Abstract:

Fire, smoke and toxicity are of significant concern for composite materials used in marine applications. Bromination of vinyl ester resin imparts fire retardancy as manifested by a reduction in the amount of smoke, carbon monoxide, and corrosive combustion products. In this research, the viscoelastic properties, modulus (stiffness) and damping (energy dissipation), of 1.25 and 2.5 wt. percent nanoclay and exfoliated graphite nanoplatelet (xGnP) reinforced non-brominated and brominated vinyl ester have been studied over a range of temperature and frequency. Effects of frequency on the viscoelastic behavior were investigated using a Dynamic Mechanical Analyzer (DMA) by sweeping the frequency over three decades: 0.01, 0.1, 1 and 10 Hz, and temperature range from 30–150°C at a step rate of 4°C per minute. Master curves were generated by time-temperature superposing the experimental data at a reference temperature. The nano reinforced composites showed a drop in initial storage modulus with bromination. Nanocomposites with 1.25 and 2.5 wt. percent graphite had the highest storage modulus among brominated specimens. Bromination was also found to significantly increase the glass transition temperature ($T_g$) and damping for all nanocomposites. Among the brominated specimens, 1.25 wt. percent graphite platelet reinforced vinyl ester exhibited the best viscoelastic response with high damping and glass transition temperature, along with superior storage modulus over a longer time period.