

# Effects of carbon nanotube and/or graphene reinforcement on the mechanical performance of glass fiber/epoxy composite

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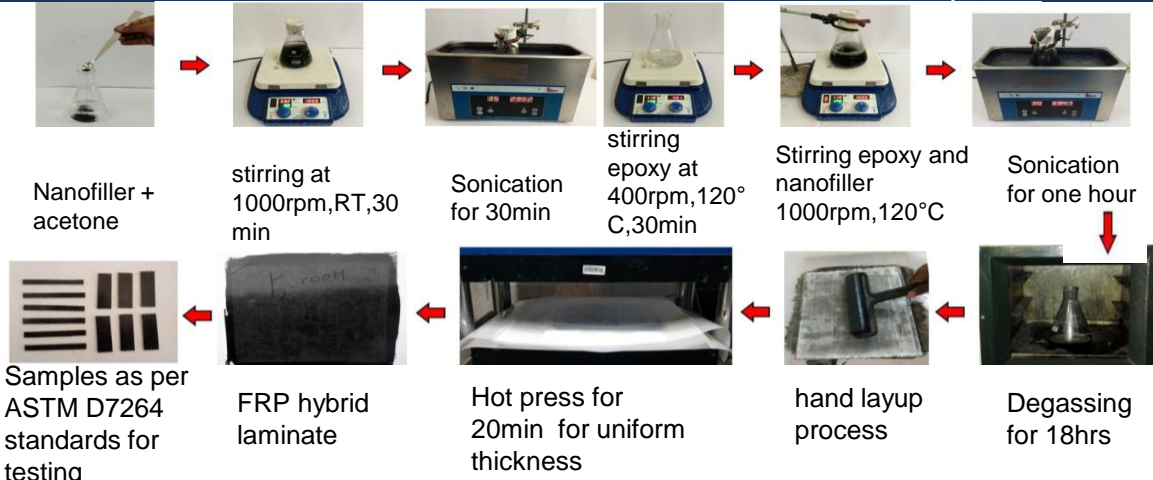
## Abstract

In current times, neat fiber reinforced polymer (FRP) composites are not able to satisfy the requirements of various critical applications where high performance is required, hence material modification is needed. The allotropes of carbonaceous nanomaterials like carbon nanotubes and graphene have attracted many researchers and engineers for improving the performance of FRP composites. In present research, addition of 0.1 wt. % of carbon nanotubes to glass fiber/epoxy (GE) composites exhibits ~13% and ~9% increase in the flexural strength and modulus, respectively when compared to control GE composite due to its higher aspect ratio, when tested at room temperature. Same amount of graphene addition showed ~12% and ~11% increment in the aforesaid properties because of its higher specific surface area. Further improvement in flexural strength and modulus was observed in hybrid GE composite reinforced with both CNT and graphene, due to the 3D combined action of these nano fillers. To study the effect of CNT and/or graphene presence on the thermal properties of the GE composite, differential scanning calorimetry (DSC) was carried out. To study the mode of failure, fractography has been done with scanning electron microscope

## Introduction

FRP composites imparts higher specific strength but poor out of plane properties and low polymer toughness. Incorporation of nano fillers like CNT and graphene enhances the interfacial strength of the fiber reinforced polymer composite.

## Fabrication route of nanofillers embedded FRP composite



## Results and Discussion

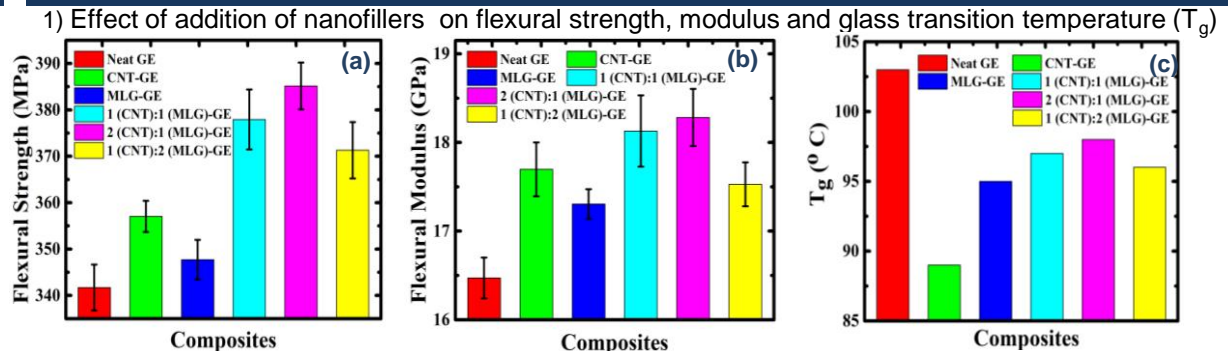


Fig.1. Depicts Mechanical performance of Nano FRP a) Flexural Strength vs Composites at RT b) Flexural Modulus vs Composites at RT c)  $T_g$  (°C) vs Composites

2) FESEM images of the fractured surface after flexural testing at RT

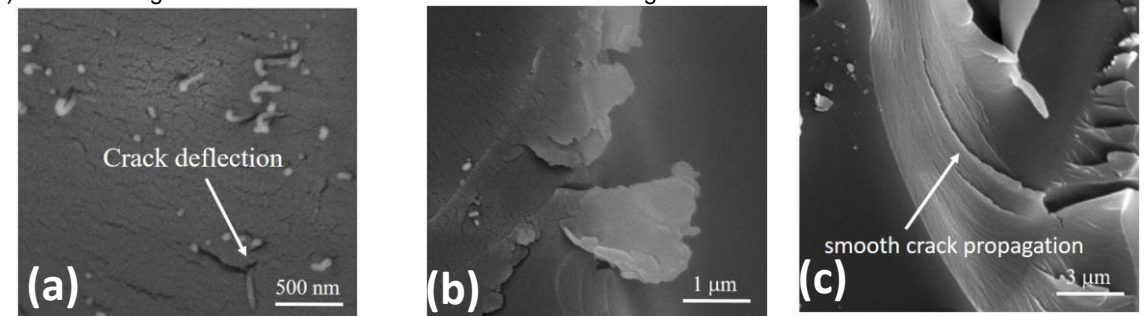


Fig.3. FESEM images of fractured surfaces (a, b) MWCNT AND MLG embedded GE, (c) GE

## Conclusion

MWCNT- MLG coalition act as superior reinforcements than individual addition of MWCNT and MLG nano fillers in the FRP field. The glass transition temperature of 2:1 MWCNT and MLG also enhances due to better bonding with the epoxy matrix.

## References

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- C. Kostagiannakopoulou, X. Tsilimigkra, G. Sotiriadis, and V. Kostopoulos, "Synergy effect of carbon nano-fillers on the fracture toughness of structural composites," *Composites Part B: Engineering*, vol. 129, pp. 18–25, 2017