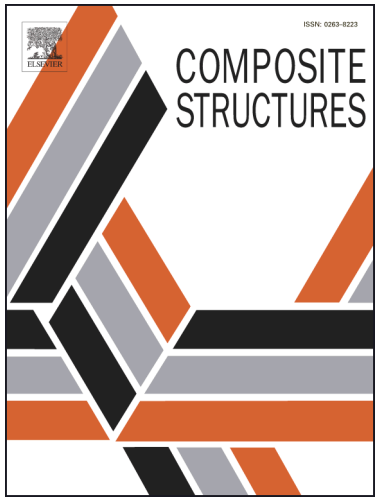

Diffusion kinetics, swelling, and degradation of corrosion-resistant C-glass/epoxy woven composites in harsh environments

Jonathon D. Tanks, Yoshihiko Arao, Masatoshi Kubouchi

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Diffusion kinetics, swelling, and degradation of corrosion-resistant C-glass/epoxy woven composites in harsh environments

Jonathon D. Tanks*, Yoshihiko Arao, Masatoshi Kubouchi

Dept. of Chemical Science & Engineering, Tokyo Institute of Technology, Meguro-ku, Tokyo 152-8550 Japan

* Corresponding author, Tel.: (863)703-6540; E-mail address: tanks.j.aa@m.titech.ac.jp

Abstract

Fiber reinforced polymer (FRP) composites are commonly used in the chemical industry for storage tanks and pipelines, since most metallic alloys suffer from corrosion and result in costly maintenance and safety hazards. E-glass fiber is commonly used because of its low cost, but it is extremely susceptible to rapid degradation in low-pH environments. C-glass is an acid-resistant substitute, and while not as durable as carbon, it is much cheaper. Nevertheless, durable fibers are not the only key aspect of designing corrosion-resistant composites, as various degradation mechanisms must be considered. In this study, plain-weave laminates of C-glass and amine-cured epoxy are exposed to water and sulfuric acid solutions, and the relationship between diffusion kinetics and strength-loss is discussed. Results show that both solutions attack the fiber surface to some degree, but more importantly sulfuric acid increases the saturation uptake of water in the material, causing high swelling stresses that significantly reduce mechanical properties.

Keywords: A. Glass fibers; Polymer Matrix Composites (PMCs); B. Environmental degradation; Mechanical properties