Cure Process Evaluation for Carbon-Epoxy Composites by Mechanical Characterization for Re-entry Vehicle Structure (RVS)

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ABSTRACT

A composite is a combination of two or more distinct materials, each of which retains its own distinctive properties, to create a new material. Mineral fillers, metals and fibers have been added to polymers for decades to form composite materials. Nikbakhti and Choupani [1] in their study, the behavior of interlaminar fracture of carbon-epoxy thermoplastic laminated composite is investigated numerically and experimentally. Tests are performed with Arcan specimens. They stated that testing with Arcan specimen gives the opportunity of utilizing just one kind of specimen for extract-ing fracture properties different mixed mode ratios of materials with exerting load via different load angles. He and Li [2] in their research on mechanical characterization of carbon fiber/epoxy composites are used to study the consequences of different novolac resin loadings. The composites are prepared by solution blending and casting in a vacuum oven and the mechanical properties are investigated by means of shear and impact tests. Paivaa, and Santos [3] have studied on degradation of carbon fiber reinforced epoxy composites by ultraviolet radiation and condensation. Based on observations of physical and chemical degradation it has been established that these environments operate in a synergistic manner that cuases extensive erosion of the epoxy matrix, resulting in a reduction in mechanical properties. Bezazi et al. [4] have studied on mechanical properties of auxetic carbon/epoxy composites developments in engineering design and technology for industries such as aerospace, automobile and sports. The requirement of such materials ranges from a combination of high stiffness and strength with significant weight savings, corrosion resistance, chemical inertness, low maintenance and improved reliability. An auxetic material expands when stretched and contracts when compressed, behaving in an opposite manner compared to traditional solids.

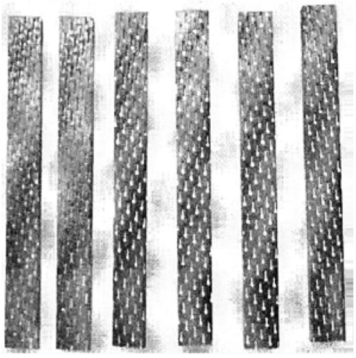

Figure 1: Carbon/epoxy specimens for inter laminar shear strength test.

The aim of this study is to determine mechanical properties for carbon/epoxy (LY556 + HT972) bi-directional compo-sites with different process parameters to improve fiber volume fraction for re-entry vehicle structure.

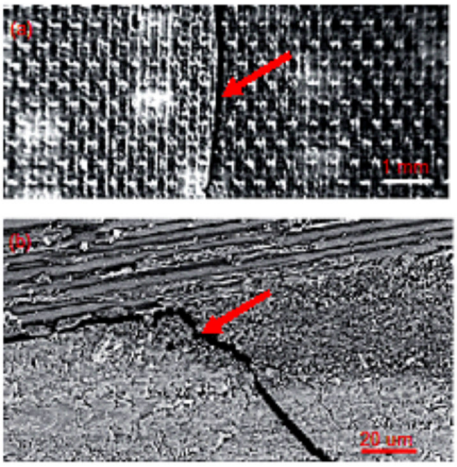

Figure 2: Validation of mathematical modeling with experimental results.

The tensile and flexural strengths were decreased with an increase in the volume fraction of fiber in the composite. The composites produced through curing under vacuum only had high tensile and flexural strengths. The occurrence of drop in flexural modulus was probably due to the fracture of the 0° fibers of the surface lamina. The interlaminar shear strength was very responsive to the presence of these gas inclusions. The fiber controlled fracture was observed in the high volume fraction of carbon fibers in the carbon/epoxy laminates.

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