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Evaluation of tensile strength retention and service life prediction of hydrothermal aged balanced orthotropic carbon/glass and Kevlar/glass fabric reinforced polymer hybrid composites

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Abstract

Quest to reduce challenges of high structural weight and cost of metallic components is increasing. It has led to their replacement with carbon and Kevlar fibers reinforced polymer (FRP) composites. These aforementioned problems can be further solved through hybridization of carbon/glass (CG) and Kevlar/glass (KG) fibers to reduce the manufacturing cost and materials usage, not at detriment of their properties. Also, investigation into their tensile properties, diffusivity, and service life is germane. Therefore, the present study focuses on influence of hybridization of CG and KG fibers on seawater diffusivity, service life, and tensile strengths of their composite systems, through hydrothermal aging. The hybrid composites were aged in seawater for 50, 150, and 300 days at temperatures of 20, 40, and 60°C. From the results obtained, it was evident that the maximum moisture absorption of both FRP hybrid composites occurred at 60°C in 300 days of hydrothermal aging. The maximum tensile strengths were obtained in unaged composite counterparts. Also, the aged FRP hybrid composites exhibited the lowest tensile strengths at 150 days. The retention of maximum tensile strengths of CG and KG FRP hybrid composites showed 75% and 70% for 100 years at hydrothermal aging temperature of 40°C. Therefore, both FRP hybrid composite samples exhibited promising behaviors for various marine and outdoor applications.

KEYWORDS

degradation, mechanical properties, thermosets

1 | INTRODUCTION

The use of synthetic fiber reinforced polymer (FRP) composites made up of carbon, Kevlar, and glass fibers is widely encouraged by researchers, academicians, and industrialists, due to their lightweight, higher strength-to-weight, higher stiffness-to-weight, higher specific strength, relative less cost for making composites, and

