HEGGEL®

You Build, We Protect!

NEWSLETTER

HEGGEL® PL 620

September 2023

INSIDE THIS ISSUE:

Sulfuric Acid in Industrial Contexts Risks to Solutions

Spotlight on Sulfuric Acid in Heavy Industries

Sulfuric acid is a fundamental element in many industrial processes. It acts as a catalyst in oil refining, producing high-octane fuel components vital for vehicles and aircraft. In gas treating, it ensures the purity of natural gas by filtering out impurities. In metal extraction, especially with copper, it plays a pivotal role, simplifying the recovery process. Furthermore, it transforms rock phosphate into fertilizers, significantly aiding global food production.

In battery production, sulfuric acid is essential for lead-acid batteries, powering a vast range of devices. In chemical synthesis, it serves as a key reagent in countless reactions, and in the steel industry, it is employed in the pickling process to remove rust and scale before further processing. The breadth and depth of its applications underscore sulfuric acid's integral role in modern industrial advancements, facilitating efficiency and progress across various sectors.

Industrial Exposure Pathways of Sulfuric Acid

Although Sulfuric acid is an industrial powerhouse, its strength comes potential hazards, notably due to its corrosive impact on materials. Ensuring safety means understanding every point of contact it has within industrial facilities. Various equipment and containment systems encounter deteriorating exposures to sulfuric acid;

Storage tanks are direct containment systems for sulfuric acid. In industries that use or produce sulfuric acid, it is often stored in large quantities. Over time, even minor imperfections or wear in a tank's interior can expose it to acid, leading to corrosion.

Sulfuric Acid

Reactors are where chemical reactions involving sulfuric acid take place. For example, in an alkylation unit in a refinery. During this process, the reactor's inner surface is continuously exposed to the acid.

Drip trays are placed beneath equipment that might have minor leaks, like flanges, valves, or pump seals. If there is a leak, the acid drips into these trays. Larger containment systems are designed to capture significant spills or overflows, so if a storage tank or reactor were to leak or rupture, the acid would be contained within this system.

Channels and trenches help direct the flow of liquids. If there is an overflow, spill, or deliberate release of sulfuric acid, it would flow through these channels. These channels are designed to manage the flow and sometimes direct it to treatment or containment areas. In the event of spills or planned releases, sulfuric acid comes into direct contact with the surfaces.

Sulfuric acid might end up in waste streams either as a residue from processes or as unwanted by-product. Waste treatment systems, like neutralization pits, work to neutralize the acid or prepare it for safe disposal. During this, the system's surfaces are exposed to the acid.

Floors and secondary containment areas around processing or storage facilities would come into direct contact with the acid in case of any significant spill, leak or tanks overflow that might spread on the floor of the containment area.

Designated loading and unloading areas in industrial facilities, where sulfuric acid is transferred to or from transport vehicles, are particularly vulnerable to acid exposure. This susceptibility arises from the risk of spillage during transfers, equipment malfunctions, or human errors.

Drainage systems, effluent treatment plants, dykes, process vessels, neutralization pits, bund areas, etc. are among other instances of zones prone to direct exposure to the acid destructive effects.

Sulfuric Acid's Deteriorative Impact on Equipment and Infrastructure

In the vast expanse of heavy industries, sulfuric acid comes an inherent risk, especially to the infrastructure and equipment it interacts with. These risks are manifested primarily through various corrosive mechanisms, each of which can have detrimental effects on the operational efficiency and safety of an industrial facility;

Sulfuric acid's corrosive effects on metals, including stainless steels, carbon steel, and various alloys, can result in gradual material weakening and the potential for system failures. Prolonged exposure may shorten equipment lifespans, resulting in frequent replacements, heightened maintenance expenses, and unanticipated downtime. Stress Corrosion Cracking (SCC) presents a hidden danger, often remaining unnoticed until it triggers sudden material fractures, particularly in pressurized systems and load-bearing structures. Hydrogen embrittlement further compounds the risk, causing metals to unexpectedly become brittle, making equipment and structures susceptible to cracking or breaking under conditions they once withstood effortlessly.

Sulfuric acid can also have significant deteriorating effects on concrete surfaces, primarily through a process known as chemical corrosion. This type of corrosion occurs when acidic substances, like sulfuric acid, react with the components of concrete, leading to structural damage and a weakening of the material over time.

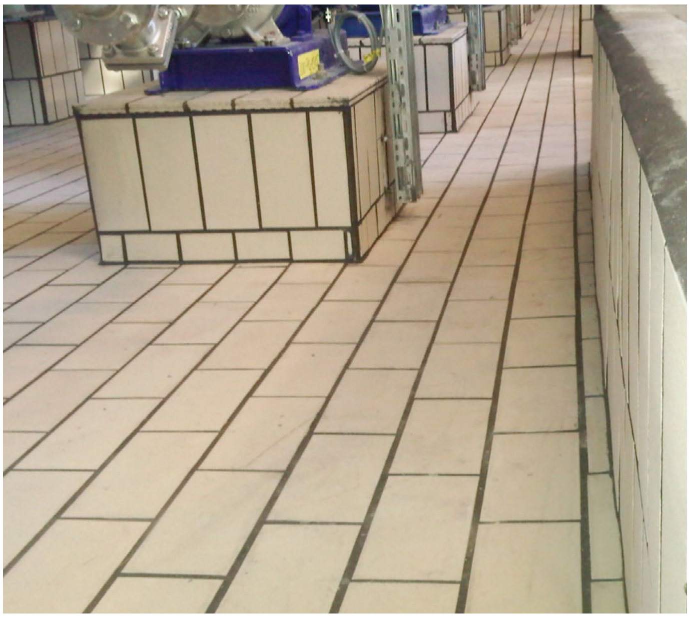
Concrete deterioration from sulfuric acid involves multiple mechanisms. It reacts with calcium oxide in cement, resulting in calcium sulfate formation, weakening the concrete structure and causing surface scaling. The acid also forms gypsum by reacting with calcium hydroxide, leading to concrete expansion and cracking. In reinforced concrete, sulfuric acid corrodes embedded steel reinforcement, compromising structural integrity. Additionally, it causes surface erosion and roughening by dissolving calcium compounds and reduces the concrete's alkalinity, diminishing its protective properties against steel corrosion.

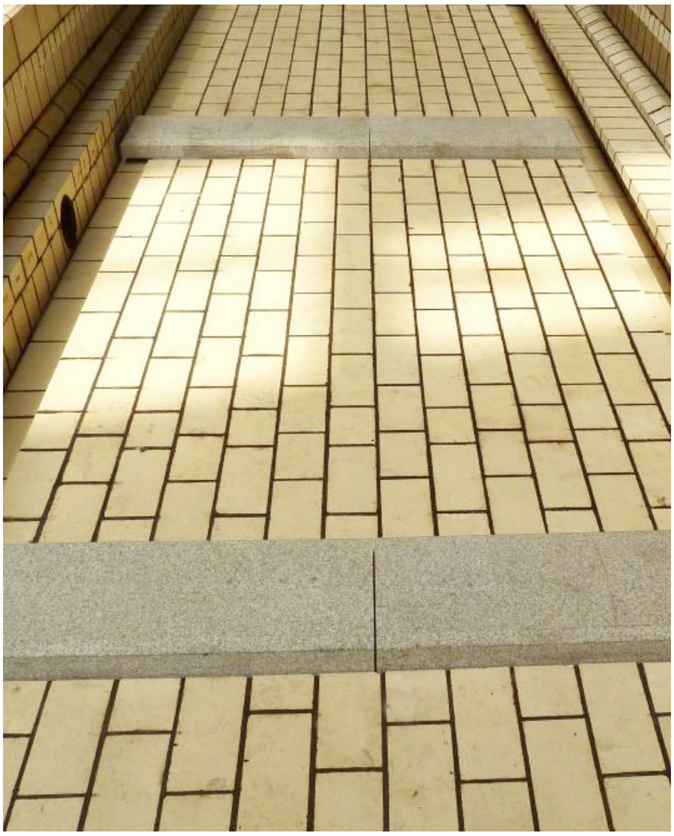
The extent and rate of deterioration of both concrete and metal surfaces depend on factors such as the concentration of sulfuric acid, exposure duration, temperature, the quality of the concrete mixture, substrate material, etc. To mitigate the deteriorating effects of sulfuric acid on these surfaces, protective measures can be implemented to prevent extended exposure to acidic substances. These measures are crucial for ensuring the longevity and structural integrity of both concrete and metal components in various applications.

Diverse Strategies for Corrosion Protection

One of the most effective ways to combat sulfuric acid's deteriorating effects is to implement a proper lining to vulnerable equipment and infrastructures. Coatings and paints typically act as the initial protective layer, establishing a barrier between the substrate and the acid, tailored with diverse formulations for specific environments. Moreover, the adoption of corrosion-resistant materials like stainless steels and certain alloys can prolong equipment life;

some metals, depending on their alloying components, showcase enhanced resistance to sulfuric acid at particular concentrations and temperatures. Polymeric linings, synthesized from polymers, offer substantial chemical resistance, fitting seamlessly in tanks, pipelines, and related infrastructure. Another avenue is cathodic protection, an electrochemical method that repurposes the metal into a cathode, reducing its inclination to corrode.





In the context of corrosion protection for concrete surfaces, several effective strategies exist. One approach involves the application of acid-resistant coatings and linings, which form a protective barrier over the concrete, shielding it from the deteriorating effects of substances like sulfuric acid. Another prudent measure is the careful selection of concrete mixtures with the addition of specific additives. These additives improve the concrete's resistance to chemical corrosion, rendering it more robust in harsh industrial environments. Additionally, maintaining a well-designed drainage system is crucial to prevent prolonged exposure to corrosive agents and facilitate the efficient removal of these substances.

The Role of Tile, Brick, and Mortar Linings

While the aforementioned methods offer certain protective benefits, when it comes to the specific application areas previously highlighted, they may not always meet the stringent technical requirements. Acid-resistant mortars, when used in tandem with tile or brick linings, stand out for their superior comprehensive protection and enduring resilience, making them particularly suitable for these challenging environments.

Traditional materials like tiles and bricks, when coupled with acid-resistant mortars, form an impenetrable barrier against sulfuric acid's aggressive nature. This lining acts as a shield, keeping the acid away from the base material of the equipment or infrastructure. Whether it is storage tanks, process vessels, drains, or the previously mentioned exposure-prone areas, a well-applied lining of tile and brick held together with acid-resistant mortar can drastically prolong equipment life, reduce maintenance costs, and ensure safe and continuous operations.

In essence, while sulfuric acid poses considerable challenges, implementing suitable protective strategies can effectively reduce risks and enhance operational reliability.

Engineered for advanced, comprehensive protection, the **HEGGEL PL 620** mortar shields against corrosion from harsh chemicals, including concentrated sulfuric acid. Beyond safeguarding against deterioration, it enhances the mechanical and thermal resistance of vulnerable substrates.

Two-Component Synthetic Phenolic Resin Mortar

HEGGEL PL 620 is a two-component mortar tailored for the seamless bedding and jointing of acid-resistant ceramic tiles, bricks, or carbon bricks. It is formulated with a modified phenolic resole resin and carbon filler, making it a highly suitable choice for this application.

HEGGEL PL 620 is recognized for its unparalleled chemical resistance properties. This high-performance material is adept at withstanding a vast range of both inorganic and organic chemicals, including the notably corrosive sulfuric acid, hydrofluoric acid, etc.

HEGGEL PL 620 stands out for its resistance to concentrated sulfuric acid; it also resists water, and alkaline substances, offering a comprehensive level of protection that sets it apart from other mortars, which may lack resistance against these exposures.

Its resilience showcases robust resistance to various greases, oils, and fuels. This makes it especially valuable in environments with frequent exposure to such substances, ensuring longevity and durability. Beyond this, **HEGGEL PL 620**'s strength extends to its remarkable ability to resist degradation from solvents and a spectrum of hydrocarbons.

HEGGEL PL 620 offers superior chemical resistance and increased mechanical strength, particularly in zones simultaneously subjected to high mechanical loads and corrosive conditions.

With robust bonding to the substrates, HEGGEL PL 620 provides unparalleled adhesion to the ceramic tiles, bricks and carbon bricks, enhancing the overall lifespan and durability of structures it is applied to. Additionally, its resistance to thermal challenges up to 180°C in wet conditions and an impressive 200°C when dry, is of outstanding technical features. Beyond these physical attributes, **HEGGEL PL 620** brings another dimension to its utility with its electrical conductivity, opening avenues for its use in applications where such a feature is paramount.

These collective characteristics earmark it as a versatile choice for industries that prioritize both performance and reliability.

Application Areas

- Bedding and jointing for tile/brick lining in process tanks within the chemical industry, flue gas cleaning processes, ore processing, etc.
- Mortar for tile lining on indoor and outdoor surfaces
- Suitable for environments with high thermal, mechanical, and chemical stresses

  Ideal for manufacturing prestressed brickwork due to permanent expansion when first heated
- Channels and trenches
- Containment areas
- Dikes
- Neutralization pits
- Vessels
- Industrial treatment plants

Technical Data	Value	Unit
Shore D hardness ASTMD 2240	70	Shore D
Abrasion resistance ASTM C 241	10	$\text{cm}^3/50\ \text{cm}^2$
Flexural strength ASTM C 580	24	MPa
Compressive strength ASTM C 579	65	MPa
Tensile strength DIN EN ISO 527	8.5	MPa
Adhesive strength to ceramic tiles DIN EN ISO 4624	> Inherent tensile strength	MPa
Adhesion to carbon tiles DIN EN ISO 4624	> Inherent tensile strength	MPa