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RESEARCH ARTICLE

Environmentally Benign High-Performance Composites-Based Hybrid Microcrystalline Cellulose/Graphene Oxide

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ABSTRACT

A novel silane functionalization prepared by a solution mixing approach of epoxy composites filled with eco-friendly reinforcement filler, that is, graphene oxide (GO) and microcrystalline cellulose (MCC). The developed composites were subjected to comprehensive analysis using various characterization techniques, encompassing mechanical testing, water absorption analysis, thermal stability assessment, and scanning electron microscopy (SEM). The tensile strength and Young's Modulus of the epoxy composite filled with 1.0 wt.% of GO (EGO1.0) demonstrated the highest value viz. 29.83 MPa and 1991.71 MPa, respectively, when compared to neat epoxy composite (E0). Meanwhile, the thermal gravimetry analysis (TGA) studies, particularly char yield, highlight improvements in the thermal stability of the EGO2.5 composite, that is, 23.39% representing a 33.73% increment compared to the E0 composite. The synergistic effect of hybrid filler, achieved by a combination of micro and nanoparticle fillers within an epoxy matrix, was investigated as a virtuous alternative to the conventional epoxy nanocomposites. A uniform dispersion of GO on the MCC surface leads to significant improvements in the mechanical properties and thermal stability of the epoxy-reinforced composite. The maximum tensile strength, Young's Modulus, and break strain of 39.77 MPa, 2591.27 MPa, and 2.90%, respectively, were observed for the modified EGO1.0MCC1.5 composite. The synergistic effect of hybrid eco-friendly reinforcement fillers (GO/MCC) and a strong interfacial adhesion between the matrix and filler reduces the formation of defects, thereby resulting in good stress transfer from matrix to fillers.

Keywords

graphene oxide | hybrid | microcrystalline cellulose | synergistic

1 | Introduction

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