Title: Mechanical and thermal behavior of nano-TiO_2 enhanced glass fibre reinforced polymeric composites at various crosshead speeds

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Abstract:

Fibre reinforced polymeric (FRP) are used in different components of aerospace, space, marine, automobile and civil infrastructure. These materials are becoming prime choice of materials in the field of structural components. During their in-service period different structural components experience a wide range of loadings. The current investigation was focused on the assessment of mechanical and thermal behavior of glass FRP composite on the addition of nano-TiO_2 particles. The control glass/epoxy(GE) composites and nano-TiO_2 modified GE composites were tested at different crosshead speeds viz. 1, 10, 100, 500 and 1000 mm/min. nano-TiO_2 was used as filler material and the epoxy matrix was processed with different nano-TiO_2 contents (0.1, 0.3 and 0.5 wt. %). Addition of 0.1 wt. % nano-TiO_2 particles exhibited an improvement in strength of nano-TiO_2 /GE composites at all crosshead speeds. Different failure patterns of nano-TiO_2 enhanced GE composite tested at 1, 10, 100, 500 and 1000 mm/min crosshead speeds were identified. Scanning electron microscopy (SEM) was carried out to know the main cause of failure that induced different morphologies. Furthermore, the viscoelastic behavior of the material was carried out using dynamic mechanical thermal analyzer which correlated the mechanical and thermo-mechanical behavior of the FRP composites.

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Image

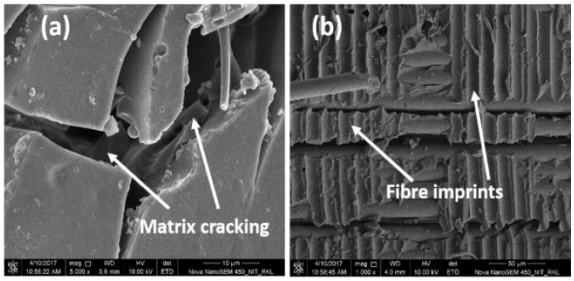


Figure 1: Scanning electron micrographs showing (a) matrix cracking (b) fibre imprints.

Recent Publications

1. Mahato K K, Dutta K, Ray B C (2018) Loading rate sensitivity of liquid nitrogen conditioned glass fiber reinforced polymeric composites: An emphasis on tensile and thermal responses, Journal of Applied Polymer Science, 135:9.

2. Mahato K K, Dutta K, Ray B C (2017) High-temperature tensile behavior at different crosshead speeds during loading of glass fiber-reinforced polymer composites, Journal of Applied Polymer Science, 134: 16.

3. Mahato K K, Rathore D K, Dutta K, Ray B C (2017) Effect of loading rates of severely thermal-shocked glass fiber/epoxy composites, Composites Communications, 3: 7-10.

4. Mahato K K, Dutta K, Ray B C (2017) Static and Dynamic Behavior of Fibrous Polymeric Composite Materials at Different Environmental Conditions Journal of Polymers and the Environment, 1-27.

5. Nayak R K, Mahato K K, Ray B C, (2016) Water absorption behavior, mechanical and thermal properties of nano TiO2 enhanced glass fiber reinforced polymer composites, Composites Part A: Applied Science and Manufacturing 90:736-747.



Biography

Kishore Kumar Mahato is pursuing PhD at National Institute of Technology, Rourkela, India. He has published around 15 research articles in different SCI and Scopus indexed journals. The research work is focused on failure and fracture behavior of fibre reinforced polymeric Composite in different harsh environments. Investigations are focused on the assessment of mechanical behavior of environmentally conditioned FRP composites through experimental and numerical analysis. Primarily, the polymer matrix and the existing fibre/polymer interface are susceptible to harsh and hostile in-service environments which can alter the durability and integrity of fibrous polymeric composites. The mechanical response of polymeric materials is loading rate sensitive and the precise mode of failure depends on the in-service environment. The environmental parameters which may influence the performance of the composites includes but not limited to temperature, moisture, UV and other high energy radiations.

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