Environmental Stress-Corrosion Cracking of Fiberglass: Lessons Learned from Failures at Small Chemical Facilities

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Abstract

Fiberglass reinforced plastic (FRP) is often used to construct tanks, piping, scrubbers, beams, grating, and other components for use in corrosive environments. While FRP typically offers superior and cost-effective corrosion resistance relative to other construction materials, the glass fibers that provide the structural strength of the FRP are often susceptible to attack by the corrosive environment. The structural integrity of FRP components in corrosive environments is usually dependent on the integrity of a corrosion-resistant barrier, such as a resin-rich layer containing corrosion-resistant glass fibers. Without adequate protection, FRP components can fail at well below the design loads by an environmental stress-corrosion cracking (ESCC) mechanism when simultaneously exposed to mechanical stress and a corrosive chemical environment. Failure of these components can result in significant releases of hazardous substances into plants and the environment.

In this paper we present case studies where fiberglass components have failed due to ESCC at small chemical manufacturing facilities. As is often typical, the small chemical manufacturing facilities relied largely on FRP component suppliers to determine materials appropriate for the specific process environment and to repair damaged in-service components. We discuss the lessons learned from these incidents and precautionary companies should take when interfacing with suppliers and other parties during the specification, construction, and repair of FRP components in order to prevent similar failures and chemical releases occurring in the future.