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(57) Abstract :

The increasing demand for innovative, high-performance materials has led to advancements in fiber-reinforced polymer (FRP) composites, particularly in engineering applications. This study explores the synthesis and characterization of glass fiber-reinforced epoxy composites infused with silicon carbide (SiC) particles. These composites were fabricated using the hand lay-up method, producing E-glass epoxy laminates per ASTM standards with dimensions of 300x300x5mm. Mechanical tests, including tensile, flexural, and impact assessments, were conducted to examine the influence of SiC fillers on the composite's mechanical properties. The experimental results indicate that the inclusion of SiC significantly enhances the toughness and flexural strength of the glass epoxy composites. Enhanced interfacial adhesion and uniform dispersion of the SiC filler particles contributed to this improvement. Higher filler volume percentages directly correlated with increased tensile and flexural strength. Specifically, tensile tests using a Computerized Universal Testing Machine (UTM) revealed that as the SiC content increased, there was a marked enhancement in load-bearing capacity. Flexural tests further supported these findings, demonstrating improved resistance to deformation under bending stress. Additionally, impact tests showed that SiC-infused composites exhibit increased energy absorption, indicating better resistance to sudden shock loads. The results suggest that glass fiber-reinforced epoxy composites with SiC fillers offer a promising alternative to traditional materials for applications requiring lightweight, high-strength structures. This material system, with its optimized mechanical properties, holds potential for a wide range of applications in aerospace, automotive, and marine engineering. This research underscores the importance of filler materials in composite technology and opens avenues for future studies aimed at refining the distribution and integration of fillers to achieve enhanced mechanical performance.

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