Dynamic mechanical properties and thermal properties of longitudinal basalt/woven glass fiber reinforced unsaturated polyester hybrid composites

ABSTRACT

This study investigates the mechanical, thermal, and chemical properties of basalt/woven glass fiber reinforced polymer (BGRP) hybrid polyester composites. The Fourier transform infrared spectroscopy (FTIR) was used to explore the chemical aspect, whereas the dynamic mechanical analysis (DMA) and thermomechanical analysis (TMA) were performed to determine the mechanical and thermal properties. The dynamic mechanical properties were evaluated in terms of the storage modulus, loss modulus, and damping factor. The FTIR results showed that incorporating single and hybrid fibers in the matrix did not change the chemical properties. The DMA findings revealed that the B7.5/G22.5 composite with 7.5 wt% of basalt fiber (B) and 22.5 wt% of glass fiber (G) exhibited the highest elastic and viscous properties, as it exhibited the higher storage modulus (8.04 × 109 MPa) and loss modulus (1.32 × 109 MPa) compared to the other samples. All the reinforced composites had better damping behavior than the neat matrix, but no further enhancement was obtained upon hybridization. The analysis also revealed that the B22.5/G7.5 composite with 22.5 wt% of basalt fiber and 7.5 wt% of glass fiber had the highest Tg at 70.80 °C, and increased by 15 °C compared to the neat matrix. TMA data suggested that the reinforced composites had relatively low dimensional stabilities than the neat matrix, particularly between 50 to 80 °C. Overall, the hybridization of basalt and glass fibers in unsaturated polyester formed composites with higher mechanical and thermal properties than single reinforced composites.

Keyword: Hybrid composite; Glass fiber; Basalt fiber; DMA; TMA