HEGGEL®

You Build, We Protect!

NEWSLETTER

HEGGEL® Corr 270

December 2022

INSIDE THIS ISSUE:

Novel Coating For Fluorinated Mineral Acids

Facts About Hydrogen Fluoride (Hydrofluoric Acid)

Hydrofluoric acid, the liquid form of hydrogen fluoride (HF), is a key chemical in numerous industrial applications. There is almost no substitute material for this fluorine containing compound, which could justify its growing global demand.

Hydrofluoric acid generates deteriorating effects through a dual action: Corrosion caused by properties common to mineral acids because of the hydrogen ions (H^+), and the unique, deeply destructive and toxic impact due to the fluoride ions (F^-). So, the double presence of H^+ and F^- in an acidic medium is one reason that hydrofluoric acid is classified as hazardous material even at low concentrations.

The main manufacturing process of Hydrofluoric acid is though heating acid-grade fluorspar (CaF_2) with concentrated sulfuric acid to produce gaseous hydrogen fluoride, which could be then cooled and concentrated, or dissolved in water into Hydrofluoric acid. Hydrogen fluoride could also be released when other fluoride-containing compounds, such as ammonium fluoride are combined with water.

Affected Units and Equipment Through Industrial Applications

The application of hydrofluoric acid covers a wide range of industrial sectors in many fields of activities.

Hydrofluoric acid is commonly used as a catalyst to promote efficiency in the alkylation process, enhancing the quality of petroleum in petrochemical industry. It is also a vital reagent in the production of fluorine containing compounds in polymer industries. Hydrofluoric acid is widely used in manufacturing process of refrigerants; among its particular applications is being used as a surface treatment agent in glass, metal, ceramic industries. Hydrofluoric acid is also applicable in pharmaceutical and agricultural industries.

Hydrogen fluoride is also a by-product generated in fertilizer plants focusing on phosphate-containing crop nutrients and phosphorus fertilizers. Moreover, during the production of phosphoric acid, the hydrogen fluoride is stripped from the phosphoric acid and recovered as either anhydrous hydrogen fluoride or concentrated hydrofluoric acid.

Although industrial units are carefully under control, unexpected deficiencies can lead to wet acid carryover into substrates, specifically those made of carbon steel, resulting in corrosion and eventual failure. Piping and equipment in HF alkylation unit, flange faces, pumps, process vessels, valves, dead legs, overhead systems, flare piping, some exchanger bundles, and downstream units exposed to HF are harshly damaged by an extreme acidic environment.

Description of Damage

Corrosion

Destructive effects by Hydrofluoric acid can result in high rates of general or localized corrosion accompanied by damaging phenomena such as Hydrogen Stress Cracking (HIC), Stress Oriented Hydrogen Induced Cracking (SOHIC), Blistering, Fouling, etc., exacerbating the corrosion rate. The extent of corrosion damages is directly proportional to some critical factors including:

- ✓ HF acid concentration (water content)
- ✓ Operating temperatures exceeding 65°C
- ✓ The composition of the substrate’s alloy
- ✓ Presence of contaminants including oxygen and sulfur compounds

Given the high chemical reactivity of HF, intensive care in corrosion control of associated storage and processing equipment is required, to prevent failure and loss of industrial assets.

Corrosion Prevention

There are some methods commonly used to mitigate the progression of corrosion defects:

Corrosion monitoring is an important operational approach to be continually taken, controlling the damage-susceptible areas of carbon steel equipment, piping systems, flanges face, the critical locations of rich-HF phase change in process facilities, heat-exchangers with condensing/heating rich-HF-containing streams, welds, hot return/regenerator services, etc.

For instance, UT inspection can be used to evaluate thickness loss of the equipment, or Phased Array Ultrasonic Testing (PAUT) can be performed for in situ crevice corrosion monitoring on flange faces.

Post Weld Heat Treatment (PWHT) of carbon steel substrates can reduce the problems with Stress Oriented Hydrogen Induced Cracking (SOHIC), and also minimizing preferential corrosion in HAZ of welds.

Minimizing feed contaminants such as sulfur, oxygen, water, etc. by careful operation in process units are of other solutions to extenuating corrosion damages.

Material selection of the equipment could be also a solution for eliminating blistering and HIC/ SOHIC-caused deficiencies.

Though effective in deferring corrosion initiation and controlling the extension of defects, still drawbacks are to count in with these solutions; for example, excessive holding times and temperatures through PWHT, result in loss of material strength. Moreover, common methods are more effective in corrosion mitigation and are not a permanent solution preventing deteriorating effects of corrosive environments.

In this regard, **HEGGEL Corr 270** has been innovatively designed with corrosion protective properties, specifically against fluorinated mineral acids.

HEGGEL® Corr 270

Solvent-Free, Graphite Modified, Phenolic Lining

HEGGEL Corr 270 is an advanced coating system with exclusive corrosion protective properties against fluorinated acids, specifically hydrofluoric acid at ambient and elevated temperatures. The maximum operating temperature is dependent upon the type of chemical being used.

A unique blend of liquid graphite, **HEGGEL Corr 270** has proprietary features to afford excellent chemical resistance, mechanical toughness and exceptional non-stick surface properties.

HEGGEL Corr 270 chemical composition has been very well integrated for an outstanding corrosion protection, withstanding attacks from a wide array of harsh chemicals and corrosive material agents. Graphite modified, phenolic lining by **HEGGEL Corr 270** offers even ultra-high chemical resistance to concentrated organic/mineral acids and more specifically concentrated hydrofluoric acid at elevated temperatures up to 100 °C.

Characteristics

- Solvent-free
- Self-priming
- Single layer application
- High temperature resistant up to 100°C (up to 180°C in acid vapors)
- Electrically dissipating
- Ambient curing
- Appliable on both metallic and concrete substrates

Application Areas

- Internal lining for pickling tanks
- Process vessels and associated piping
- Pumps
- Valves
- Concrete walls/floors in secondary containment areas

Full Immersion Chemical Resistance

- 70% Hydrofluoric acid
- 37% Hydrochloric acid
- 100% Glacial acetic
- 84% Phosphoric acid
- 98% Sulphuric Acid
- 40% Chromic Acid
- 50% Nitric Acid

Technical Features

Technical Data	Standard
Abrasion Resistance ASTM D 4060	32 mg weight loss (Taber CS-17/1kg/1000 cycles)
Impact Resistance ASTM G14	Forward: 5 Joules Reverse: 2 Joules
Adhesive Strength ASTM D4541	16.0 MPa (cohesive failure)
Elongation to Break BS 6319 Part 7 1985	1.0%
Temperature Resistance NACE TM0174	100°C Immersed 200°C Non-Immersed