

CHEMICAL PROCESSING

ETFE Rotationally Lined Pipe Delivers Long-Term Corrosion Protection in Copper Mine's Concentrated Acid Operations



One of ASARCO's domestic open-pit copper mines in southeastern Arizona.

Arizona is America's top copper-producing state, and Tucson-headquartered ASARCO's integrated copper mining, smelting and refining operations produce 350 to 400 million pounds of copper annually. One of the company's sites east of Phoenix consists of side-by-side concentrator and heap leach operations. In the latter part of the 1990s, ASARCO contacted RMB Products for help in solving corrosion problems that occurred in transporting and mixing concentrated sulfuric acid for ASARCO's concentrator operation.

Challenge

Reducing corrosion in piping systems that handle concentrated sulfuric acid has been a challenge for copper mining companies. In sulfuric acid injection systems, localized high temperatures occur at the locations where 94% to 98% concentrated sulfuric acid is injected into a diluted acid stream. Downstream from the injection point, the acid is mixed inline and releases heat, resulting in temperatures as high as 300°F. The combination of high temperatures and acidic conditions creates a highly corrosive environment.

Corrosion also can create significant problems in piping near the intake and discharge nozzles of acid pumps. ASARCO uses carbon steel pipe to transport sulfuric acid at a low velocity over long distances. But at pump stations, the flow velocity in the pipe in the immediate vicinity of the pump's intake and discharge

At a Glance

Client: ASARCO

Industry: Chemical Processing

Manufacturing solution: Rotational lining with ETFE

PROJECT GOALS

- Reduce corrosion throughout concentrated sulfuric acid pipelines
- Minimize corrosion-producing turbulence at pipeline connections
- Eliminate pipe failures resulting in sulfuric acid spills
- Decrease maintenance costs

REQUIREMENTS

- Provide exceptional corrosion resistance to concentrated sulfuric acid
- Stand up to harsh mining conditions better than DIP and PTFE-lined pipe
- Supply complete turnkey solution: engineering and design, fabrication, testing, lining, assembly, and painting
- Extend pipeline service life

HIGHLIGHTS

- No leaks or failures in over 25 years of service
- Withstands high temperatures up to 300°F
- Tefzel ETFE rotationally lined Schedule 120 carbon steel pipe (custom designed with square corners at flanges) matches bore of connecting Schedule 160 pipe
- No limitations on flow velocities
- Additional piping switched to Tefzel-lined pipe due to long service life and repeated failures of other technologies
- Expanded use of Tefzel-lined pipe to include the process plant
- Considering switching all concentrated acid piping to Tefzel-lined pipe to enable higher-velocity pumping without corrosion



Tefzel ETFE rotationally lined Schedule 120 carbon steel pipe with external coating.

nozzles (which typically have smaller inner diameters than the connecting pipe) increases rapidly, producing extremely corrosive conditions due to the turbulent flow that results from the increased velocity.

Many companies that handle concentrated sulfuric acid combat corrosion in these problem areas through the use of ductile iron pipe (DIP) or polytetrafluoroethylene (PTFE)-lined pipe, but neither solution is ideal. DIP imposes flow velocity limitations and is brittle, frequently shattering under stress. Because of the rugged conditions encountered in mining operations, DIP piping is vulnerable to breaking, leading to dangerous and costly chemical spills.

ASARCO considered using PTFE-lined pipe, but that solution would have required frequent re-torquing of the pipe. By comparison, ethylene tetrafluoroethylene (ETFE)/Tefzel-rotolined pipe does not require constant re-torquing. Using PTFE instead of Tefzel-lined pipe would increase the company's maintenance costs and the risk of leaking pipes and sulfuric acid spills.

Solution

RMB Products began providing custom-manufactured ETFE rotationally lined pipe to ASARCO in 1997. Rotational lining with Tefzel produces pipe with superior resistance to chemical corrosion and excellent strength over a wide temperature range up to 300°F.

RMB Products lines Schedule 120 carbon steel pipe with a thick layer of high-strength Chemours® Tefzel ETFE so that the inner diameter of the lined pipe exactly matches the inner diameter of the unlined Schedule 160 pipe that it connects to at ASARCO's plant. RMB Products specially manufactures the lined pipe with square corners at all flanges. This combination of square corners and matching inner pipe diameters results in the least amount of turbulence at any connection—eliminating a primary cause of corrosion and excess wear in sulfuric acid pipelines.

Because RMB Products offers a full range of vertically integrated manufacturing services at its Fountain, Colorado, facility, the company provides ASARCO with a complete turnkey

manufacturing solution. All engineering and design, fabrication, lining and painting are completed in-house, saving ASARCO lead time and the added expense of shipping the pipe from manufacturer to manufacturer to complete the project.

Providing all services in-house also enables RMB Products to carefully control product quality:

- Use of Chemours Tefzel ETFE exceeds all of ASARCO's service requirements
- The external coating applied to the piping protects it from ASARCO's harsh mining environment
- Tefzel rotationally lined pipe provides ASARCO with a maintenance-free solution
- Unlike DIP, the Tefzel-lined carbon steel pipe is not brittle, bending rather than shattering under stress

Results

ASARCO has not experienced a single failure of any ETFE-lined pipe from RMB Products for over 25 years of service; none of the lined pipe has required replacement. Over time, the mine has expanded its use of Tefzel-lined pipe. ASARCO has replaced existing piping throughout different areas of its operations with ETFE-lined pipe from RMB Products because of the pipe's proven long service life and the repeated failures of other piping technologies.

Looking ahead, ASARCO is considering switching all of its concentrated acid piping to Tefzel-lined pipe—including the long, straight sections of carbon steel pipe used for transporting the sulfuric acid at a low velocity over long distances. Making such a move would enable ASARCO to pump the concentrated acid at higher velocities without having to worry about corrosion.

About ASARCO

ASARCO was organized in 1899 as American Smelting and Refining Company. Originally a consolidation of a number of lead-silver smelting companies, ASARCO evolved over the years into an integrated producer of copper and other metals. The company is a fully integrated miner, smelter, and refiner of copper in the United States. ASARCO's domestic mines produce 350 to 400 million pounds of copper annually.

About RMB Products

RMB Products is a leading supplier of engineered polymer products for critical applications in the aerospace, chemical processing, semiconductor, and biopharmaceutical industries. Our success is based on helping every customer lower capital cost and operating expenses through innovative manufacturing processes and high-performance materials.



To learn more about how our innovative solutions help you extend the service life of your infrastructure, visit our website at rmbproducts.com.