

CASE HISTORY

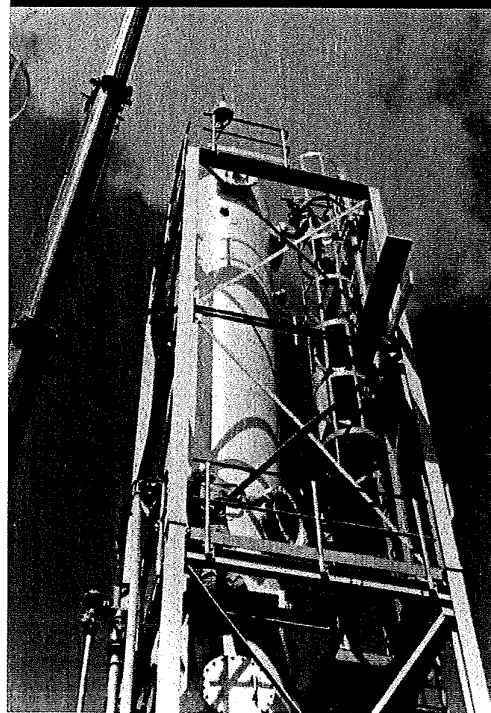
Fluoropolymer Lining for a Chlorine Scrubber

J. KAROL ARGASINSKI, *Solvay Solexis, Inc., West Deptford, New Jersey*
MARCEL E. LOOSBERGH, *M.E.L. Consultants, Overijse, Belgium*

A chlorine scrubber fabricated from fiberglass-reinforced plastic (FRP) was installed in 1977. Major repairs began in 1981 and continued at four-year intervals. After exploring several replacement materials, a FRP/ethylene-chlorotrifluoroethylene dual laminate scrubber was selected. This was installed in 1987 and remained in continuous service until the plant shut down in 2001. Examination shortly after plant closing showed the liner to be in excellent condition.

During 1987, a Monsanto plant located in the petrochemical harbor area north of Antwerp, Belgium, installed an FRP/ECTFE (Halar[†]) dual laminate chlorine scrubber (Figure 1). The 1.5-m diameter and 24-m high vessel was designed to operate with 22% caustic soda (sodium hydroxide [NaOH]) to scrub vapors from several process reactors (chlorinators and others) and storage tanks. The 22% caustic soda was diluted with de-mineralized water to prevent salt precipitation. The chemicals to be removed from the process stream included chlorinated hydrocarbons combined with hydrochloric acid (HCl), as well as molecular chlorine. The flow rate of the gas stream passing through the scrubber was 9,000 m³/h, the pH of the liquid was 12 or higher, and the operating temperature was 40 °C.

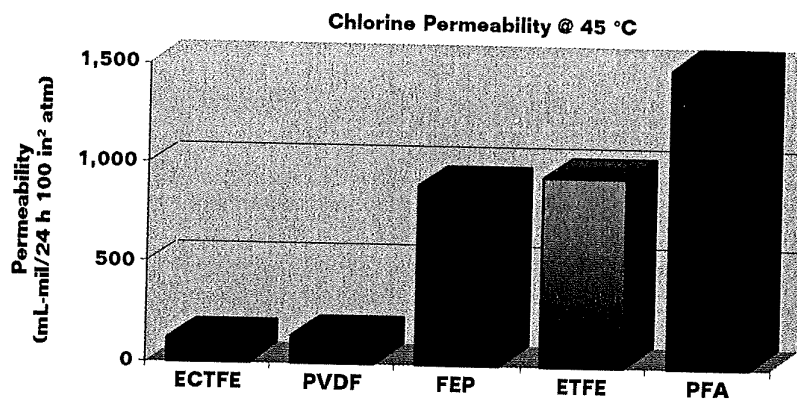
FIGURE 1



FRP/ECTFE chlorine scrubber.

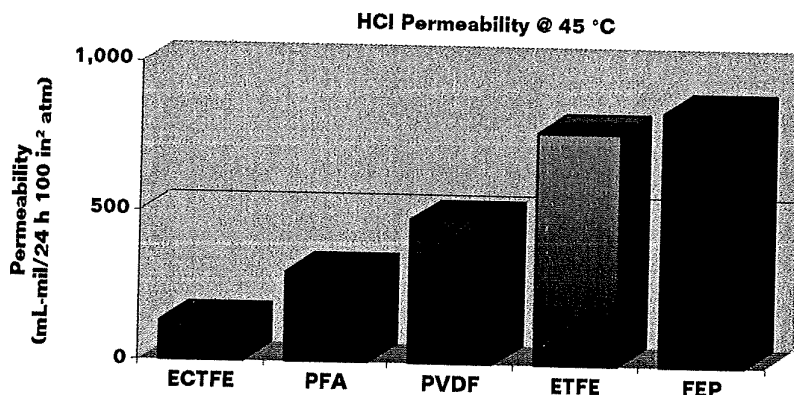
[†]Trade name.

FIGURE 2



Chlorine permeability of fluoropolymers at 45 °C.

FIGURE 3



HCl permeability of fluoropolymers at 45 °C.

tance failed because of the permeation of process chemicals through the liner. In some cases, the excessive permeation caused blisters inside the liner; and in severe cases, the chemicals permeated through the entire thickness of the liner and attacked the layer between the polymer and FRP or metal shell.

In addition to ECTFE, fluoropolymers commonly used for corrosion protection include PVDF, ethylene-tetrafluoroethylene (ETFE), perfluoroalkoxy resin (PFA), and fluorinated ethylene-propylene (FEP). Of all the fluoropolymers, the ECTFE resin had the best permeation resistance to chlorine and HCl at temperatures as high as 100 °C. Figures 2 and 3 clearly show that the ECTFE resin had the lowest permeation rate at 45 °C, slightly above the operating temperature.

Plant records dating back to July 1985 show that coupons made of ECTFE were tested to demonstrate to plant engineers that ECTFE was suitable for their process (caustic soda, chlorinated hydrocarbons, and chlorine). Individual ECTFE coupons and blind flanges were exposed for six to 12 months in situ. When no color change or any noticeable degradation was observed after this test period, the plant decided to proceed with an ECTFE-lined scrubber. The fabricator, Plastion Oldenzaal (NL), used a 2.3-mm thick ECTFE fiber-backed sheet to line the 24-m high isophthalic FRP scrubber.

The scrubber was put on stream during 1987. This part of the plant was closed for business reasons in 2001. A final inspection by plant personnel shortly after the plant shut down determined that the ECTFE lining was in excellent condition after operating trouble- and maintenance-free from 1987 to 2001.

Conclusions

Fourteen years of continuous and maintenance-free service of the ECTFE lining confirms the excellent chemical resistance of this material in alkaline environments with chlorine and chlorinated

Scrubber History

Before the ECTFE duel-laminate vessel was installed, the plant had experienced regular failures with scrubbers made of FRP. Chemical attack of the gelcoat, combined with mechanical erosion at the nozzles, prevented the plant from operating maintenance-free for long periods. The original FRP scrubber was installed in 1977 and the first major repair was made in 1981. Major repairs had to be made every four years thereafter.

To avoid further downtime from recurring FRP repair work, the plant decided to look for a suitable alternative to FRP. Polyvinylidene fluoride (PVDF) lining could not be recommended for the

process conditions because of their poor stress-crack resistance in high-alkaline environments.

Candidate Replacement Material Evaluation

The ECTFE resin was the leading replacement candidate since it has a very good chemical resistance to NaOH, chlorine, and HCl. Good chemical resistance of polymeric materials, however, does not always guarantee that the liner will perform well in specific applications. The other factor that has to be considered is the permeation resistance of the resin. There are several known case histories where a resin with good chemical resis-

solvents at an operating temperature of 40 °C. At the time of the plant shutdown, visual inspection by plant personnel confirmed that the liner was still fully functional. Judging from the appearance of the liner after 14 years, it is apparent that this particular ECTFE/FRP dual laminate scrubber had the potential to perform well for least another 14 years in similar service.

Acknowledgment

The authors thank Ir J. Baeten of Monsanto Europe N.V. (Antwerp, Belgium) for kindly sharing this information with Solvay Solexis.

J. KAROL ARGASINSKI is the market development manager at Solvay Solexis, Inc., 10 Leonard Ln., West Deptford, NJ 08086, e-mail: karol.

argasinski@solvay.com. A chemical engineer, Argasinski joined the Research and Development Fluoropolymer Group of Allied-Signal (later Ausimont USA, then Solvay Solexis) in 1986. He worked as an engineer and senior engineer before becoming the market development manager. He is responsible for technical service and application development of the PVDF, ECTFE, and PFA polymers in the chemical processing industry. He is a 10-year member of NACE International.

MARCEL E. LOOSBERGH is the director of M.E.L. Consultants, G. Gezellelaan 8, B-3090 Overijse, Belgium. After eight years of oil exploration in South America, he joined Allied Chemical International, where he worked with fluoropolymers as an applications engineer. He worked for Ausimont as technical service manager, Europe, and in 1998 became an independent consultant in the field of fluoropolymer coatings and linings. He has an engineering degree from K.U.L University in Louvain, Belgium. *MP*



THE D. E. STEARNS COMPANY



Model 14/20
1kv - 14kv

Model 10/20
0.8kv - 35kv

Holiday Detectors

We've Got You Covered!

24-hr Service From Stock Sales / Rentals

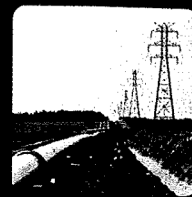
@destearns.com

4402 Greenwood Rd, P.O. Box 3456,
Shreveport, LA 71133-3456

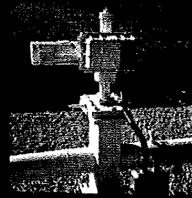
Phone Fax

www.destearns.com

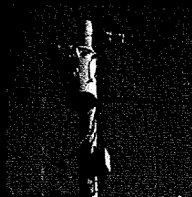
PROVEN SOLID-STATE SOLUTIONS



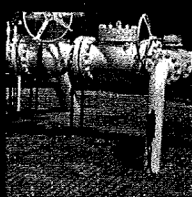
AC MITIGATION



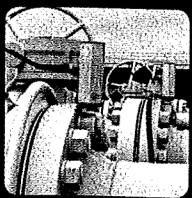
DECOUPLING EQUIPMENT



DECOUPLING STATION GROUNDS



GROUND MAT DECOUPLING



INSULATED JOINT PROTECTION

P: 608-877-9900
CONTACT@DAIRYLAND.COM

DEI

WWW.DAIRYLAND.COM