

Assessment of Mechanical Properties of Aged Composite Laminates in Saltwater Environment

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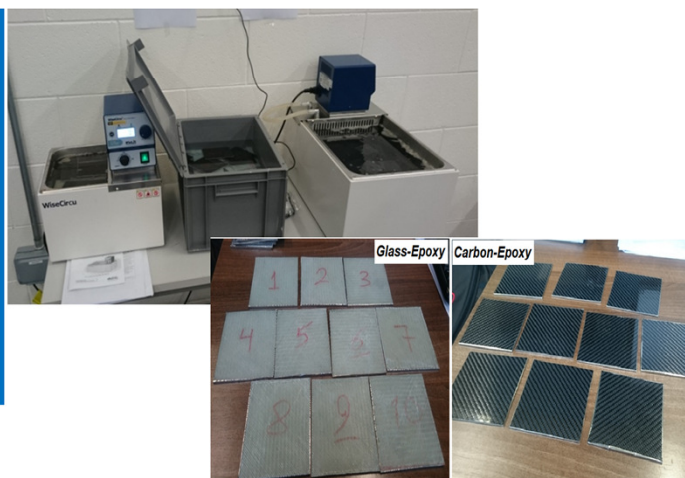
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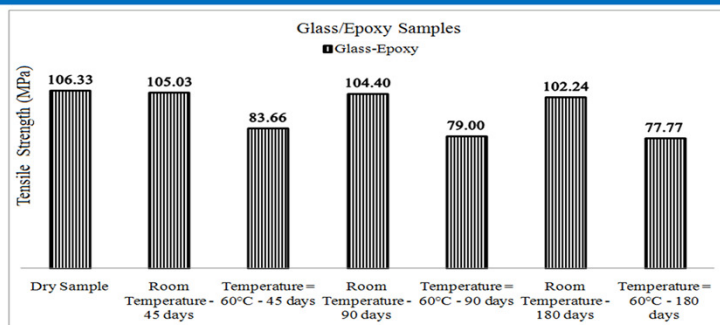
Introduction

This research presents accelerated ageing on glass/epoxy and carbon/epoxy samples in artificial sea-water immersion at room and elevated temperatures (60°C). These accelerated tests were used to evaluate the performance of composite materials, components and/or structures used in marine-based applications through tensile, differential scanning calorimetry and microscopic assessment. In this order, the water immersion of composite laminates has been done over 180 days at 60°C and room temperature in artificial sea water with 3.5% salinity.

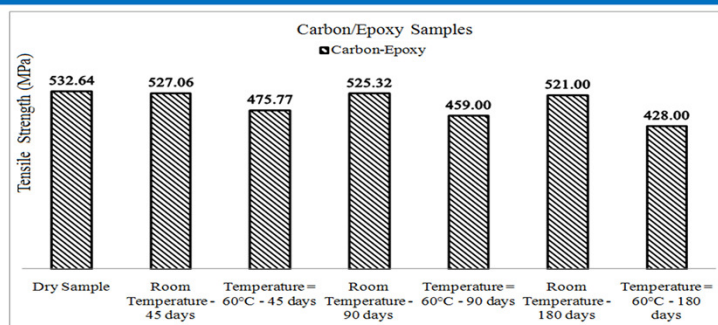
Materials & Ageing Process



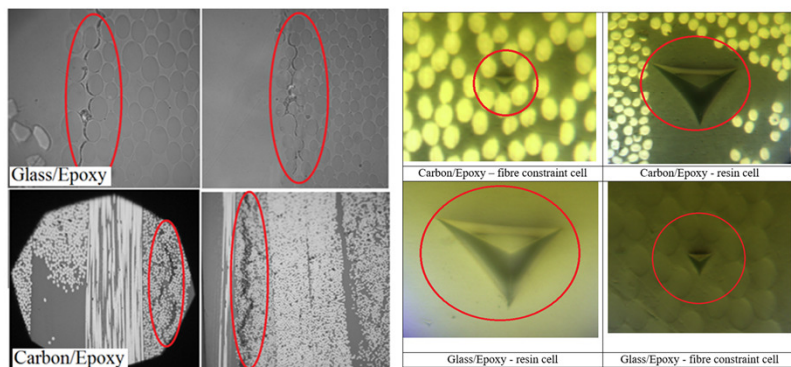
Tests & Results



Tensile test results of dry and aged composite Glass/Epoxy samples.



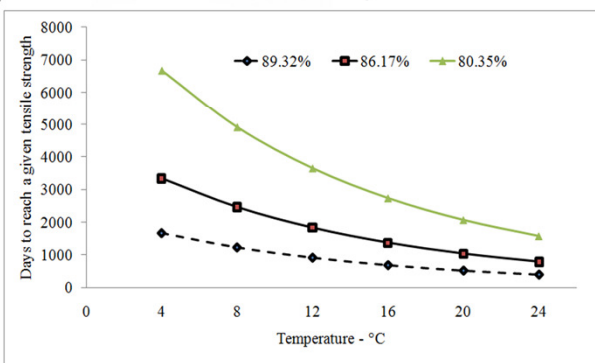
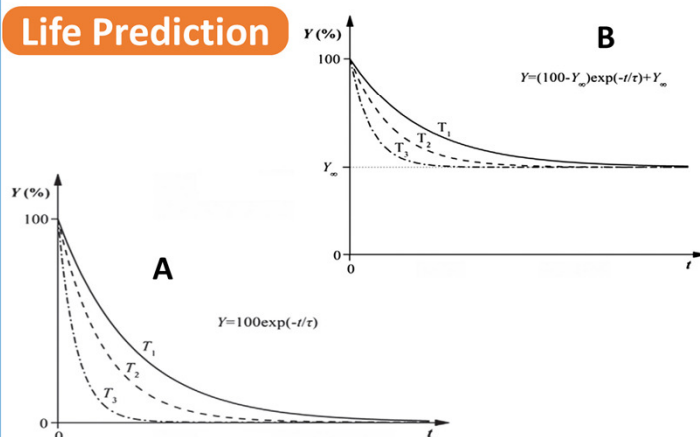
Tensile test results of dry and aged composite Carbon/Epoxy samples.



Microscopy: Matrix cracking and fibre de-bonding in the aged composite specimens at 60°C.

Nano-indentation: Both in-situ resin and fibre constraint cells (Average carbon fibre diameter = 12µm, Average glass fibre diameter = 17µm)

Life Prediction



Model A: Prediction of long-term life of Carbon/Epoxy composite samples

Conclusion

- Change in mechanical properties occurs even after reaching the saturation point in both glass/epoxy and carbon epoxy laminates.
- Effect of chemical-based degradation (reaction between water and epoxy, chain scission) on the loss in mechanical properties of composite samples is higher than effect of the mechanical-based damages (induced stress by water absorption, capillary and osmosis phenomenon).
- The theoretical models showed an acceptable accuracy to predict the long term life of aged composite specimens for the duration of 2 years (available experimental results to compare)