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NEWSLETTER

HEGGEL® Corr 211

September 2022

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Novel Technology Protection against Caustic Corrosion

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Caustic Soda

Caustic Soda represented by the empirical formula of NaOH (Sodium Hydroxide), is a significant basis used in the manufacturing process of various products advantageous in numerous applications ranging from daily lives to specific industrial applications. Though available in its pure form as a white-colored solid, it is also used as a 50% solution.

Caustic soda is also a fundamental feedstock in manufacturing processes of chemicals; whether being used as a reactant, catalyst or an intermediate agent, it is an inseparable component of chemical processing. Widely used in petroleum and gas industries, its application is mainly to neutralize/remove acidic streams from hydrocarbons and scrub acidic ingredients from off-gases. Main industrial sectors directly influenced by caustic soda also include:

- ✓ Energy: fuel cell production, batteries, transportation
- ✓ Chemical manufacturing: epoxy resins, anionic surfactants, detergents, solvents, adhesives, coatings, dyes, pesticide
- ✓ Oil and gas: drilling, boiler systems
- ✓ Petroleum products
- ✓ Aluminum production
- ✓ Pulping and bleaching in paper industry
- ✓ Metal processing: metal cleaning, aluminum production
- ✓ Water treatment and conservation: acidity control, heavy metal removal
- ✓ Textiles and synthetic fibers
- ✓ Pharmaceuticals

Caustic Storage

Due to the vital role of caustic to meet a variety of industrial needs in diverse applications, the material should be stored in containers for a quick accessibility, in order to maintain the integrity of industrial processing chain.

Being a strong base, Sodium Hydroxide demonstrates corrosive properties, vigorously reacting with metals in its liquid state. Moreover, owing to its slippery nature, caustic solution readily penetrates through leak paths, consequently exposing the weak parts of storage facilities to severe corrosion. Therefore, specialized storage solutions are required to prevent multiple leaks and eventual failure, and meet hazard requirements safely while extending the durability of the engaged facilities.

To minimize potential leak sources and eliminate sidewall penetrations, some measures should be taken into account for a proper, durable and cost-effective caustic storage:

Material Selection of Storing Facilities should be resistant to the chemical's corrosive nature; carbon steel, stainless steels, nickel and high-nickel alloys are of metal substrates commonly applied in the manufacturing of storage tanks.

Secondary Containments such as double-walled tanks and sidewall tank fittings are of other necessities to make sure of safe storage in a way that spillages are collected and contained, to prevent environmental toxic/corrosive effects of Sodium Hydroxide.

Design is also another fundamental factor for a safe storage; a tank system with less piping runs for instance, prevents freezing and solid deposition of Sodium Hydroxide and the destructive consequences.

Temperature is also a crucial parameter to be maintained to promote fluidity and prevent caustic deposition and solidification resulting in material waste and damages to the storage tanks itself.

Protective Coatings could effectively provide durable storing conditions with less maintenance against the principal threat of caustic corrosion to storage vessels.

Caustic Corrosion

Though controllable at room temperature, caustic corrosion causing significant damages to steel tanks is a severe industrial concern; the conditions are even exacerbated at fluctuating and elevated temperatures, and/or with exposures to higher concentrations of caustic solutions.

Caustic conditions can rapidly attack the steel substrates; NaOH can additionally react with exposed elemental iron to form atomic hydrogen, resulting in hydrogen embrittlement, dramatically decreasing the wall thickness. Caustic stress corrosion cracking (CSCC) caused by caustic embrittlement results in plant failures, and the cracking indicative of caustic embrittlement caused by caustic agents are identified at the failure locations.

Spent Caustic coming from multiple sources in refineries of oil and gas plants is another instance of severe caustic environment, deteriorating the engaged infrastructures like storage vessels.

General corrosion and aggressive pitting corrosion are also amongst common problems within equipment exposed to caustic and high pH including extractors, absorbers, settlers, tanks and other vessels.

Caustic corrosion incrementally shortens the lifespan of storage tank and other associated equipment. Furthermore, corrosion products leading to increased levels of contamination, decrease the quality of final product which could be a huge loss of investment.

Solutions

When it comes to protection against caustic solution, corrosion protective coating is the first-rate solution to provide a durable, complete coverage with minimum maintenance overtime. Unprotected steel/metal substrates in contact with caustic solution are extremely vulnerable to corrosion attacks, and the interior surfaces of storage tanks and related apparatus are constantly at risk.

However, other solutions of varying performances have been established as well to control corrosion and counteract the unpredictable destructive effects of caustic environment.

Vessel replacement, weld metal overlays, metal spray cladding, etc., are some of the implemented solutions against aggressive process media of caustic; though effective in corrosion control to some extent, the cons could be listed as:

- ✓ Temporary solution
- ✓ Added maintenance intervals
- ✓ Multiple in-service failures
- ✓ Forced shutdowns due to unpredictable flaws
- ✓ Costly with time-consuming installation process
- ✓ Significant lead time & forward planning

Internal Coating

Corrosion resistant coatings should not only protect the storage vessels, but also demonstrate protective features to maintain properties of the stored mediums.
Accordingly, in addition to the corrosion resistant characteristics of the coating for the substrates, it is critical for an internal coating to be compatible with the substances being stored to hinder flaws such as discoloration, sedimentation, etc.

Depending on the stored material, multiple requirements should be met to provide adequate corrosion resistance to the substrates for an extended lifespan of the tanks and avoid deficiencies in the specifications of the final products.

Different coatings are available through the market, ranging from conventional paint-based coatings to common epoxies designed to withstand various levels of alkalinity. In spite of being generally inexpensive, the common coatings do not offer a long service life, and extreme considerations should be taken into account to ensure the integrity of the applied coating during corrosive exposures.

Presenting excellent quality, **HEGGEL Corr 211** is an advanced coating system to perform a comprehensive corrosion protection against a broad range of chemicals from sub ambient to elevated temperatures. **HEGGEL Corr 211** demonstrates high performance protective features in concentrated caustic storage tanks/vessels, ensuring a continuous long service life.

HEGGEL® Corr 211

High-Tech Combination of Organic and Inorganic Molecules for Advance Corrosion Protection

With its two-component hybridized epoxy-based structure, **HEGGEL Corr 211** is a novel coating system, innovatively designed to offer corrosion protection against a very broad range of organic and inorganic acids, alkalis, solvents, salts, hydrocarbons, etc.

HEGGEL Corr 211 is capable of fully meeting the technical requirements in aggressive exposures within temperatures ranging from -50°C up to +230°C. The impermeable microstructure of **HEGGEL Corr 211** obstructs penetration paths thoroughly, thereby preventing corrosion initiation by deteriorating mediums with slippery nature such as caustic solutions.

The cured **HEGGEL Corr 211** coating has excellent sliding abrasion resistance coupled with a very smooth finish surface that enhances fluid flow and prevents sludge build up and sedimentations for a durable corrosion protection.

Following a simple surface preparation, the single layer application of **HEGGEL Corr 211** with ambient cure, makes the coating installation a convenient process. Furthermore, since **HEGGEL Corr 211** allows on-site application while the equipment is operational, reducing downtimes considerably and preventing added costs.

Characteristics

- ✓ Excellent chemical resistance
- ✓ In situ application to exterior of hot surfaces
- ✓ Resistant to CUI conditions
- ✓ Single coat curing at ambient temperature
- ✓ Very high fouling resistance
- ✓ Easy repair of existing coating

Application Areas

- ✓ Chemical tanks
- ✓ Process vessels
- ✓ Evaporators
- ✓ Scrubber units
- ✓ Heat exchangers
- ✓ Condensers
- ✓ Distillation units
- ✓ Autoclaves

Technical Features

Description	Value
Abrasion Resistance	ASTM D 4060 25 mg weight loss (Tabor CS-17/1kg/1000 cycles)
Impact Resistance	ASTM G14 Forward: 12 Joules Reverse: 2.8 Joules
Adhesives Strength	ASTM D4541 26 MPa (cohesive failure)
Temperature Resistance	NACE TM0174 +170°C Immersed +230°C Non-Immersed

Chemical Resistance

- ✓ 98% sulphuric acid
- ✓ 37% hydrochloric acid
- ✓ 100% glacial acetic
- ✓ Methylenechloride, vinyl chloride, benzyl chloride
- ✓ Carbon disulphide
- ✓ Molten sulphur + acidic vapour
- ✓ Sodium hypochlorite, sodium perchlorate
- ✓ 50% sodium hydroxide