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RESEARCH ARTICLE

Effect of hybridization and stacking sequences on mechanical properties and thermal stability of aloe vera-roselle-glass fiber reinforced polymer composites

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Abstract

Environment friendly polymer composites made of plant based natural fibers such as bamboo fiber, roselle fiber (RF), aloe vera fiber (AF) oil, or kenaf fiber are cardinal of the current world toward sustainability. They offer lower carbon footprint, higher biodegradability, higher specific strength, higher thermal, and acoustic characteristics. On the other hand, properties of synthetic glass fibers (GFs) such as high specific strength to weight ratio, great resistance during impact, and high durability extend their application perspective for various engineering materials. As such, in the present study, mechanical properties and thermal stability of hybrid laminate comprising of natural fiber (i.e., AF and RF) and synthetic fiber (i.e., GF) fabricated using hand layup process were investigated. Experimental findings reveal that sequencing of the

respectively while hybrid laminates composed of three successive layers of RF exhibited 12.6% higher impact strength compared to hybrid laminate composed of AF. Besides, the thermal stability of hybrid laminates was higher (i.e., minimal weight loss of <6.1% when heated up to 800°) compared to neat polymer or laminates with single reinforcement. The enhanced thermal stability, mechanical properties, and tribological properties of the “greener” hybrid laminates can be employed in various structural or lightweight industrial applications.

Highlights

- Hybridization using natural fibers and synthetic fibers are attempted and investigated.
- Fiber sequencing significantly affects mechanical properties of the composite.
- Higher thermal stability of hybrid laminates, that is, minimal weight loss of <6.1% when heated up to 800°.
- Laminated composed of AF in between RF exhibited lowest frictional coefficient.
- “Green” hybrid polymer laminate suitable for various structural and lightweight industrial applications is identified.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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