

Knight Material Technologies Expands Leverage Power of Three Companies for Sulfuric Acid Protection

Three companies specializing in advanced corrosion control technologies are now affiliated, enabling Knight Material Technologies (KMT) to offer more comprehensive protection and engineered solutions to the sulfuric acid processing industry and end users. This provides processors the 3 in 1 leverage in global sulfuric acid protection by working with three companies, each with its own specialty, under one corporate umbrella. Within the past year, KMT added Electro Chemical (EC) as a new division, at the same time gaining the fluoropolymer expertise of its subsidiary, Superior Dual Laminates, Inc. (SDL). As a result, these companies' complementary technologies now supply the broadest selection of products and core competencies for corrosion protection during the production, storage and use of sulfuric acid and other corrosive substances.

media can increase capacities, improve gas-liquid distribution and help operators realize a longer service life by lowering the pressure drop. This yields energy efficiencies that last the life of new towers or a tower upgrade.

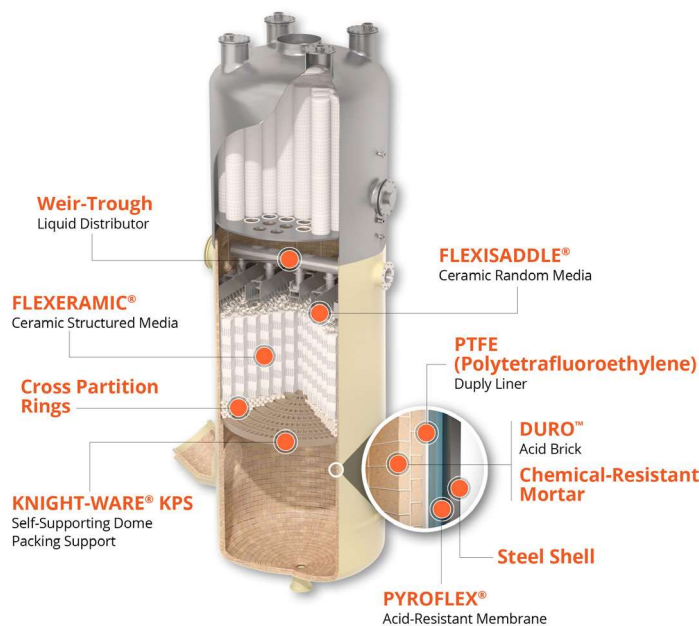
Tower construction begins with KMT's extensive experience with and vast knowledge of ceramics, alloys, thermoplastics and fluoropolymers and their application for corrosion resistance. KMT has prepared and lined hundreds of sulfuric acid towers of varying heights, beginning with one of the most effective protective lining systems for absorption towers, its proprietary PYROFLEX® Acid-Resistant Membrane System. This flexible, uniformly thick sheet membrane acts as an acid-resistant barrier and expansion joint between acid-resistant brick and the absorption tower shell, whether steel, alloy or concrete. The membrane is a non-porous, non-aging thermoplastic that supplies a continuous, uniform lining. Tower preparation begins with:

- Sandblasting the outer steel shell to SA-3 specifications
- Applying black PYROFLEX® 1080 Primer as a binding layer
- Adding the PYROFLEX Acid resistant sheet lining in sections
- Conducting spark testing to assure barrier protection

As a secondary layer of protection in sulfuric acid applications, KMT overlays the PYROFLEX with a PTFE film sheet or DUPLY lining. This supplies acid resistance through a continuous, uniform lining without joints. This lining is:

- Highly resistance to thermal decomposition
- Simple and easy to apply without steam, curing or aging
- Unaffected by climatic conditions

DURO™ Acid Brick courses add an extra layer of protection, maintaining corrosion resistance in high-temperature environments. KMT acid bricks conform to ASTM 279 specifications and are either pressed or extruded, with different degrees of water absorption, acid solubility, and compressive strength. This is a true acid-resistant brick, secured with acid-resistant mortar.



The layers in a sulfuric acid vessel allow for flexibility and acid resistance.

Layered Protection Creates Absorption Tower Efficiencies

KMT's capabilities, including engineering, design, installation, manufacturing and service support, supply start-to-finish solutions for sulfuric acid processing absorption towers. A variety of proven

Unique Dome Configuration Provides Uniform Gas Flow

In a sulfuric acid absorption tower, the KNIGHT-WARE® self-supporting dome configuration offers a uniquely designed open area for gas flow to reduce pressure drop. It also provides a more uniform gas flow from the gas inlet up the tower leading out through the gas outlet. The dome requires little to no maintenance and is suited for retrofit applications or new construction projects.

Open ceramic rings of different heights are installed above each dome level to provide the flat area required to place the FLEXERAMIC® ceramic structure packing.

KMT structured media with proprietary designs supply greater resistance to fouling than random or monolithic media. Its geometric-waved cross-channel design helps reduce bed depth by offering a greater surface area per volume unit. As a result, it provides more efficient mass transfer than an equivalent amount of random saddle packing. At the same time, it effectively minimizes channeling and radially distributes gas and liquid uniformly over the tower cross-section. The structured media:

- Minimizes channeling and radially distributes gas uniformly
- Offers more efficiency per unit volume
- Improves film formation and enhances mass transfer efficiency
- Increases flow and lowers pressure drop

The lower pressure drop enables a higher flow capacity through the packing, leading to a reduced tower diameter design. The lower pressure drop also translates into lower energy consumption and reduced utility costs.

PFA Expertise Ends Costly Company Shutdowns

Outside of sulfuric acid absorbers, when a different chemical mixture calls for a high-end fluoropolymer lining, KMT can offer a broad range of protection after adding EC as a new company division. The fluoropolymers, such as PVDF, ECTFE or PFA, can provide a robust barrier membrane behind brick, or without it, in applications when the protection of brick is not needed or when the weight-bearing load is a significant factor.



Copper processing requires materials resistant to highly corrosive steam.

For example, a company in the copper refining and precious metals processing industry had to shut down a production line every two to three months to repair the lining in an elbow pipe venting sulfuric acid steam from an evaporator unit. This process raises the strength of the sulfuric acid solution to 70%, creating highly corrosive steam at 300° F that requires venting. Contributing factors to its previously installed lining failures included high temperatures, temperature fluctuations and vacuum pressures, causing pinholes, cracks and leaks.

These frequent shutdowns caused costly repairs and lost revenue due to interrupted or halted production schedules. As a result, the company called on EC to install a new bonded PFA lining using recently developed technology. Other alternatives were either too heavy for the weight load of the ductwork, too expensive or too time-consuming.

EC lined this steel ductwork with an advanced PFA fluoropolymer to maintain an acceptable weight while protecting the elbow joint from sulfuric acid steam. The key to the project's success was a new, high-temperature epoxy. It offered the right degree of elasticity while tolerating elevated temperatures without cracking or becoming brittle. After the relining, the company could maintain its production schedule without the devastating impact of unplanned shutdowns or unexpected maintenance and repairs.

Fluoropolymer Linings Fill in the Gaps

Fluoropolymer lining systems supply a sweet spot option for operators looking for a solution with a lower life-cycle cost than some alternatives. Fluoropolymer linings work best at temperatures below 250° F for strong acids, alkalis, oxidizers, or solvents. Fluoropolymer linings can supply a protective barrier in corrosive conditions typically in the range of 500° F if used in combination with chemical-resistant masonry, such as KMT DURO bricks for absorbent tower builds. Some of the fluoropolymers where KMT can offer material expertise include PVDF, ECTFE, ETFE, FEP and PFA for new builds, relining work or repairs.

Another situation spared a shutdown included a multinational chemical company operating a specialty silicone production facility looking for field repair options for a spent sulfuric acid storage tank. EC was able to perform an in-situ relining for a cost-effective solution with a swift turnaround. First, the vessel was stripped, repaired and grit blasted. EC then installed a 90-mil thick, fabric-backed polyvinylidene fluoride (PVDF) sheet lining system. EC utilized a proprietary adhesive to form a bond between the fluoropolymer and the substrate, tested in accordance with ASTM D-903, for secure adhesion, which helps extend the lining surface life and reduces the risk of a bulk storage tank failure. The tank was restored after a short time period for trouble-free service.

Other fluoropolymer linings, such as ECTFE, have a long history of serviceability in sulfuric acid, with many dating back to the initial

introduction of these systems. Many systems have outlasted the chemical process industry plants where they were installed or are still in service today.

Application	Lining Type	Current Status
18 foot scrubbers exposed to 93-96% sulfuric acid at 140-160° F	90 mil ECTFE	Inspected after 12 years of service - no evidence of any corrosion
	90 mil ECTFE	
65% Sulfuric Acid, 250° F	90 mil ECTFE + Acid Brick	Plant shut down
UHP Sulfuric Acid Tank, 140° F	90 mil ECTFE	Still in use
UHP Sulfuric Acid Tank	90 mil ECTFE	Still in use
Sulfuric Acid Filter Body	90 mil ECTFE	Plant "mothballed"
Sulfuric Acid Trailer	90 mil ECTFE	Still in use
Sulfuric Acid Trailer	90 mil ECTFE	Still in use
UHP Sulfuric Acid Tank	90 mil ECTFE	Still in use
Sulfuric Acid Trailer	90 mil ECTFE	Still in use
2 Sulfuric Acid Attack Tanks, 22' dia. X 38' tall (65% sulfuric acid solution, 280° F)	90 mil ECTFE + Acid Brick	Used continuously for 10 years until "mothballed"

Independent lab testing of ECTFE.

Bonded Linings Virtually Eliminate Failure Due to Expansion Differential

As part of the business acquisition, the specialty services of Superior Dual Laminates, Inc. are also available in conjunction with KMT sulfuric acid expertise, specifically dual laminate and FRP materials for custom-designed manufacturing of corrosion-resistant process piping and equipment. The bonded SDL dual laminate system prevents the concentration of stresses, thereby eliminating the potential of mechanical damage due to expansion differential and providing excellent corrosion resistance.

Trust the trifecta of companies within Knight Material Technologies for global leadership in the sulfuric acid industry, from complex projects to reline installations, from flange to flange, for companies located anywhere around the globe.

For more information on Knight Material Technologies, Electro Chemical or Superior Dual Laminate Products, visit www.knightmaterials.com/our-companies.