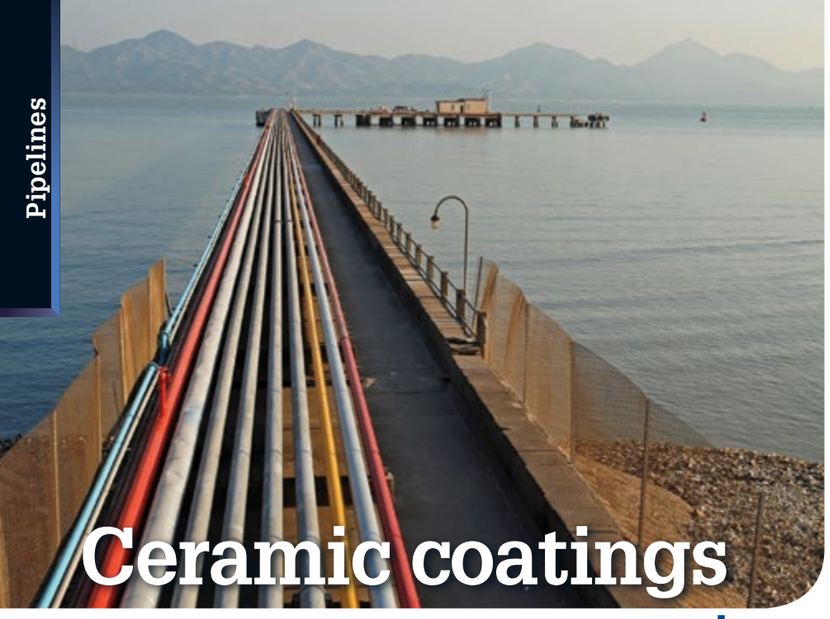


Ceramic coatings can prevent corrosion

Corrosion has long been the bane of the oil industry. Now new approaches and coatings are resolving the difficulties and providing intriguing possibilities for offshore pipelines, explains Tony Collins of EonCoat.

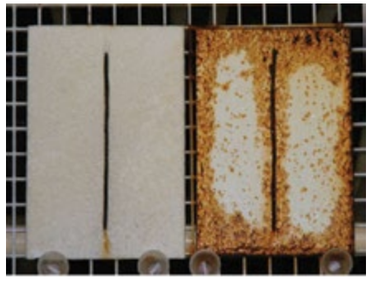
In the oil and gas industry, corrosion accounts for over 25% of failures, according to a recent National Association of Corrosion Engineers (NACE) International report. Corroded pipe repair or replacement costs the industry over US$7 billion per year, based on estimates from NACE. This figure can double when lost revenue, productivity, and spill or leak cleanup costs are tallied.

As deepwater exploration accelerates, protecting offshore pipelines from seawater corrosion is becoming more vital than ever to preserve deeper and more costly oil and gas assets. While offshore pipelines supplement corrosion protection with cathodic protection, the main defense against corrosion remains external pipeline coatings, particularly fusion-bonded, epoxy-powder coatings.

"Corrosion is a major industry challenge," says Scott Justice, Tank Division operations manager of Bolin Enterprises Inc. (BEI), a Casey, Ill.-based pipeline and tank maintenance contractor serving the oil and gas industry.

While traditional corrosion protection has relied mostly on short-lived, physically-bonded coverings of substrate surfaces such as tapes, elaborate three-part coating systems (zinc, epoxy, and urethane), and cathodic protection, these merely attempt to lengthen the time before the steel asset inevitably rusts.

Now a growing number of proactive, oil and gas industry maintenance professionals are turning to a new category of tough, chemically-bonded, phosphate ceramics (CBPC) that can prevent corrosion, extend equipment life, and minimize the cost and production downtime required to recoat, repair, or replace corroded equipment.



EonCoat is a true ceramic coating that delivers a tough-as-nails, corrosion resistant coating that can stand up to just about any application in the industrial or commercial sector.

EonCoat is resistant to high temperature, abrasion, chemicals, UV sunlight, and other environmental factors.

New approach

"What caught my eye about [CBPC coating] was its unique adhesion and chemical properties," says Justice, who visited Wilson, N.C.-based EonCoat LLC to view its corrosion testing lab, processes, and procedures for its CBPC coating. "If its hard outer shell is breached or knocked off, it still has corrosion protection where traditional coatings do not. Whether its coating is aged, beaten, or banged around, it still protects the surface. If you remove the outer ceramic shell, the chemical bond with the substrate still stops corrosion at the surface."

In contrast to typical paint polymer coatings that sit on top of the substrate, the anti-corrosion coating bonds through a chemical reaction with the substrate, and slight surface oxidation actually improves the reaction. This makes it impossible for corrosion promoters like oxygen and humidity to get behind the coating the way they can with ordinary paints. The corrosion barrier is covered by a true ceramic shell, which resists corrosion, fire, water, abrasion, chemicals, and temperatures up to 1000°F.

While traditional polymer coatings create a film structure, which mechanically bonds to substrates that have been extensively prepared, if gouged, moisture and oxygen will migrate under the coating's film from all sides of the gouge. Moisture and heat are then trapped by the film, creating a "greenhouse effect," promoting corrosion and blistering. By contrast, the same damage to the ceramic-coated substrate will not spread corrosion because the steel is essentially alloyed. Its surface oxides have been converted into an inert, electrochemically stable metal incapable of supporting oxidation.

Ceramic coatings such as this consist of two, non-hazardous ingredients that do not interact until applied by a plural-component spray gun like those commonly used to apply polyurethane foam or polyurea coatings. Since the components are not mixed and do not meet prior to application, the need for hazardous volatile organic compound (VOC)-generating ingredients is eliminated, as are hazardous atmospheric particles and odor. This means that the work can be done in occupied areas.

"The results of the corrosion tank test were impressive," says Justice. Among the corrosion tests frequently run by the manufacturer of the CBPC product is one where the ceramic coating has gone more than 10,000 hours with no corrosion in a salt spray ASTM B117 test. "If the coating works as well as we hope, it could help to stop or minimize corrosion and extend the longevity of a range of oil and gas assets," adds Justice.

Independent electrochemical corrosion potential testing of the CBPC product also indicates its usefulness for offshore pipeline corrosion protection. Steel plates coated with EonCoat were placed in a beaker of saltwater by Dr. Ki Yong Ann, Dept. of Civil and Environmental Engineering, in a lab at Hanyang University, Seoul, Korea. When voltage was run through the solution and the corrosion rate measured by measuring current leakage across the coating in ma/sq m, the coated plates were found to have no corrosion potential. Any result below '2' is considered to have no corrosion potential, and the coated plates tested at 1.15 the first time, and 0.85 the second time.

For submerged offshore pipeline applications, an anti-fouling topcoat can be added to the CBPC coating, which enhances appearance and reduces barnacle growth.

Unlike organic, carbon polymer-based paints and coatings, which may give a foothold for corrosion causing microbes to grow, ceramic coatings are completely inorganic, so they are inhospitable to mold or bacteria. "Since EonCoat is inorganic, it cannot sustain mold or bacteria growth," says Justice.

While not widely considered, the Achilles heel of many traditional corrosion coatings may be in how exact the environmental conditions must be during their application to meet specifications. "A lot of coating products fail due to changes in temperature, humidity, dew point, and other atmospheric factors during application," says Justice. "As conditions change seasonally throughout the year, it can be difficult to provide perfect coating conditions."

Protective ceramic coatings can be applied on hot or cold surfaces, from 40-150 °F in 0-95% humidity, excluding direct rain.

"Since the ceramic coating takes changes in temperature, humidity, and dew point out of the equation during application, it can be reliably used in tough environmental conditions that might otherwise compromise the corrosion protection of typical coatings," says Justice.

Cutting downtime

Shane Bartko, a director at TKO Specialty Surfaces, a Calgary, Alberta-based tank, pipeline, and structure maintenance contractor, has used the ceramic coating for corrosion control on a variety of oil and gas projects. "To keep a corrosive coating working well, you want one that will be resistant to high temperature, abrasion, chemicals, UV sunlight, and other environmental factors," says Bartko.

The time saved on a corrosion coating project with ceramic coating comes both from simplified surface preparation and expedited curing time. "With a typical corrosion coating, you have to blast to white metal to prepare the surface," says Bartko. "But with the ceramic coating, you typically only have to do a NACE 3 commercial brush blast." Bartko explains that on coating projects using typical polymer paints such as polyurethanes or epoxies, the cure time may be days or weeks before the next coat of three coatings can be applied, depending on the product. The cure time is necessary to allow each coat to achieve its full properties, even though it may feel dry to the touch.

In contrast, ceramic coating is applied in a single coat, with almost no curing time necessary. Return to service can be achieved in as little as one hour.

"With the ceramic coating for corrosion protection, we're able to get facilities back up and running right away after spraying, sometimes in an hour," says Bartko. "That kind of speed in getting an oil and gas facility producing again can potentially save millions per day in reduced downtime. It makes sense to use the ceramic coating anywhere steel is used and may corrode, from pipelines and processing to storage." OE

For more info, call 252-360-3110; email TonyC@EonCoat.com; visit www.eoncoat.com.

With EonCoat it took about four days to get the facility up and running again, compared to 10 to 12 days with other coatings.

Corrosion is a major industry challenge from external floating roof tanks, to tank interiors, to above and below grade piping systems, particularly where pipes transition from above to below grade.