure, a Magnesium Anode provided cathodic polarization of a carbon steel panel coated with VpCI-396 in a water-based conductive solution. These conditions yeild an electrochemical reduction reaction of Hydrogen ions (H^+) from water to Hydrogen atoms (H). These species, when collected under the coating, loosen its adhesion to the metal.

Excellent adhesion of VpCI-396 to the metal was confirmed during our test, and later by testing in Russia. “I have tested hundreds of primers from

the different countries, but adhesion of VpCI-396 to the metals is amazing, and far better than everything I’ve tested” - commented one of the customers.

The biggest Gas and Oil Companies in Russia already implemented this interesting application in their factories.

NEWS IN WATER-TREATMENT AREA

VpCI Coolant Antifreeze

Cortec’s anticorrosion additives to the coolants/antifreezes (M-640, M-640 L) are well known by our customers and distributors as very effective and environmentally friendly chemicals.

Recently Cortec Corporation has received many requests for development and manufacturing of ready-to-use Coolant/Antifreeze, able to provide the same level of corrosion protection as the above mentioned additives.



VpCI Coolant/Antifreeze is an ethylene glycol based heat transfer fluid, which is possible to apply in a wide temperature range: -50C (-60F) to 175C (350F).

This fluid is specially formulated with corrosion inhibitor to offer excellent corrosion protection and great thermal stability.

For the majority of applications, VpCI Coolant/Antifreeze can be diluted with water in ratios from 1:2 to 2:1. VpCI Coolant Antifreeze is in compliance with European requirements, and it does not contain phosphate, silicate, and nitrite/nitrate.



Based on results obtained from the ASTM D-1384 (Corrosion Test for Engine Coolants in Glassware) VpCI Coolant Antifreeze meets and exceeds the GM engineering standards to ethylene glycol type automotive coolants.

NEWSWORTHY

Cortec has Changed the Back Page of our EMS Brochure to Emphasize A Better World for Future Generation

Cortec proudly and ambitiously develops products from sustainable resources to provide a better world for future generations. We take the responsibility in conserving our natural resources seriously - we develop Cortec products from annually renewable materials such as herbaceous plants from soybeans to the coconut fruit of the palm tree species.

Sugar Beet:

MCI-2005
MCI-2005 NS
MCI-2006
MCI-2006NS



Corn:

EcoWorks
EcoClean Dispersant 600



Orange Peel

VpCI-411
VpCI-422



Soybean:

VpCI-629 Bio
VpCI-705 Bio
S-14 Bio
BioCorr RP

EcoLine Cleaner/Degreaser
MCI EcoCure
EcoLine Cutting Fluid
EcoLine Food Machinery Lubricating Grease

EcoLine All Purpose Lubricant
EcoLine Rust Preventative
EcoLine Bearing Chain and Roller Lubricant



Coconut Oil:

BioClean 610

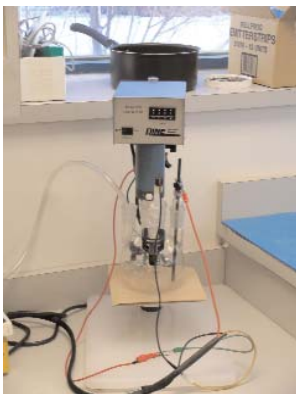


VpCI Coolant Antifreeze provides year-round protection to the cooling system: it prevents freeze-up in winter and boiling over in summer. A high level of the reserved alkalinity provides a very durable service life to this product.

Evaluation of Process Additives Using the Rotating Cylinder Electrode (RCE) Test

It is very important to choose a proper laboratory testing procedure for evaluation of any corrosion inhibitors. This is especially true for inhibitors in oil and natural gas production, where mistakes are very costly.

Many companies are working on design of the equipment for these tests. The price of this laboratory equipment is very costly.



In the past, the majority of petroleum companies were satisfied with corrosion inhibitors evaluated according to the NACE-recommended 'Wheel Corrosion Test' (#1D182 Test).

Recently though, a new standard was developed, ASTM G-170-01 "Standard

Guide for Evaluation and Qualifying Oilfield and Refinery Corrosion Inhibitors in the Laboratory". According to that document, the main emphasis in evaluation of corrosion protection is made on

electrochemical tests conducted in close-to-the-field conditions: i.e. temperature, pressure, flow rate, etc.

One of the recommendations by ASTM G-170-01, and widely used for evaluation of oil field corrosion inhibitors electrochemical test methods, is the 'Rotating Cylinder Electrode'. This device is the combination of a rotating motor with an internal electrode. The rotating electrode is connected with electrochemical instruments (potentiostat or corrosometer). Corrosion inhibition can be evaluated by comparing the levels of corrosion currents of the inhibitor treated and non treated solutions. This test allows evaluation of performance of the inhibitors under different flow rates and to predict their drag reduction properties.

Cortec has a number of products for corrosion control in the petroleum industry. Three of them - VpCI-637, VpCI-637 GL and VpCI-629 Bio - were evaluated using the rotating cylinder electrode. According to the test results, they provide the same or better protection than the most popular competitor products.

To summarize, we've collected all data from the laboratory and field testing and have created the recommended application chart for Cortec's corrosion inhibitors for petroleum and natural gas industries.

We hope that this chart will support your promotional effort of oil/gas additives!

Material	Oil Wells	Oil Flow Lines and Gathering Systems	Hydraulic Pumping Equipment	Gas Wells	Gas Wells Flow Lines	Gas Handling Equipment, Vessels	Water Handling and Injection
VpCI-629/629 D	0		0	0			
VpCI-629 Bio		0					
VpCI-637		0					0
VpCI-637 GL/ VpCI-637 GLD		0		0	0	0	
VpCI-639	0	0	0	0	0		
VpCI-705 Bio						0	
VpCI-705						0	

New Biodegradable Multimetal Powder VpCI-308

Everyone who uses our VpCI-609 powder is well aware of its' excellent properties not only as a powder, but also as a water treatment product for lay-up, hydrotesting, partial and full immersion in solution, cleaner's additive, etc.



from left to right:
Bob Berg, Packaging Engineer; Dario, Carlo Dozio (Italy); Dario Dell'Orto, European Sales Manager

The only one limitation for the use of VpCI-609 is insufficient protection for yellow metals, i.e. copper and copper alloys.

VpCI-308 is the most recent modification of VpCI-609. Being

based on VpCI-609, this product utilizes all benefits of VpCI-609. It provides exceptionally good

protection in the vapor phase, its readily soluble in water, its a film-former, non-flammable, environmentally friendly, biodegradable, etc. At the same time, VpCI-308 provides extended protection to multiple metals, including yellows.

If the system you are going to protect, contains a number of different metals - VpCI-308 is the product for you!

NEW WATER-BASED BIODEGRADABLE RUST PREVENTIVE ELIMINATES PRICE INCREASES FROM PETROLEUM BASED PRODUCTS

A new rust preventive that replaces petroleum-based products was recently developed in our laboratories. Based on Cortec's advanced green technology - with renewable resources and patented Cortec VpCI technology, - the new product offers the first complete solution for a biodegradable rust preventive. Called BioCorr, it offers up to two years of protection against corrosion during indoor storage. BioCorr eliminates the price increases from petroleum based products and pays for itself in reduced processing and labor costs.



BioCorr provides a new standard in product effectiveness and environmentally friendly chemistries. BioCorr is non-toxic, VOC free and replaces hazardous mineral oils and flammable

On the Road with the Lab

The Cortec Laboratory will go to great lengths to answer questions and provide technical support for Cortec products, sometimes as far as 4911 miles. While the lab performs most of our work inside the Cortec world headquarters, sometimes travel is required and 2004 was no exception.



Nobel Prize Laureate Vitaly Ginzburg visits Cortec distributors' office in Moscow!

Lab members traveled to such exciting cities as Nashville TN, Austin TX, and Chicago IL, to help existing or potential customers this past calendar year. One trip took Margarita all the way to Moscow where she made 4 presentations at "Modern technologies of corrosion prevention" conference and, also, worked in the booth. So when you think of the lab, remember the world class work performed in the lab day in and day out, but don't forget we are not chained to our lab benches.



Margarita Kharshan and Sergey Budnitsky (distributor in Russia) at the conference, Moscow, Russia, October 2004

solvents. Its biodegradable formulation does not contain chlorinated compounds, chromates or nitrites. BioCorr eliminates the expensive costs of special storage and disposal associated with oils. Further, the BioCorr anti-corrosion film is virtually undetectable to normal visual inspection and does not need to be removed before further processing or usage. This allows parts to move from storage directly to their next stage, thus eliminating a variety of processing steps required of parts protected with petroleum-based material.

Formulated as a high performance rust preventive, BioCorr is effective for both ferrous and non-ferrous metals including steel, galvanized, copper and aluminum. It performs well in both ASTM D-1748 (Humidity Chamber test) and ASTM D-4627-86 (Cast Iron Chip test). Applied by dip or spray, the product displaces water and oil from metal surfaces. It dries to a virtually invisible film providing clean protection to parts and enabling a clean workplace.

BioCorr is your economical and safe replacement for oil-based rust preventives.

MCI LINE IS GROWING

MCI-2008 L

A new product has been added to the growing line of MCI concrete admixtures - MCI-2008 L.

Cortec's MCI admixtures to concrete not only provide corrosion protection but modify properties of concrete mix. Some of them effect only the properties of hardened concrete making it stronger, minimizing the reaction on the elements such as climate, pollution, and marine environment. Others affect flowability, prolong the pot life or promote the setting of fresh concrete mix. All MCI admixtures help to achieve the main goal - to produce very durable reinforced concrete. One of the important conditions in manufacturing of durable dense concrete is to utilize the mix design with low water/cement



Debbie Hannan, Quality Manager

ties of concrete mix. Some of them effect only the properties of hardened concrete making it stronger, minimizing the reaction on the elements such as climate, pollution, and marine environment.

ratios, and, at the same time have flowable, self-compacting, self-leveling concrete. Cortec's MCI-2008 is one of the best on the market for this purpose. The first product of this line was MCI-2008. This product is in powder form. To satisfy customers, who prefer to use admixtures in the liquid form, MCI-2008 L (liquid) was formulated.

NEWSWORTHY

For a World Class Company, a State of the Art Laboratories

Every year we are getting some additions to our laboratories' capabilities. This year wasn't an exception. We are proud to announce that recently has been purchased a modern stereomicroscope. It allows us to view materials in 3D. It has been fitted with a camera adapter to allow images to be photographed. Our gas chromatograph (GC-MS) is upgraded with a more powerful computer system to allow for improved data management and faster operation. A personal computer and new instrument software are being purchased to operate our infrared spectrometer (FT-IR). The new software gives us more possibilities with data operation.

MCI Laboratory

With the fast growing MCI line to have more testing equipment for the concrete laboratory became obvious.

New MCI formulations in addition to providing corrosion protection for the metal reinforcement in concrete effect other properties of fresh and hardened concrete.

It takes special tests and special instruments to evaluate these

effects. Recently we purchased several items for the concrete sample preparation and measurement. Now we have prism molds and length comparator which confirms to ASTM C-151, C-157, C-227, C-490, C-1260, AASHTO M-210, T-107, T-160.

The first project started with these equipment is the measurement of expansion of concrete as a result of alkali-silica reaction (ASTM C-1260). The work is in progress.



Marlin Hansen, Coating Consultant and Alla Furman, Sr. Corrosion Engineer

Chemically, MCI-2008 L is a mixture of aminocarboxylates and polycarboxylates. This combination provides excellent protection to metal rebars, compatibility with a wide variety of mix designs, and incredible self-leveling and self-healing properties. All components of MCI-2008L are safe, environmentally friendly and very economical.

We would like to take this opportunity to thank Marijana Serdar - a student of Zagreb University (Croatia) for her input in formulating and testing of MCI-2008 L, while she was here working in our laboratory.

Did You Know? The History of the MSDS

The history of the material safety data sheets (MSDS) can be explained in many ways. Samuel A. Kaplan, Division of Chemical Health and Safety, Kansas State University has chosen to show its development in a logical, historical sequence. Kaplan traced the origins of the MSDS to hieroglyphics on the inside of the pyramids which gave users of various chemicals information about how to use them safely, etc.

In the 19th century, chemists were recording safety precautions, etc, and making them available to their customers. The Public Health Service and others made chemical safety sheets available in the early 20th century. By the 1940's the Manufacturing Chemists Association (precursor to today's American Chemistry Council) had a series of sheets available on commodity chemicals. In the 1950's, Dow



Nadia Fine, Administrative Assistant

Chemical published an article in the industrial hygiene journal describing their MSDS program in their company. From a US regulatory standpoint, the first requirements were adopted in the late 1960's in the maritime industry. In 1983, they were required by OSHA in the manufacturing industry - this was later expanded to cover all employers in 1987. MSDSs are also required in Europe, Asia, Canada, Australia, and there are international activities currently underway to have an internationally harmonized approach to these requirements.

Q&A

by Alla Furman, PhD, Senior Corrosion Engineer

1. Why electrochemical methods can be applied for evaluation of corrosion?

Electrochemistry can be used for that purpose because corrosion accompanies the charge exchanged between corroded metal and surrounding corrosive substances. Metals give away the electrons to hydrogen ions, oxygen, water or other species. This exchange - electrical current can be registered and measured by electrochemical equipment.

2. Why to use electrochemistry?

Electrochemistry allows us to evaluate the corrosion rate and subsequently the performance of the inhibitors in a short time with accuracy.

3. What data can one obtain using electrochemical testing?

Corrosion potential, corrosion current, corrosion rate, polarization resistances and electrochemical impedance level of metal can be measured. Corrosion rates, the probability of local corrosion including pitting or crevice, can also be predicted based on electrochemical measurements.

It is obvious that low corrosion rates, high polarization resistance and level of electrochemical impedance are preferable.

4. What does it mean 'corrosion potential'?

Corrosion potential is the characteristics of the interaction of a metal and electrolyte. Corrosion potential is the voltage in between corroded metal and the reference electrode - a device, which has a stable potential. Metals susceptible to corrosion have low negative potential.

5. What does 'polarization curve' mean?

Polarization is electrically charging the metal from the power source in the corrosive electrolyte. It is the electrochemical method of studying of corrosion behavior of this metal. Polarization curve is the graph: applied to the electrode voltage vs. the current, caused by this voltage, or opposite - applied current vs. poten-

tial of the electrode: $I = f(E)$, where I - is the current, E - is the voltage (potential). If a little change of the applied potential causes a significant increase in current, metal is corroding fast. If it is necessary to apply substantial voltage for the small increase of current, the corrosion is developing slowly.

6. What is Electrochemical Impedance Spectrum?

Electrochemical Impedance is usually measured by applying an AC potential to an electrochemical cell and measuring the current through this cell. One of the characteristics of AC signal is its frequency. Electrochemical Impedance Spectrum is the graph Electrochemical Impedance (Ohm) vs. Frequency (Hz) of applied electrical signal. This test can be used for evaluation of the systems, which have high electrical resistance, for example, coatings, concrete and others.

7. Where electrochemical equipment can be used?

It can be used in the laboratory and in the field. In the laboratory utilization of electrochemical instruments accelerates evaluation of the exist-

ing products, and those under development.

In the field, corrosion monitoring by different types of corrosometers and other electrochemical instruments allows to measure corrosion rates inside of pipes, reinforcing steel in concrete, etc.

8. Which electrochemical instruments Cortec's laboratory uses?

We have four types of corrosion meters for monitoring corrosion in liquids, vapor phase, underground and in concrete, two modern potentiostates: one - for measurements in water based liquids, another - for measuring corrosion rates in concrete and under the coatings. Both potentiostates are equipped with the software, which makes these instruments easy to use.

Cortec lab utilizes all described above tests in its every day work.

What would you like to see in the next Leading Edge?

If you have comments/suggestions, please let us know.

Again, this is your newsletter, and we'd love to hear from you.

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