WORLD PIPELINES®

COATINGS & CORROSION

A PROTECTIVE BARRIER FROM CORROSION

Ana Juraga, Cortec Corporation, USA, presents environmentally safe inhibitors for corrosion protection.

Cortec® Corporation is one of the global leaders in innovative, environmentally responsible Vapour phase Corrosion Inhibiting (VpCI®) and Migratory Corrosion Inhibiting (MCI®) corrosion control technologies for various industries. Headquartered in St. Paul, Minnesota, Cortec manufactures over 400 products distributed worldwide. Presently, the company is producing a full line of multifunctional products, and highly commits to continued development of solutions that are useful, non-hazardous to the environment, and recyclable whenever possible.

Environmentally safe corrosion protection

The company's strong environmental concern is demonstrated in the design and manufacturing of the products that protect materials of all kinds from environmental degradation. A strong commitment to produce recyclable products made from sustainable resources has been, and will be, its future policy, due to its expansion into new markets and creating new high-tech applications every day.

VpCI technology is an innovative, environmentally safe, cost-effective option for corrosion protection. It protects with

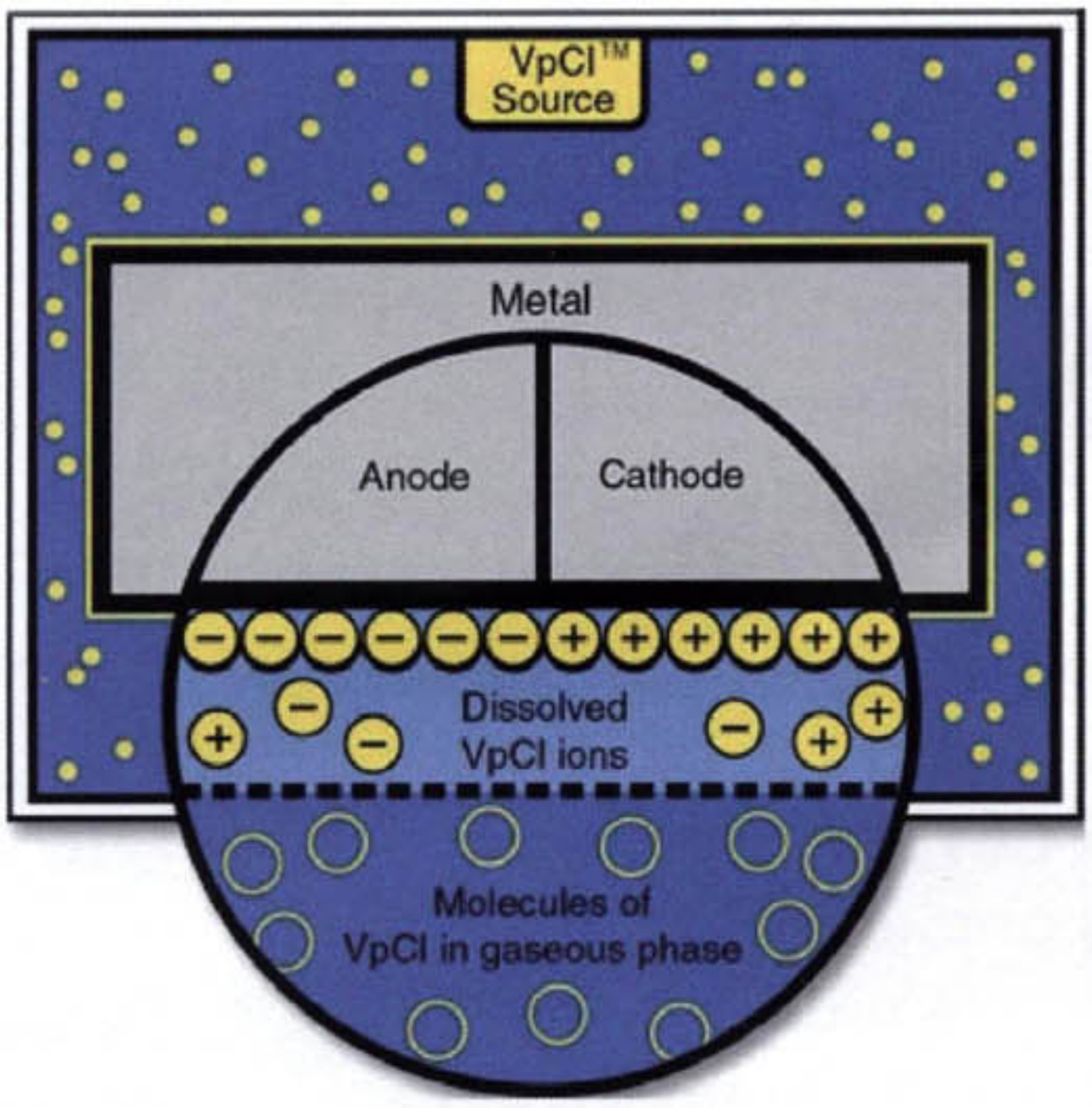

Figure 1. Patented VpCI technology protects the metal substrate with a tight bonding molecular structure. This system eliminates the gaps that occur with traditional inhibitors and prevent corrosion from starting. Environmentally safe VpCI inhibitor technology substantially cuts time and cost throughout the entire product life cycle.

a thin, mono-molecular protective barrier that re-heals and self-replenishes, and can be combined with other functional properties for added protective capabilities. VpCIs form a physical bond on the metal surface, which creates a barrier layer against aggressive ions and consequently protects the multi-metals in enclosed environments.

Additionally, these molecules are based on amine carboxylate chemistry and are dipoles with a non-uniform distribution of charges, which translates into attractive forces that that pull the molecules towards the metallic surfaces. The molecules arrange themselves parallel to one another and perpendicular to the metallic surface, forming a mono-molecular layer. This layer then adsorbs to the metal, displaces the water molecules, and protects the metal from corrosion. Being a dipole allows the protection of both the anodic and cathodic components of the corrosion cell. As a result, VpCIs are effective at protecting multimetals in electrical, static, rotating and civil equipment, and structures.

VpCIs have a medium vapour pressure around 10^{-2} - 10^{-7} mmHg that causes it to vaporise or sublimate into to the vapour phase. Sublimation continues until the enclosed space is saturated achieving equilibrium. The VpCI molecules diffuse from areas of high concentration to low concentration reaching all areas of the enclosure. VpCI molecules can therefore go wherever oxygen molecules can, making them an effective protection method for hard-to-reach areas such as crevices. VpCIs have an affinity and are attracted to metallic surfaces where they condense to provide protection.

Manufacturing the product

Cortec technology can be used in each stage of the product's lifecycle, starting from the production of metal stock to its actual use in the field. When properly applied, the VpCI/MCI technology substantially cuts time and cost throughout the entire product life cycle: manufacturing, storage, shipping, and field service. It eliminates the extra processing steps such as cleaning, degreasing, rust removal, pickling, sandblasting, and re-protecting, while enabling less re-work, fewer rejects, improved quality, reduced rust claims, and extended equipment life.

During the manufacturing of the product, the technologies easily integrate into customer's fabrication and assembly processes. While eliminating the corrosion of ferrous and non-ferrous metals, Cortec products can provide lubrication, enhance production speed, and prolong tool life, to help the customer produce first-quality products.

Man vs corrosion

The oil and gas industry has presented many different challenges to researchers in fighting the effects of corrosion – in economic loss and environmental safety. The total annual cost of corrosion in the oil and gas production industry is estimated to be US$1.372 billion, more specifically US$589 million in surface pipeline and facility costs, US$463 million annually in downhole tubing expenses, and another US$320 million in capital expenditures related to corrosion.

Cortec's capability offers highly efficient and economical corrosion protection for oil and gas applications. The company's products have been developed using proprietary VpCI technology, which is a safe, cost-effective method for preventing and diminishing the severe damage caused by corrosive process streams. Utilising the corrosion inhibiting products will help companies within the oil and gas industries to comply with safety, health, and environmental policies, as well as reduce unplanned maintenance and deferment costs.

Why this method?

Unlike conventional methods, such as filming amine corrosion inhibitors, VpCIs can be injected into any part of the system; they go to work immediately and are self-replenishing. Continuous, uninterrupted protection in the liquid phase, interphase, and vapour phase can be added at multiple points. For example, the automatic injection of Cortec VpCIs into a system – with no attendance operator – provides protection immediately, even on pre-rusted or scaled surfaces.

In a rapidly growing market, the company continues to lead in the oil and gas industry with its innovative corrosion control products. Many of these unique products conform to ASTM G 1, ATMS G3 Standard Test Methods, NACE Standard TM-01-64 for Laboratory Corrosion Testing of Metal for the Process Industries, and NACE Standard TM 0169-95 for Laboratory Corrosion Testing of Metals.

In order to continue to facilitate and ensure that its customers' needs are met efficiently, Cortec provides:

- Quality management system (ISO 9001 certified).
  - Product offerings – an innovative producer of leading edge products.
  - Customer service – a positive, long lasting impression through every link of the company.

- Environmental commitment.
- An ethical and respectful company culture, of colleagues, customers, and vendors.

- Environmental management system (ISO 14001 certified).
- Laboratory accreditation (ISO/IEC 17025) – ensures quality testing services, and to continually improve the effectiveness of the quality management system. It is the company's goal to encourage active participation of all employees in quality planning and continual improvement efforts to meet all quality and service objectives. It is the only lab in the industry that has received ISO/IEC 17025.

CorroLogic

With the support of corrosion scientists, engineers, and testing facilities, the company has especially created a CorroLogic®

Figure 2. A major US pipeline company successfully used CorroLogic VpCI-639 HFB, for the lay-up of transporting pipeline and corrosion protection during their hydrotesting.

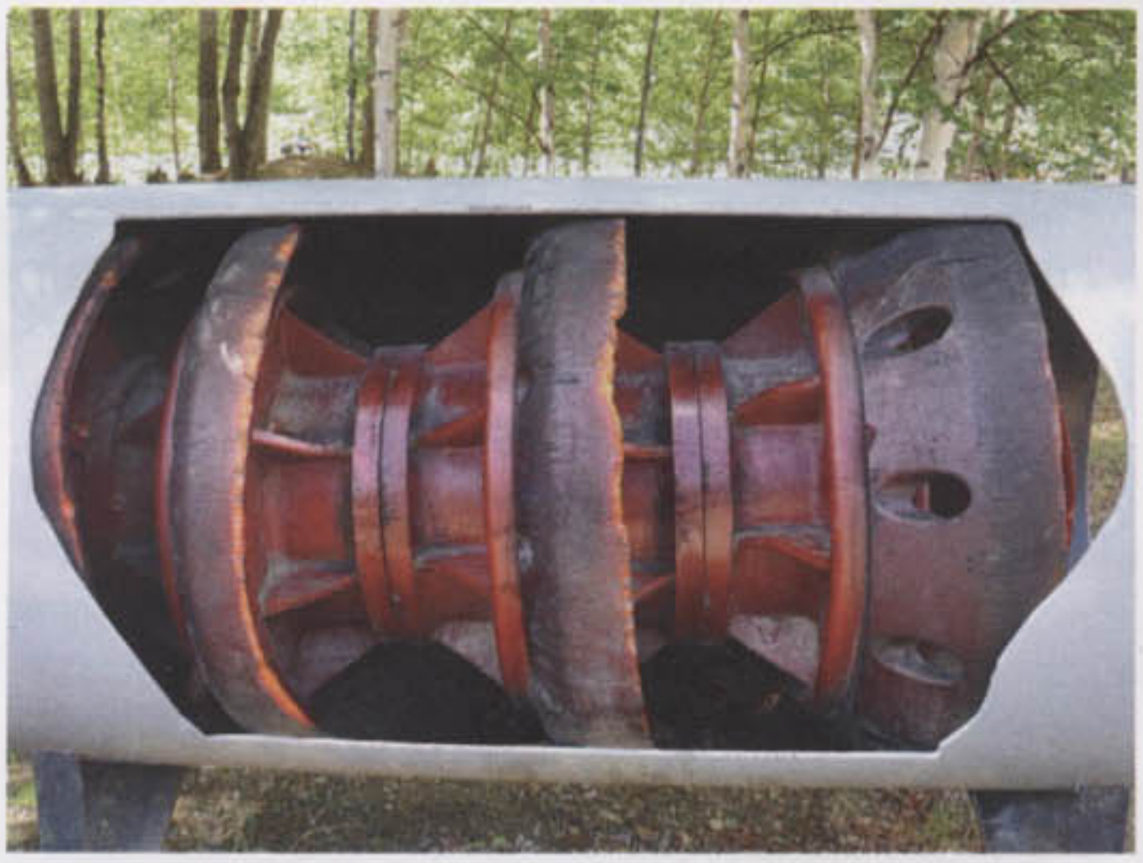

Figure 3. VpCI-639 HFB provided excellent corrosion protection during hydrotesting, the lay-up period following hydrotesting, and it was also beneficial when the pipeline was going back into service.

VpCI-639 and VpCI-639 HFB system of corrosion inhibitors. They are designed to provide continuous corrosion protection against severe conditions encountered in petroleum/natural gas production and processing. The VpCI-639 and VpCI-639 HFB systems are oil soluble, water dispersible, fast acting, long-term inhibitors for multiple oilfield applications.

They are effective for a wide range of refined hydrocarbons, crudes, and oil/water ratios. The products' unique chemistry allows the provision of effective anti-corrosion protection in sweet/sour (low or high hydrogen sulfide concentrations) environments at a very low concentration for metals in the presence of water, halogens, and corrosive gases such as dissolved oxygen, sulfur dioxide, carbon dioxide, and hydrogen sulfide. Additionally, they are very stable and will perform at elevated temperatures and in high-pressure environments without gunking, and protect even areas that are inaccessible to direct solution contact.

VpCI-639

VpCI-639 is recommended when a customer needs a product with high flash point and the ability to stop or minimise bio-growth progress. Thusly, it protects internal parts during low fluid levels, and combats atmospheric corrosion in production and storage tanks.

Temperature stability is maintained up to 400°F (204°C) and pressures stability up to 9000 psi (621 bar) in sweet/sour systems. These inhibitors provide corrosion protection through the range of extreme service conditions encountered in natural gas applications. They are designed for use in offshore equipment, wells, pipes, pipelines, refineries, tankers, production and storage tanks, and chemical plants, and are also available in liquid form for easy direct application without premixing, it enables post action inhibiting effect.

VpCI-639 HFB

Recently, a major US pipeline company successfully used CorroLogic VpCI-639 HFB, for the lay-up of transporting pipeline and corrosion protection during their hydrotesting. The slug of VpCI-639 HFB was run between two pigs to achieve full coverage of the internal surface of the pipeline. VpCI-639 HFB provided excellent corrosion protection during hydrotesting, the lay-up period following hydrotesting, and it was also beneficial when the pipeline was going back into service. The preservative used in the formula suppressed bacteria usually present in pipes transporting petroleum including anaerobic sulfate reducing bacteria. The customer appreciated the relatively low cost of application; instead of inhibiting the whole volume of the water used for hydrotesting VpCI-639 HFB was only used in a limited amount that provided a tenacious protective film on the inner walls of the pipeline.

VpCI-639 has successfully passed its wheel tests, and confirms to the NACE test method ID 182 (Film persistency-90+% protection, Continuous Treatment-90+% protection) in addition to the Rotating Cylinder Electrode Test, ASTM G-170-01, 'Standard guide for evaluating of Qualifying Oilfield and refinery Corrosion Inhibitors in the Laboratory', 95+% of protection.