Tensile and thermal effects on inter-ply hybrid Fiber Reinforced Polymer Composites

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Abstract

Hybridization of glass and carbon fiber (CF & GF) is one of the most efficient technique to improve the mechanical properties of an inter-ply laminated fiber reinforced polymer (FRP) composites. Combining two combinations of fibres (CF and GF) layers with different stacking sequences of hybrid composites. The stacking sequence of five layered hybrid composites is like C_1G_4, C_2G_3, $C_1G_3C_1$, $G_2C_1G_2$ as compared with G_5 and C_5. The specimens were tested at 1 mm/min loading rate at different temperatures (30ºC, 70ºC & 110ºC).

Introduction

- The engineering applications including mechanical parameters to certify a material, (a) strength, (b) toughness, (c) stiffness. Effect of temperature [1], loading rate and change of environment on mechanical behavior of fiber reinforced composite [2].
- The tensile strength of carbon and glass fibers may be similar however, the strength of GE composite expressively lower than CE composite in tensile and compressive loading [3].
- By combining two or more fiber types, these hybrid composites offer a better balance in mechanical properties than non-hybrid composites for which the response can be predicted [4].

Materials and method

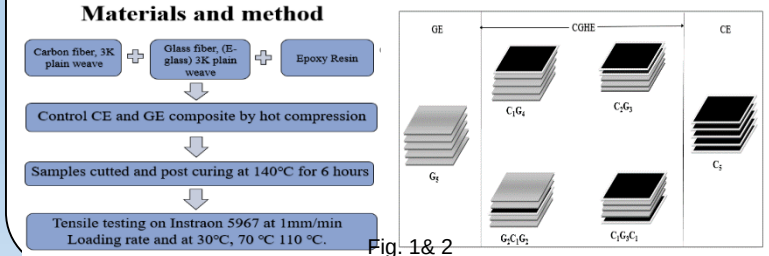

Fig. 1& 2

Results

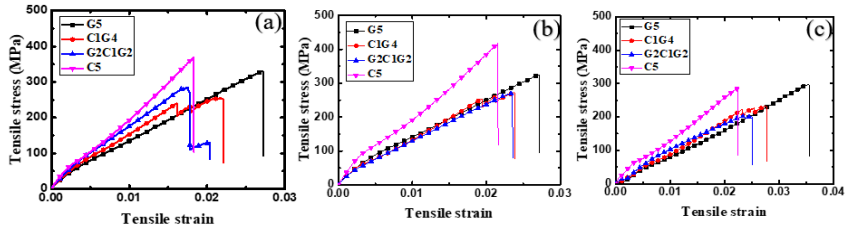

Fig.3 Stress ~ Strain behavior of 1C+4G composite system with different stacking sequence with CE and GE composites (a) 30˚C, (b) 70˚C and (c) 110˚C.

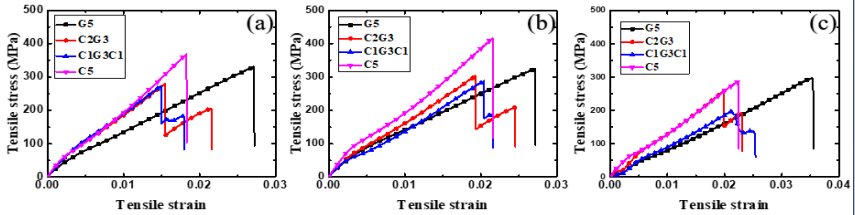

Fig.4 Stress ~ Strain behavior of 2C+3G composite system with different stacking sequence with CE and GE composites at (a) 30˚C, (b) 70˚C and (c) 110˚C.

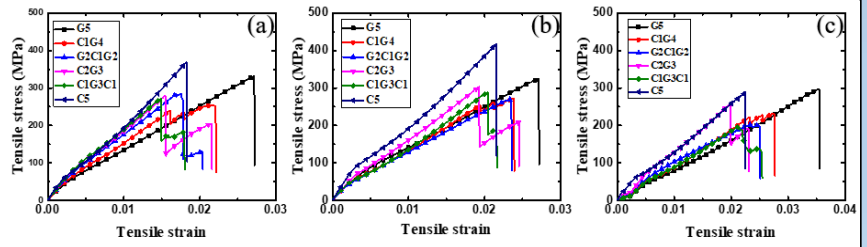

Fig.5 Stress ~ Strain behavior of CGHE composites with different stacking sequence at (a) 30ºC, (b) 70ºC and (c) 110ºC.

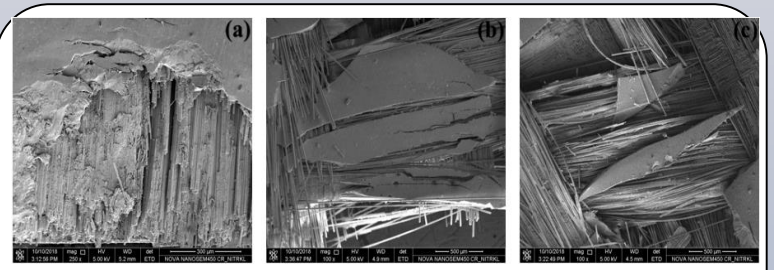

Figure. 6 Scanning electron microscope images of composite specimens at a) 30°C, b) 70°C and c) 110°C.

Conclusions

- Fibre hybridization of composites were found to be temperature sensitive i.e. tensile parameters were affected by increase in temperatures.
- C_2G_3 composite at 30°C and 70°C shows higher modulus value (27GPa & 21GPa) as compared to other combinations of composites.
- The different failures modes obtained from SEM are matrix microcracks and matrix damage at various temperatures.

References

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