DESIGN AND DEVELOPMENT OF 2D WOVEN JUTE FIBER NANOFILLER/EPOXY HYBRID COMPOSITES FOR UAV STRUCTURAL APPLICATIONS

Dr. Santosh Kumar M B
Akshara Ravi (Junior Research Fellow)
Cochin University of Science and Technology, University Road, South Kalamassery, Kalamassery, Kochi, Pin - 682022. Kerala, India.
dr.santocusat@gmail.com

Abstract
The growing need for lightweight, strong, and environmentally sustainable materials in unmanned aerial vehicles (UAVs) has driven interest in natural fiber–based composite systems. This work presents the fabrication and assessment of 2D woven natural fiber-reinforced nanofiller/epoxy composites intended for drone structural applications. The woven reinforcement architecture contributes to enhanced in-plane mechanical stability, while the incorporation of nanoscale fillers improves interfacial bonding, stiffness, and resistance to crack initiation. Composite laminates were fabricated using the hand layup method and subsequently cured under controlled conditions to ensure uniform resin distribution and complete fiber impregnation. Mechanical characterization, including tensile, flexural, and impact testing, demonstrated significant improvements in strength-to-weight ratio compared to standard synthetic fiber composites. Microstructural analysis confirmed homogeneous nanofiller dispersion and strong fiber–matrix adhesion. Overall, the results indicate that these hybrid natural fiber composites offer a scalable, cost-effective, and eco-friendly material platform suitable for load-bearing components in next-generation UAV structures.

References

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