Thermogravimetric and dynamic mechanical analysis of woven glass/kenaf/epoxy hybrid nanocomposite filled with clay

ABSTRACT

This research studies the thermogravimetric and dynamic mechanical analysis of woven glass/kenaf/epoxy hybrid nanocomposites filled with clay. Epoxy resin modified with 1.0 wt% silicon is sonicated with varying clay loading of 1.0, 3.0 and 5.0 wt%. The resin is then spread onto alternating woven glass and NaOH-treated woven kenaf. Thermogravimetric analysis (TGA) reveals the benefits of dispersing clay onto the thermal properties of nanocomposite. Higher residue and higher temperature at 10 wt% mass loss is observed in clay nanocomposite. In addition to that, kenaf treatment, woven glass reinforcement and epoxy modification also help in improving the thermal stability of composites. Dynamic mechanical analysis (DMA) reveals that TKG1% composite possessed the highest storage modulus at room temperature with 136.74% higher than UKG1% composite due to the polymer chain diffusion between well dispersed clay structures. TKG1% also achieved the highest loss modulus which indicates strongest internal friction among other composites. Despite that, TKG1% composite exhibited the lowest T_g which is 72°C. This could be reasoned with the elimination of hemicellulose due to fibre treatment that is responsible for stiffness in natural fibre. Elimination of hemicellulose is proven through Fourier-transform Infrared Spectroscopy (FTIR) analysis conducted on treated kenaf fibre at wavenumber 1514, 1696 and 1726 cm^{-1}.

Keyword: Clay; Dynamic mechanical analysis; Hybrid fibre composite; Thermogravimetric analysis; Thermal stability