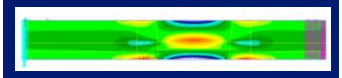

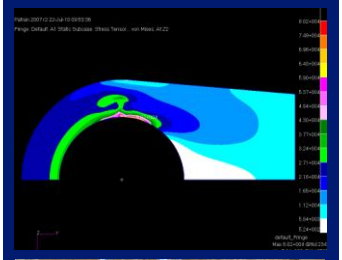

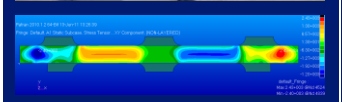

UAHuntsville
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE
Research Institute

Reliability and Failure Analysis Lab

E-glass Epoxy Composite Material Testing - Static Properties Characterization

Testing

The Reliability and Failure Analysis Lab has developed a method for characterizing E-glass composite materials with fiber distortion. Manufacturing methods were developed to produce quality samples. The material used was a pre-impregnated fiberglass, epoxy-phenolic matrix, composite material. This basically means the resin must undergo a thermal process to attain its final strength.

Each sample was created by cutting strips of the pre-preg tape from a large roll to a desired length. The material was then sorted by aligning the tracer fibers of the material and consolidating every 10layers under a vacuum. The final laminate was composed of 110layers of the e-glass epoxy material with an inserted defect. After consolidation was finished the pre-processed laminate was put into an aluminum mold with a pressure plate. The mold was placed into a vacuum bag and inserted into the autoclave to undergo a programmed heat/pressure cycle.

There is an ideal volume ratio of approximately 60% fiber to 40% epoxy matrix. To understand the quality of samples produced acid digestion tests were performed to validate manufacturing methods by comparing amounts of epoxy to the amount of fibers found in the composite. This was done by digesting away the epoxy from the glass fibers by using nitric acid.

FEA models were created to simulate stresses in the composite material. An experimental design was utilized to gain an understanding of different waviness effect on the composite material in tension and shear.

Tests were carried out with the use of Instron 8800 servo hydraulic test machine. An extensometer and strain gauges were used to gather detailed stress vs. strain data. The data was organized and analyzed to show a trend in strength degradation of the composite, with larger fiber distortion.

Applications

- Aircraft Structural Health
- Material Analysis

Advantages

- Failure modeling as a function of stress in thick lay-up composite structural components.

Contact

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