Study And Mechanical Testing Of Fiber Reinforced Plastic Laminate And Carbon Fiber Laminate Composite

Naveen Kumar Yadav, Rishi Dewangan

Abstract— **The use of composite materials at industrial and domestic levels is increasing day by day, due to which the work in the direction of enhancing its mechanical property is being on a fast pace. In this study, the mechanical properties of Polyester resin and Carbon Fibre Composite were analyzed experimentally. Tensile and Compressive strength of the specimen were determined and compared. It was found both laminates together provides a positive impact in the enhancement of mechanical properties of the composite.**

Index Terms— **Polyester resin, carbon fibre, composite, Fibre reinforced plastic.**

I. Introduction

Composite materials have a wide range of application in structural engineering, aircraft engineering, automobile engineering etc. due to their good mechanical properties, less weight, corrosion free properties and easy fabrication techniques as compared to the conventional metal structures. Due to this many scientists and researchers are doing work in the field composite technology for enhancing its mechanical properties by using varied materials as fillers, additives etc. in it so that it can be used on a wide scale. Fibre reinforced composite are formed by embedding fibres into resin. Carbon, glass, basalt, bagasse etc. are the common fibres used in the formation of fibre reinforced composites with different resins like epoxy, polyester etc. Out of these carbon fibre reinforced composite and glass fibre reinforced composites are widely used [1-4]. As comparison to glass fibres carbon fibre shows good mechanical and physical property [5-9] which make it a suitable for the composite material. It has been also studied that the size of the fibre and orientation of the composite structure also plays a vital role in determining and enhancing the mechanical properties of the composite material [10-13]. Due to the excellent mechanical properties of carbon like tensile strength, compressive strength etc. it also helps in increasing the strength of the composite in which it is being used.

II. Experimental Procedure:

A. Materials:

Polyester resin, chopped strand mat and carbon fibre are the raw material used in this study for the sample preparation. Polyester resin is used as an adhesive, chopped strand mat is a form of reinforcement used in the fibre glass. The carbon fibre used is about 5-10 micrometre in diameter and is composed of carbon atoms.

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B. Sample Preparation:

Polyester resin is applied on the ply of chopped strand mat. Similarly, 5 plies are made and attached with each other in a sandwich manner. Carbon fibre is taken and attached on up and down side of the CSM adhesive sandwich.

Fig. 1: Top View of Composite sample

Fig. 2: Side view of Composite sample

From the prepared sample, a specimen of dimension 220 X 180 X 50 mm (length X Breadth X height) is taken out for further mechanical testing.

III. Testing:

After the fabrication of the laminates, specimens were subjected to various mechanical tests as per ASTM standard D 3039-76. Universal testing machine is used to perform the mechanical tests on the specimen. The experimental results were validated using the theoretical correlations 1 and 2.

$$Tensile\ stress = \frac{F}{A} \quad (1)$$

$$Fluxural\ Strength = \frac{3FL}{2bd^2} \quad (2)$$

Where F is the applied force, A is the cross-sectional area of the specimen, L is the length of the specimen, b is the breadth of the specimen and d is the height if the specimen used.

IV. RESULT AND DISCUSSION:

Testing of the composites was carried out by using ASTM Standards. The specimens were subjected to tensile and compressive loading and the behaviour was analyzed. Figure 3 shows that the specimen can sustain a maximum compressive stress of 1.4MPa at 0.3% elongation in it which is permissible. The Fig 4 Shows that the specimen can sustain a Tensile stress at Maximum Load is 3.52Mpa and the tensile strain at the breaking point is 1.37%.

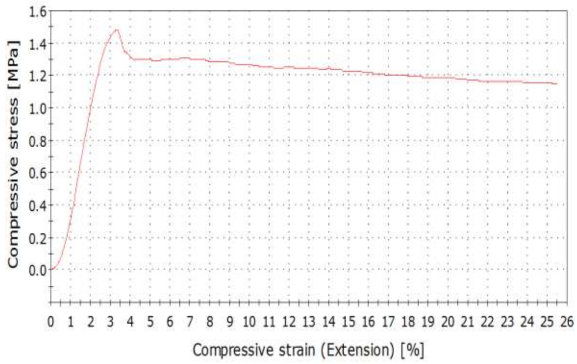

Fig. 3: Compressive stress-strain curve for carbon fibre laminate composite.

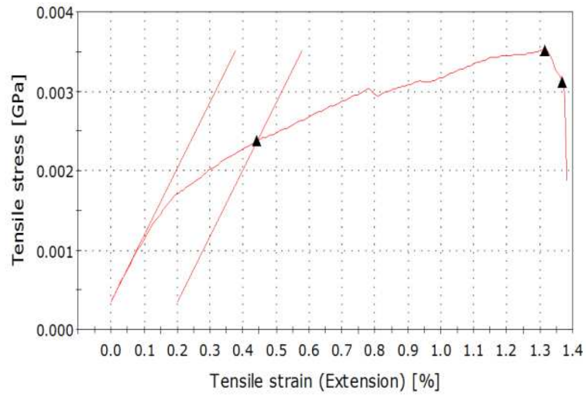

Fig. 4: Tensile stress-strain curve for carbon fibre laminate composite.

V. CONCLUSION:

It has been observed that the mechanical properties of composite such as tensile test, compression test and flexural test has the tremendous capacity to take load on it.

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