

Short-Term Test on Thin Plastic Plates in Aggressive Chemical Environment

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ABSTRACT

The effects of various chemical solutions on the physical and mechanical properties of high performance polymer plates were investigated. The effects of specimen thickness (50% difference) on the short-term exposure to concentrated chemical solutions were investigated. Tests were performed according to ASTM C 581 standard and the chemicals selected for accelerated test were tap water, D.I. water, sulfuric acid and sodium hydroxide. Changes in weight and flexural strength were measured over a month period. The weight of the specimens continued to change even after a month of immersion.

INTRODUCTION

Polymer materials are becoming extremely popular in cure-in-place pipe application for rehabilitating pipes because of their outstanding mechanical properties and relatively easy installation for wide range of sewer pipes. Since these thin sections of high performance polymer composite will be exposed to various chemical environments during their service life, it is important to study their behavior in concentrated chemicals.

OBJECTIVE

The overall objective of this study was to investigate the effects of specimen thickness on the short-term chemical tests.

MATERIALS AND METHODS

Specimens: plate specimens with average thickness of 0.0950, 0.1364, and 0.1488 inches were used in this study.

Chemicals: The agents used in the chemical testing program were: tap water, D.I. water, sulfuric acid (3%, 10% and 30%), and sodium hydroxide solutions (3%, 10% and 30%).

Testing program: The physical and mechanical properties of the specimens were tested before and after one month of immersion.

Chemical Immersion Test: This test was done in accordance with ASTM C 581 Standards. The specimens were immersed completely in chemical solutions stored in

airtight cylindrical immersion jars. Changes in specimen appearance, cloudiness of solution, weight change, thickness, and hardness were monitored during the test. A total of 24 specimens were tested.

Short-term Flexural Test: This test was performed according to ASTM D 790 Standard in order to ascertain the change in mechanical properties with time. Over 100 specimens were tested.

ANALYSIS OF RESULTS

Weight Change in Chemical Immersion Tests: Generally, the specimens had higher weight gain in tap water and D.I. water than in acid and alkaline solutions. The weight gain in water and acid solutions varied from 0.77% to 1.26% in one month of immersion. The weight gain in 30% sodium hydroxide was only 1/3 of the weight gain observed in other solutions. Weight changes in the specimens were still increasing after one month of immersion.

Flexural Strength: Test results showed that the percentage flexural strength change was affected by the solutions and the thickness of the specimens. The thicker the specimen, greater the variation of flexural strength was observed. The variation of the flexural strength was lower than 6% for specimens with thickness less than 0.1 inch for most of the cases.

CONCLUSIONS

Based on the test results, following conclusions can be advanced:

- 1 Weight of the specimens continuously increased during the test period. Weight change in 30% NaOH solution varied from 0.22 to 0.35% while the weight changes in other agents varied from 0.77 to 1.26% in one month of immersion.
- 2 The results indicated that the type of chemical solution and specimen thickness affected the flexural strength of the material.

ACKNOWLEDGEMENT

This work was supported by the CIGMAT under grants from industries.

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