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SureTap® Hot Tapping Machines

A SELF-REPLENISHING CORROSION BARRIER

Ana Juraga Oluic, Cortec Corporation, Croatia, details a corrosion inhibiting technology and its recent applications protecting pipelines.

One of the global leaders in innovative, environmentally responsible corrosion control technologies for various industries is Cortec® Corporation. Headquartered in St. Paul, Minnesota, the company manufactures over 400 products distributed worldwide.

Following extensive research and development, Cortec pioneered the application and distribution of Vapour phase Corrosion Inhibiting (VpCI®) and Migratory Corrosion Inhibiting (MCI®) technologies. Cortec produces a full line of multi-functional products and highly commits to the continued development of solutions that are useful, non-hazardous to the environment, and recyclable whenever possible.

The company's strong environmental concern is demonstrated in the design and manufacturing of its products that protect materials of all kinds from environmental degradation.

VpCI technology is an environmentally safe, cost-effective option for corrosion protection. VpCI products protect with a thin, mono-molecular protective barrier. The barrier 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, creating a barrier layer against aggressive ions, and protect multi-metals in enclosed environments.

VpCIs have a medium vapour pressure of approximately 10^{-2} - 10^{-7} mm of mercury that causes them to vaporise or sublimate into 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 go wherever oxygen molecules can go, making them an effective protection method for hard-to-reach areas such as crevices. VpCIs are attracted to metallic surfaces where they condense to provide protection.

VpCI molecules are based on amine carboxylate chemistry. These molecules are dipoles with non-uniform distribution of charges, which translates into attractive forces that pull the molecules towards metallic surfaces. The molecules arrange themselves parallel to one another and perpendicular to the metallic surface, forming a monomolecular layer. This layer 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. VpCIs are effective at protecting multi-metals in electrical, static, rotating and civil equipment and structures.

VpCI and MCI technology can be used in each stage of the product's lifecycle, starting from the production of metal stock to actual use in the field. When properly applied, VpCI/MCI technology substantially cuts time and costs throughout the entire product lifecycle: manufacturing, storage, shipping and field service. These products eliminate

Figure 1. The internal and external surfaces of the pipes were washed with VpCI™-414. The inside surfaces were sprayed with VpCI-369D and the external surfaces were coated with VpCI-368M. Both ends of the pipes were sealed with a plastic cap or film.

Figure 2. After the application of Cortec® products, the pipes are stored for three years.

the extra processing steps such as cleaning, degreasing, rust removal, pickling, sandblasting and reprotecting. This allows for less re-work, fewer rejects, improved quality, reduced rust claims and extended equipment life.

During manufacturing, these technologies easily integrate into customers' fabrication and assembly processes. While eliminating the corrosion of ferrous and non-ferrous metals, they provide lubrication, enhanced production speed and prolonged tool life to help the customer produce high-quality products.

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 VpCIs into a system – with no attendance operator – provides protection immediately, even on pre-rusted or scaled surfaces.

In order for Cortec to be able to continue to facilitate and ensure that its customers' needs are met efficiently, the company provides:

- Quality Management System (ISO 9001 Certified).
- 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 Cortec's goal to encourage active participation of all employees in quality planning and continual improvement efforts to meet the quality and service objectives. Cortec Laboratories is the only lab in the industry that received ISO/IEC 17025.
- Environmental commitment – Cortec commits to the continued development of processes and products that are useful, non-hazardous to the environment, and recyclable whenever possible.

Deterioration due to corrosion of tubular structures during transportation and temporary storage is a huge and persistent problem in industry. It causes direct as well as indirect material losses. Owing to corrosion, time is diverted to handling complaints and customer loyalty is potentially lost. Deliveries are delayed as corroded components are reworked; corrosion weakens the structural integrity of a pipeline and makes it unsafe for transporting potentially hazardous materials. Since it can appear within hours or days, a prevention method must be implemented. The increased risk of pipeline failure far outweighs the costs associated with installing, monitoring and maintaining corrosion control systems. Preventing pipelines from deteriorating will save money, preserve the environment and protect public safety. Therefore, planning for corrosion protection during temporary storage and transportation is a logical and above all necessary step to minimise these losses.

Thankfully, modern solutions – such as CorroLogic VpCI technology – are available on the market. The solutions provide protection to equipment and parts during these

Figure 3. Pipes were sealed with an end cap and Cortec VpCI-309 powder was fogged in at a rate of 500 g/m^3.

Figure 4. The opened end was sealed with an end cap. This would ensure the protection of the pipes for more than three years.

sensitive time frames. A specialised product range developed by Cortec Corporation's scientists and engineers offers solutions for preventing corrosion of pipelines and extending the structural life of pipelines. This range is the Corrologic CorrCaps™ powered by Nano VpCI, which are heavy wall black polyethylene pipe caps containing proprietary VpCIs.

Case study: outdoor pipe storage

A customer needed to prevent corrosion on the inside and outside surfaces of pipes being stored outdoors. The customer uses the pipes to repair damaged transport system gas lines.

The internal and external surfaces of the pipes were washed with VpCI-414 (15% dosage rate). The inside surfaces were sprayed with VpCI-369D, and the external surfaces were coated with VpCI-368M. Both ends of the pipes were sealed with a plastic cap or film. After the application of Cortec products, the pipes are stored for three years. The customer's needs were met in an efficient and economical way.

Case study: storage of gas pipes

Unit Engineers & Construction Ltd carries out various tasks on gas pipes. Approximately 50 of the pipes, varying in length between 1 - 10 m and an internal diameter of 40 - 70 cm, were in need of long-term protection. These pipes were to be stored outside, open to the elements, possibly causing internal corrosion.

The customer required a solution that would allow the pipes to be stored outside prior to assembly, which could be for up to two years.

The pipe flanges were treated with VpCI-389D and allowed to dry. The ends and various other openings on the pipes were then covered with VpCI-126, while VpCI-609S was fogged into the internal areas of the pipes.

Cortec's solution resulted in low cost anti-corrosion protection, allowing the equipment to be stored outside prior to assembly.

Case study: equipment preservation

Ensco required the cleaning and long-term, outdoor preservation of one Annular and two BOP NXT double bodies. The equipment was to be stored outdoors, at a coastal storage yard in the UAE where temperatures can regularly exceed 50°C and humidity upwards of 100% is not uncommon in the summer. Both internal and external preservation with a tried and tested solution was required.

Cortec's VpCI products were proposed to Ensco to mitigate the effects of corrosion for the Annular and BOPs. The preservation work took place in a GAC yard in Mussafah, Abu Dhabi. Lifting lug access was maintained so that equipment could be moved from the GAC yard to permanent storage, as required by Ensco.

The process took the following steps:

- Equipment was hand cleaned before VpCI-414 was brushed on to prepare the surface for the new coating.
- VpCI-386 was applied to all painted surfaces and VpCI-368 to all bare surfaces.
- Internal void spaces were protected by placing VpCI-308 pouches inside the cavity.
- Equipment was wrapped with MilCorr VpCI Shrink Film to prevent the ingress of dust to the unit and provide additional corrosion protection.

The equipment was effectively and efficiently preserved with Cortec products at the yard where they were stored. Following which they were moved to a new storage location. Access to lifting lugs was maintained and the MilCorr wrap was durable enough that it did not tear or rip during transit.

Conclusion

Deterioration due to corrosion during transportation and temporary storage during interstage manufacturing, is a huge problem in the industry. As a result of temporary corrosion, time is diverted to handling complaints and customer loyalty is potentially lost. Therefore, planning for corrosion protection during temporary storage and transportation is crucial to minimise these losses. Cortec is developing new technologies and integrated solutions to ensure safe transport of materials and minimal losses for clients.