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Research Paper

# **EXPERIMENTAL INVESTIGATION** OF TENSILE PROPETIES OF STITCHED **GLASS FIBER EPOXY COMPOSITE**

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The current trend in aerospace, automobile and structural components is to replace metallic components with composites due to their inherent like weight and immune to corrosion. Generally the fiber reinforced epoxy laminated plates are fabricated with several layers of fiber with opposite orientation in an epoxy matrix. In this investigation an effort is made to increase the tensile strength by subjecting the fibers to stitching with a cotton thread before the application of the hardener and the epoxy material. The results of the tensile tests revealed an appreciable increase in the tensile strength of the stitched laminates when compared with the un-stitched laminates.

## INTRODUCTION

A composite material is defined as a material composed of two or more constituent materials that remain separate and distinct on a macroscopic level. Composite materials or 'composites' are found everywhere from surfboards and golf clubs to airplanes and space shuttles and are becoming a very important part of life in the 21st century. Recently the price of composites has reached the point where, in some cases they are more cost effective than traditional materials. There is an estimated 100-1000 Euros of savings per kilogram reduced in aircraft travel, this opens the doors for potential composite applications as can be seen by the wide use in the new Boeing and Airbus aircraft.

Generally speaking composite materials or 'composites' can be broken into two parts, the matrix and the reinforcement. The reinforcement supplies the strength and stiffness while the matrix binds the reinforcement and provides a means of transferring the load throughout the reinforcement. A synergism between the constituents produces material properties unavailable from the individual materials. A wide variety of constituent materials are used in composites such as plastic, metal and ceramic for the matrix and carbon, aramid, glass, boron or metal for the reinforcement. The role of the reinforcement in a composite material is fundamentally one of increasing the mechanical properties of the neat resin system. All of the

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different fibers used in composites have different properties and so affect the properties of the composite in different ways. The properties and characteristics of common fibers are explained below. However, individual fibers or fiber bundles can only be used on their own in a few processes such as filament winding. For most other applications, the fibers need to be arranged into some form of sheet, known as a fabric, to make handling possible. Different ways for assembling fibers into sheets and the variety of fiber orientations possible lead to there being many different types of fabrics, each of which has its own characteristics.

## **EXPERIMENTAL WORKS**

This project discuss the fabrication of the composite laminates and the effect of stitching of fiber on the tensile strength of glass epoxy composite. Some of the specimens with different orientations and stitched in through the direction of unidirectional. Unstitched laminates specimens are fabricated with different orientations.

The composite laminate was fabricated by hand layup technique. The specimens were subjected to tensile test.

## MANUFACTURING METHOD

In this process, a stack of plies consisting of nominally in-plane fibers is penetrated and bounded together by needle and stitch thread. The stitching was done by using cotton thread. The laminates fabricated were at room temperature. The composite is maintained by using seven layers of fiber ply. The stitching is made at 90° at tensile direction and the volume fraction of stitch thread is 0.3%. In order to reduce fiber distortion in the interior of the laminate a modified lock stitch was adopted for stitching and

thus easing the tension of the needle thread. The resin was applied to between the reinforcement fibers and act as glue to hold the fiber together. Before the mould was cleaned and applied the releasing anent. Generally the epoxy is used in industries. In this project study the epoxy LY556 was used. The hardner HY951was used. The ratio of epoxy and hardner is mixed in appropriate ratio with room temperature curing cycle of 48 hours duration. The laminates were fabricated by placing the fiber one over the other with a resin matrix between the layers. Used the brush to distribute resin uniformly, compact plies and to remove entrapped air. Finally nominal thickness of all laminates was 5.4mm after curing.

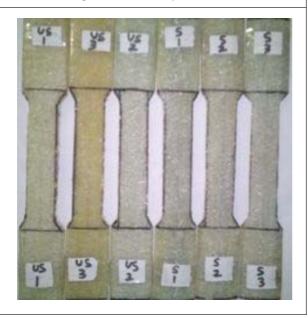
## TENSILE TESTING

#### Instrumental

The composite laminates were subjected to tensile load conducted in universal testing machine. The specimens were clamped and tests were performed. The tests were closely monitored and conducted at room temperature. The load at which completed fracture of the specimen occurred has been accepted as breakage load.

Figure 1: Tensile Testing Setup

Figure 2: Test Specimens



All composites were processed such that fiber fraction was greater than the epoxy resin. For the purpose of investigation three laminates and different laminates. The different laminates are stitched and un-stitched. The fiber direction selected for the experimentation was ±45°. The tensile properties of the glass fiber epoxy composites were determined according to IS: 1608-2005 test standard specifications. The average tensile properties were determined from three specimen tests on stitched and un-stitched laminates.

Figure 3: Fractured specimens



### RESULTS AND DISCUSION

The tensile test revealed a higher tensile strength in the stitched specimens was greater than the un-stitched specimen as shown in Table.1. This results indicates the stitching in the fiber increases the tensile strength of the composite laminates.

Table 1: Tensile Strength of Specimens			
S.No.	Ultimate Tensile Strength	Stitched Specimen (N)	Un-stitched Specimen (N)
1	Ultimate Breaking Load (N)	10533	7680

## CONCLUSION

The tensile tests were carried out in unstitched and stitched glass fiber epoxy composite. A cotton thread was used to stitch prepare fiber layers. The stitched laminated specimen leads to improve ultimate tensile strength and delamination over than unstitched laminated specimens.

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