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RESEARCH ARTICLE

Flexural, impact, and dynamic mechanical analysis of glass fiber/ABS and glass fiber/carbon fiber/ABS composites

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Abstract

In this study, a hybrid manufacturing technique was proposed to fabricate composites of acrylonitrile butadiene styrene (ABS) with Bidirectional woven glass fiber mat (GF)/ABS and GF/Bidirectional woven carbon fiber mat (CF)/ABS. The composites were fabricated using fused deposition modeling 3D printing, followed by hot compression molding, and their flexural, impact, and dynamic mechanical behaviors were examined. Results indicated that composites with GF and ABS combinations had shown the highest maximum flexural strength (64.46 MPa) and impact strength (0.089 J/mm^2). The hybrid composites showed intermediate performance between ABS and GF/ABS composites, with higher flexural strain before failure than ABS and GF/ABS. A comprehensive analysis utilizing scanning electron microscopy was carried out to evaluate the adhesion characteristics of the fiber-matrix interface in impact-tested samples. Dynamic mechanical analysis showed that GF/ABS composites had offered superior E', E'', and tanδ than the hybrid configuration. The peak tan delta values obtained from ABS, GF/ABS, and GF/CF/ABS composites were utilized to determine their respective glass transition temperatures. The observed values for ABS, GF/ABS, and GF/CF/ABS composites were 109.65, 69.95, and 71.5°C, respectively. Some potential applications for the composites fabricated in this study could include the development of lightweight and strong components for aerospace or automotive industries.

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