Thermal properties of HL002-TA/B epoxy resin/hardener in fibre metal laminates composites for aero-engine

ABSTRACT

Fibre metal laminates (FML) composite are now widely used in many industries such as aerospace and automobile industries among others due to their superior properties compared to those of traditional materials; therefore the thermal stability and viscoelastic properties of the composite play important roles in high temperature application. The main purpose of this study is to evaluate the performance of the composites at high temperature application in fire designated zone of an aircraft engine. The composites were fabricated in a mold using hand lay-up method, compressed using a compression machine and then cured for 24 hours. The composites were heated from ambient temperature to a certain higher temperature at different heating rates using nitrogen and air gas for mass loss during thermogravimetric analysis (TGA), storage modulus, loss modulus and tan delta for dynamics mechanical analysis (DMA). The TGA result indicated a remarkable improvement in the thermal stability of all the fibre metal laminate composites where carbon fibre reinforced aluminium laminate with aluminium alloy at front and rear face had the highest percentage of residue which was 58.85%, while the smallest percentage was shown by the composite that was hybridized with natural fibre (kenaf). Dynamic mechanical results showed an increase in the storage modulus and an average glass transition temperature in the presence of polymer used; higher increment was observed on carbon fibre reinforced aluminium alloy with aluminium alloy at front and rear face. This investigation confirmed that fibre metal laminates of aluminium alloy 2024-T3, carbon fibre, epoxy and some other types of natural fibres composites possess excellent features that can be used in fire designated zone of an aircraft engine nacelle in the near future.

Keyword: Dynamic mechanical analysis; Fibre metal laminate; Natural/synthetic fibre; Thermogravimetric analysis