RESEARCH ARTICLE OPEN ACCESS

Experimental Investigation of Carbon/Glass/Epoxy Hybrid Composites

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Abstract:

An Extensive research work has been carried out on Carbon / Glass / Epoxy hybrid composite materials due to its applications. An investigation was conducted to characterize the mechanical properties of hybrid composites made from Carbon/Glass/Epoxy composites. The tests were conducted using laminates having same thickness. The specimens are tested using computer integrated Universal Testing Machine.The result shows that the mechanical properties of in traply hybrid composites increased. For composites reinforced with Carbon/Glass there will be an improvement in compression properties and modulus of elasticity.In addition the numerical methods have been used to validate the mechanical properties of hybrid composites.

I. INTRODUCTION

COMPOSITES

Composite materials are materials that combine two or more materials (a selected filler or reinforcing elements and compatible matrix binder) that have quite different properties that when combined offer properties which are more desirable than the properties of the individual materials. The different materials work together to give the composite unique properties, but within the composite you can easily see the different materials; they do not dissolve or blend into each other.

MATERIAL SELECTION

The Technology advancements are necessitating exploring materials of unusual combination of properties (mechanical, electrical, corrosion, optical,magnetic, semi conducting dielectric etc). A composite is a structural material that consists of two or more combined constituents that are combined at a macroscopic level and are not soluble in each other. One constituent is called reinforcing phase and one in which it is embedded is called the matrix.

Composite materials were recognized for their strength and lightweight when used in the construction of the first all composite, radar proof airplane. Honeycomb exemplifies natural sandwiched composites which was guided man to build airframe structure. Composite materials in the form of sandwich construction showed that primary aircraft structures could be fabricated from these materials.

Polymers are particularly attractive as matrix materials because they are easily process able and their density is comparatively low when compared to other materials. They exhibit excellent mechanical properties. High-temperature resins are used as composite materials are currently used in the manufacture of high-speed aircrafts, rockets and other related space and electronics.

The reinforcements share the major load especially when a composite consists of fiber reinforcements dispersed in a weak matrix (e.g., carbon/epoxy composite), the fibers carry almost all the load. The strength and stiffness of such composites are, therefore, controlled by the strength and stiffness of constituent fiber.

LAMINATE PREPARATION:

The structural applications of composites are mostly in the form of laminates. Laminates provide the inherent flexibility that a designer exploits to choose the right combination of materials and directional properties for an optimum design. A lamina is the basic building block in a laminate. A lamina may be made from a single material (metal, polymer or ceramic) or from a 36

composite material. A composite lamina, in which all filaments are aligned along one direction parallel to each other, is called a unidirectional lamina.

A general unsymmetric laminate may contain 00 laminae, 900 laminae which is due to high bonding strength. When thermoset resins and hardeners are mixed it is important that the correct amount of hardener is used for a certain weight of resin. For some special resin/hardener systems the weight ratio can be varied to produce cured material with differences in properties, usually in flexibility or hardness. The epoxy and the hardener ratio should be 2:1.The molding process can done by compression molding machine. It is a closed molding process with high pressure applicants.

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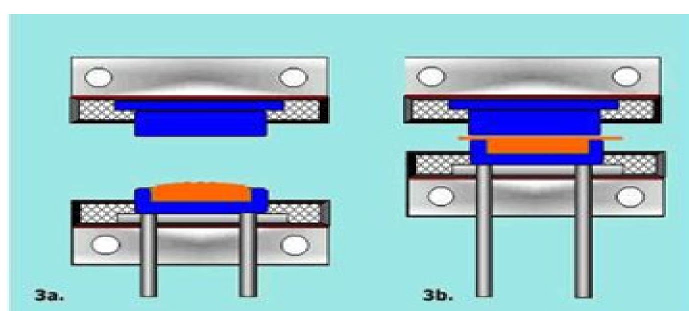
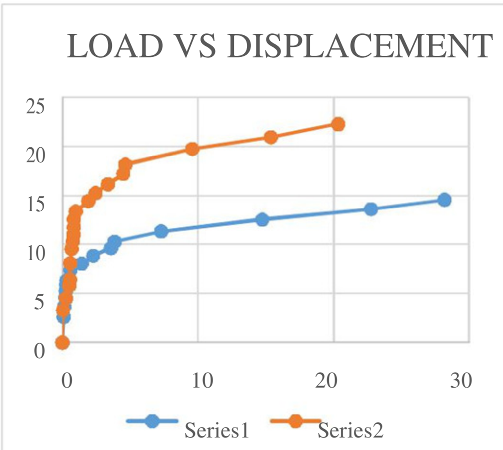


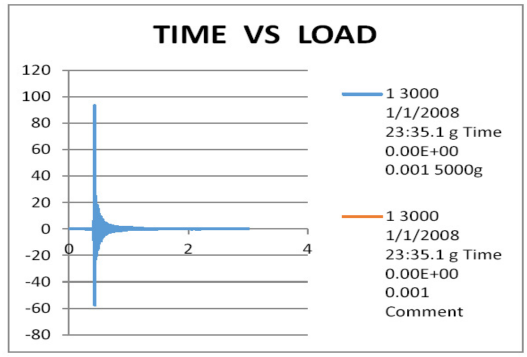
TESTING PROCESS

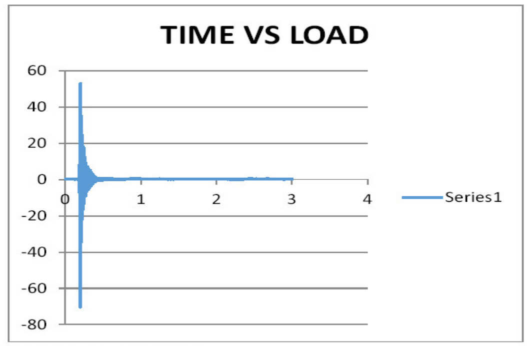
We are various testing can be carried out. The list of the testing is given below. The given fig is the UTM for compression testing. Compression testing Vibration testing Dynamic mechanical analysis.

COMPRESSION TEST RESULTS

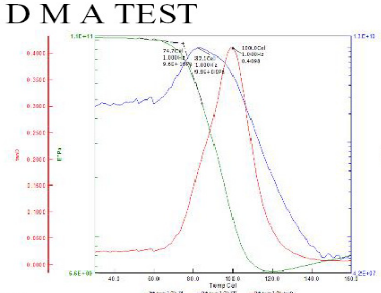


VIBRATION TEST





D M A TEST



VIBRATION SPECIMEN I

(CENTERING SIDE)

CONCLUSION

Carbon fiber reinforced polymer with Glass fiber and epoxy as polymer was conducted to estimate the compression, vibration and DMA (Dynamic Mechanical Analysis) with same thicknesses. We plotted graphs by the value from the experimental testing. From the result we concluded that the compression strength is more when compared to the other strength. Hence the Carbon fiber reinforced polymer with glass and epoxy as polymer laminates shows the greater strength when the laminates are in 0°/90° ply orientation.

REFERENCES

1. K.H.G. Ashbee, Fundamental Principle of Fiber Reinforced Composites (2nd Edition), Technomic Publishing AG, Switzerland, 1993.

2. N.K. Naik, Woven Fabric Composites, Technomic Publishing AG, Switzerland, 1993.

3. G.S. Springer and S.R. Finn, Composite Plates Impact Damage: An Atlas, Technomic Publishing Co., Lancaster, 1991.

4. R.A. Kline, Nondestructive Characterization of Composite Media, Technomic Publishing Co., Lancaster, 1992.

5. A. Brent Strong, High Performance and Engineering Thermoplastic Composites, Technomic Publishing Co., Lancaster, 1993.

6. S.M. Lee, Dictionary of Composite Materials Technology, Technomic Publishing Co., Lancaster, 1989.

7. G. Cederbaum, B. Gurion, I. Elishakoff, J. Aboudi and L. Librescu, Random Vibration and Reliability of Composite Structures, Technomic Publishing Co.,Lancaster, 1992.

8. A.M. Skudra, Structural Analysis of Composite Beam Systems, Technomic Publishing Co., Lancaster, 1991.