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NEWSLETTER

HEGGEL® Corr 280

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Novel Thermally Stable Protective Coating

Corrosion Threat in Molten Sulfur Storage Tanks

Produced in a wide range of industries, molten sulfur is globally used in large volumes in natural gas plants, oil refineries, petroleum refining sectors, etc. It is universally used in the production of sulfuric acid, rubbers, detergents and other chemical compounds. Sulfur storage tanks are accordingly an inseparable utility of gas treating systems in sour crude oil refineries and gas sweetening plants, enabling sulfur recovery plants to temporarily store sulfur liquid.

H_2S and SO_2 are among main chemicals present in molten sulfur, and in case of any kind of water exposure, high levels of corrosion risk and toxicity will be imposed on industrial assets. For instance, SO_2 is prone to forming extremely corrosive sulfurous acid if water is present, and the structures could fail due to the destructive effects of acid accumulations and solid buildups. Solidified sulfur itself could act as an insulator, lowering the surface temperature to proceed with the oxidation of H_2S to condensate water, creating a perfect environment for accelerating corrosion. In sulfur handling systems, the sulfur vapor could also be combined with moisture to create a sulfuric acid, threatening the integrity of infrastructures.

Furthermore, thermal loads exceeding 140˚C to maintain sulfur at liquid status, combined with high acidic exposures, exacerbate corrosion effects on the facilities including sulfur tanks, piping systems, nozzle vents, etc. Complicated processes with a variety of mechanisms are involved to cause both external and internal corrosion outbreaks in sulfur tanks.

Internal Corrosion

Solid sulfur deposition is a major cause of internal corrosion in sulfur tanks and the associated components. Temperature variations caused by lack of insulation, external climate changes, insufficient heating, etc. are also effective in solidification of the sulfur fog and the consequent propagation of severe internal corrosion.

Rust layers at the internal surfaces of the tanks form another potential mechanism for internal corrosion. Water presence of any kind would result in wet sulfur corrosion; for instance, leakage in internal steam coils used to maintain the temperature of molten sulfur could be a source of water, creating an ideal condition for iron/sulfur corrosion.

Since internal corrosion is not easily detectable, it will remain inconspicuous and eventually emerge as an overwhelming catastrophe.

External Corrosion

The Presence of water in any form, penetrating the insulation of the tanks is the preliminary cause of the external corrosion. Generally, in case the temperature falls below 100˚C, e.g., as a result of inadequate heating or deficiencies in insulation, the water trapped between the tank surface and the insulation will not vaporize and consequently corrode the surface, specifically the walls of the tanks.

External corrosion could also be as a result of the accumulation of sulfur element or sulfuric acid on the base areas or tank surroundings.

Corrosion Consequences Fire and Failure

Corrosion is indeed the root cause of concerns regarding integrity, technical performance, longevity and safety in industrial infrastructures. Corrosion mechanisms activated by the combined effect of solid sulfur formation and liquid water are considerable issues associated with sulfur storage tanks.

Moreover, pyrophoric compounds, such as FeS, formed in iron/sulfur contact corrosion, will be extremely flammable when exposed to air, leading to a fulminant combustion. Vibrations could further aggravate the hazardous situation in a way that red-hot FeS may fall into the liquid sulfur, starting a fire in the tank. In case corrosion product (FeS) is exposed to oxygen, sulfur fire will ignite and the damages would be beyond repair.

Failure in sulfur storage tanks is not only a huge loss of revenues due to prolonged downtime and reconstruction, but also could be a dramatic environmental disaster causing human safety risks, pollution and water contamination issues.

Review on Solutions

Eliminating Corrosion Mechanisms

Heating systems are requisite to maintain high temperature for keeping the sulfur in molten state, preventing solid sulfur buildups and water accumulation inside the tank and the vent points. Having conventional heating systems such as coils replaced with external heating technologies is an effective approach to minimize the risk of corrosion mechanisms being activated. However, it is not always applicable for maintaining the temperature, since having the internal surfaces of the tanks adequately heated requires precise design, prediction of heat paths, temperature variations and spacing of steam elements in various operating conditions.

Mechanical Design Improvements

Though significantly enhanced, design codes and fabrication measures for sulfur storage tanks still face restrictions in mitigating the initiation and the progress of corrosion. For instance, even with optimized mechanical designs, unnoticed areas susceptible to internal corrosion are of prudent concern.

High-Tech Protective Linings

Conventional linings cannot tolerate the simultaneous effects of corrosive chemicals attack, erosion and high temperature. In contrast, high-tech protective linings effectively eliminate corrosion mechanisms, and demonstrate excellent performance in chemical resistance at elevated temperatures.

Categorized as a high-temperature corrosion resistant coating, **HEGGEL Corr 280** has been innovatively formulated to effectively counteract corrosion mechanisms, preventing destructive effects of internal corrosion deteriorating the sulfur tanks.

HEGGEL® Corr 280

Advanced Hybrid Ceramic Anti-Corrosion Coating

With a novel design and extremely high performance, **HEGGEL Corr 280** is an advanced coating system offering a thermally stable structure for superior corrosion protection against aggressive chemical stresses at high temperatures.

The unique molecular structure has enabled **HEGGEL Corr 280** to exhibit exclusive properties in long-term corrosion protection against chemically and thermally harsh environments.

The impermeable microstructure of **HEGGEL Corr 280** effectually hinders the reactive species from penetrating through the coating. This provides enhanced durability against corrosion of equipment in continuous and/or intermittent exposures to harsh chemicals.

The excellent adhesion of **HEGGEL Corr 280** to the substrate preserves the coating integrity. Slight texture and semi-gloss finished surface drastically prevents sulfur depositions, and is among the determining characteristics of an effective corrosion protection in sulfur storage tanks.

Blistering occurs all the time on industrial equipment with multilayer traditional solvent-based coatings. The solvent may get trapped between the layers; this process is drawn out and eventually the coating starts to blister or the result would be a porous spongy structure, the porosities exacerbating the coatings permeability. By contrast, the solvent free microstructure of **HEGGEL Corr 280** prevents solvent retention, eliminating the risk of blistering defect and the consequent failure.

Wet on wet application of **HEGGEL Corr 280** simplifies the installation process and reduces downtime not only in surface preparation, since the surface preparation between coatings is fully bypassed, but also through coating application itself due to the ambient curing capability of **HEGGEL Corr 280**, eliminating the post curing treatments and thereby saving cost and time.

Environmentally friendly, synthesized with modern polymer technology, **HEGGEL Corr 280** is a comprehensive response to the growing demand for corrosion prevention and control in sulfur storage tanks.

Product Features

- ✓ Self-priming
- ✓ High-temperature anticorrosive capabilities
- ✓ Chemically resistant to liquid sulfur, SO_2 and H_2S
- ✓ 100% solid content
- ✓ Fully curing at ambient temperature
- ✓ Thermal shock resistant
- ✓ Considerably abrasion resistant
- ✓ Single coat application
- ✓ Thermal cycling resistant
- ✓ Easy repair and long service life

Technical Data

Description	Value
Continuous Temperature Resistance	250°C
Intermittent Temperature Resistance	300°C
Temperature Cycling	Ambient to 250°C 50 cycles - No damage
Salt Spray Test ASTM 117	Tested on heat aged samples 1000 hours – No damage
Adhesive Strength ASTM D4541	25 MPa (glue failure)
Compressive Strength BS6319: Part 2: 1983	111.30 MPa