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Choosing a System to Combat CUI

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Corrosion under insulation (CUI) is a heavily discussed and well-studied subject in the oil & gas industry. To mitigate CUI, suppliers and owners are constantly seeking new, more effective ways to protect cladding, keep water out of facilities and improve coating systems and corrosion detection methods. Still, after struggling with CUI for years, the industry has not been able to eliminate the problem completely.

CAUSES OF CORROSION UNDER INSULATION

The amount and speed of corrosion development depend on variable factors, including the climate, temperature ranges and cycles, frequency and duration of exposure to moisture, corrosivity of the aqueous environment, design of the structure and the protective system, insulation type, tracing systems and site-maintenance practice. In most cases, the chronology is about the same. As long as water cannot enter the system, CUI will not exist, but as soon as the cladding becomes damaged, water can penetrate. The more water that enters the system, the more contaminants will be deposited on the surface. From then on, the existing coating system will be the only protective barrier between developing corrosion and the steel.

Unfortunately, no surface stays consistenty hot. There will be cooling from events such as maintenance shutdowns and postponed startups, so water ingress — by condensation, for example — will always be possible.

PPG HI TEMP 1027 was used to protect pipes and valves against CUI in severe cyclic temperature service.

THREE PILLARS OF PROTECTION

Cladding, insulation and the coating system are all equally important considerations when it comes to combatting corrosion.

1. **First Pillar: Cladding** is the initial barrier between the steel and the environment, and it needs to be placed in a professional manner. After installation, it should not be walked on, and damages should be reported and repaired immediately.
2. **Second Pillar: Insulation** is chosen based on certain criteria. When existing insulation is removed, the first question should be whether new insulation is necessary. What is its purpose — personal protection, process control, other? Then, one must determine if old insulation should be replaced with the same type or if alternatives have a better chance of preventing CUI in this instance.
3. **Third Pillar: Protective coating** is essential. When choosing the coating system, all relevant factors — such as downtime, steam-out phases, time to start-up, temperature ranges (cyclic or not) and maintenance requirements — should be taken into account.

With no official testing standard at present, the industry, itself, has developed and adopted several studies as well as guidelines for mitigating CUI. Highly detailed documents — referred to as API 583, EFCWP13 and WP14 — address design and insulation but do not cover coating specification in depth. A more coating-specific document is NACE SP0198-2010, in which different temperature ranges determine coating system recommendations.

Within ISO and NACE, technical committees are working on a new standard for CUI (expected late 2018), providing a protocol for dedicated service by which coating suppliers can test protective coating systems.

TYPES OF COATING SYSTEMS

Zinc, an active pigment added to coatings to protect against corrosion, is used less often than it was several years ago. A more reliable solution for protecting against corrosion is use of the barrier principle. Available technologies include two-pack epoxy coatings, two-pack epoxy phenolic coating, and multipolymeric and inert multipolymeric matrix systems designed to serve in challenging conditions and different temperature ranges.

Advantages of epoxy (immersion grade) and epoxy phenolic technology are 1) high chemical resistance and 2) service at temperatures of up to 150 Celcius (C) with limited cycles. Phenolic systems, however, need a surface preparation to SA 2.5 (ISO 8501), which makes them less suitable for maintenance.

Inert multipolymeric coating systems perform extremely well in the temperature range from cryogenic to 0 C and from 120 C on. Because these coatings form a barrier of around 250 µm and are filled with either micaceous iron oxide or aluminium, they tend to perform well in the ambient temperature range, too. This versatility makes them an ideal solution for on-site maintenance of insulated surfaces as well as a good long-term solution for newbuild systems.

CONCLUSION

Every type of product — whether an epoxy, a phenolic epoxy, a multipolymeric matrix system or a technology such as thermal sprayed aluminum (TSA) — has its place. In the design phase, it is very important to consider the types of coatings available, taking all relevant factors into account to ensure the selection of a system that will best protect the asset.

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Chris started his career in paints and coatings in 2004 with Sigmakalon, which was acquired by PPG in 2008. A certified Frosio Level-Three coating inspector, he has spent the last four years as a business development manager for the EMEA region, with responsibility for driving two specific PPG product ranges, the HI-TEMP coatings and PPG tank-lining solutions.

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