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MECHANICAL PROPERTIES OF HYBRID GLASS/JUTE REINFORCED EPOXY COMPOSITES

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ABSTRACT

Application of composite materials is increasing these days in areas like aircraft engineering to automobile industry, ships etc. because of their unique properties. In new days, use of fiber reinforced polymer composites is increasingfast due to their improved mechanical properties like tensile strength and flexural strength, and also due to their low cost and low density. It can be utilized more effectively in the development of composite materials for various industrial applications. Burmese silk orchid fiber has better mechanical properties but it'snot easily available. This research was carried out by reinforcing the matrix (Epoxy) resin with natural fiber (jute) and glass fiber. The hybrid composites reinforced with chopped glass and jute fibers were produced using hand layup method. It was found that the addition of natural fibers (jute) along with chopped glass fibers improve the mechanical properties of hybrid composites. Test specimens are cut as per the ASTM standard. Tensile strength, flexural strength are determined using universal testing machine (UTM).

I. INTRODUCTION

Composite is a new element prepared which gives new properties after combining two or more elements of different properties. It consists of a matrix and one or more reinforcement. Matrix is the base material on which two or more elements are reinforced. Matrix material makes physical bonding with the reinforced materials and there is no chemical reaction between the elements.

Interest in this area is rapidly increasing both in terms of their industrial applications and central research as they are renewable, cheap, easy availability, and biodegradable. Among all the natural fiber reinforcing materials, jute appears to be a capable material because it is comparatively inexpensive and commercially available in the required form. Glass Fiber Reinforced Polymers (GFRP) is a fiber reinforced polymer prepared of a plastic matrix reinforced by well fibers of glass. Fiber glass is a lightweight, strong, and strong material used in different trades due to their brilliant properties.These composites may find applications as structural materials where difficult strength and cost attentions are important [1]. The tensile and flexural properties of pineapple leaf fiber (PALF) and sisal reinforced polyester composites are better by the adding of a small amount of glass fibers in these composites, showing positive hybrid effect [2]. Experimental study on natural woven jute fabric-supported polyester composites shows the capability of this renewable source of normal fiber for application in various consumable products [3]. The market outline for composite applications is changing due to the introduction of fresherbiodegradable polymers. Composite materials reinforced with natural fibers, such as flax, and jute, are benefit increasing importance in automotive, aerospace, packaging and other industrial applications. The determination of this study is to make use of natural fiber like jute fiber, which is richly available in India and to join with synthetic fiber like glass fiber to enhance the mechanical properties. In this research work an effect of hybridization of jute/glass fiber reinforced epoxy composites is calculated. The results of the tests help in certain the potential applications of the jute/glass fiber reinforced epoxy composites. Composite is prepared by hand layup method using epoxy resin. Layer of chopped glass fiber sheet are placed on the jute. After the material is prepared, both tensile and compressive tests are performed on UTM. Graph is plotted load and displacement tensile strength and compressive strength is calculated.

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II. EXPERIMENTAL PROCEDURES

2.1. Materials

The achieved fibers are washed with dried at room temperature. Later, fibers are cut to a length equivalent to the length of mold. Epoxy mixed with hardener is used as a matrix material. Epoxy and hardener are mixed at a ratio 20:1 respectively. It can be easily prepared by molding process. Chopped fiber glass sheets are usedin this research work. Taking length of glass fiber between 3 to 25 mm. Fig. 1 shows the sheet of chopped glass fiber. Glass fibers has lower strength alone.

Fig.1 Sheet of chopped glass fiber

Jute is used as the second material. Jute is aligned longitudinally on this sheet. The properties such as Jute is a long, soft, glossy vegetable fiber that can be turned into coarse, strong threads. Low cost,100% bio-degradable and good strength to weight ratio, Jute is considered in the research work. In earlier tests Burmese silk orchid was used in place of jute.Epoxy resin is used in the preparation of the hybrid composite is Epoxy is the dried end product of epoxy resins and also a colloidal name of the epoxide functional group. Epoxy resins (polyepoxides) are a group of reactive pre polymers and polymers containing epoxide groups.

2.2 Fabrication of composite

Hand Lay-up is a technique which combines layers of reinforced fiber with the resin. The process comprises the positioning of reinforcement material into layers. These layers are then soaked with a resin system either through a brush or roller to guarantee a good wet out of the reinforcement material. After 24 hours the mold is kept in an oven for 20 minutes such that the releasing agent gets molten and removal of the composite material from the glass mold is an invented easier.Both the chopped glass fiber sheet layer and jute layer are placed by this process. Percentage volume of glass fiber and plywood is given in Table 1.

Table 1: Composition of hybrid FRP material

Sr. No	Types of layer	Percentage in hybrid
1	glass fiber	36.21%
2	jute	63.79%

Then it is soaked with the wet epoxy resin by pouring it on the fiber layers. The fiber layers and the wet epoxy resin are left to cool in the general room temperature. We can keep the material at different temperature levels for the best temperature level to get outstanding mechanical properties. Test specimen of needed size is cut of the composite manufactured after curing. Fig. 2 and Fig. 3 shows the preparation of composite material.

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Fig 2. Application of epoxy on chopped Glass fiber sheet

Fig 3. Jute placed on glass fiber sheet

III. TENSILE STRENGTH TEST

Tensile test is act on composites by cutting specimens according to ASTM test standard on a Universal Testing Machine (UTM). The cross head speed is maintained at 10 mm/min, at a temperature 25 degree centigrade. The specimen used in this study is cut from the rectangular sheet of thickness 5.8 mm prepared by hand layup process. For the test purpose, the specimen is cut in dumbbell shape. The dimensions of the specimen are taken as per the Table 2. Fig. 5 shows the original specimen and Fig. 6 shows the machine on which the experiment is performed.

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Table 2: Dimensions of the specimen for tensile test (in mm)

Total length	Gauge Length	Width	Thick	Length of pipe
90	50	12.8	5.8	20

Fig.4 Specimen design

Fig.5 Specimen for tensile test

Fig.6 UTM on which test is performed

Testing machine with a capacity of 600 KN is used for the test. The final results are shown in graph 1.

IV. FLEXURAL STRENGTH TEST

Specimen with dimension 90× 56.5× 5.80 (L×W×T) are used in this test.The sample is placed in the machine such that the glass fiber is on the compressive side i.e., it is placed upward. The load touches its surface and the jute is below bearing tensile load. Fig. 7 shows the specimen on which the test is performed.

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Fig.7 specimen for compressive test

Final result is shown in the Graph 2.

V. RESULTS AND DISCUSSIONS

As we know by now that composites are prepared so that some good properties can be completed with the help of two different materials by making a physical compound between them. In this research work, tensile and compressive tests are done on the glass fiber composite reinforced with jute. As a result of these two tests, following data is achieved. As mentioned in Table 3, Table4, Graph 1 and Graph 2. Fig. 8 and 9 shows the specimens after tensile and compressive tests respectively. Fig. 10 is also an image of specimen after compressive test.

Table 3: Tensile Test

Sr. No.	Parameter	Observation
1	Cross-section Area (mm²)	74.24
2	Gauge Length (mm)	50
3	Elongated Length (mm)	51.0
4	Elongation (%)	2.0
5	Ultimate Load (KN)	5.48
6	Ultimate Tensile strength (MPa)	74
7	Young's modulus (N/mm²)	3690.5N/mm²

Table 4: Compressive Test

Sr.No.	Parameter	Observation
1	Width (mm)	56.5
2	Thickness (mm)	5.80
3	Length (mm)	90.0
4	Ultimate Load (N)	500
5	Flexural Strength (N/mm²)	35.5

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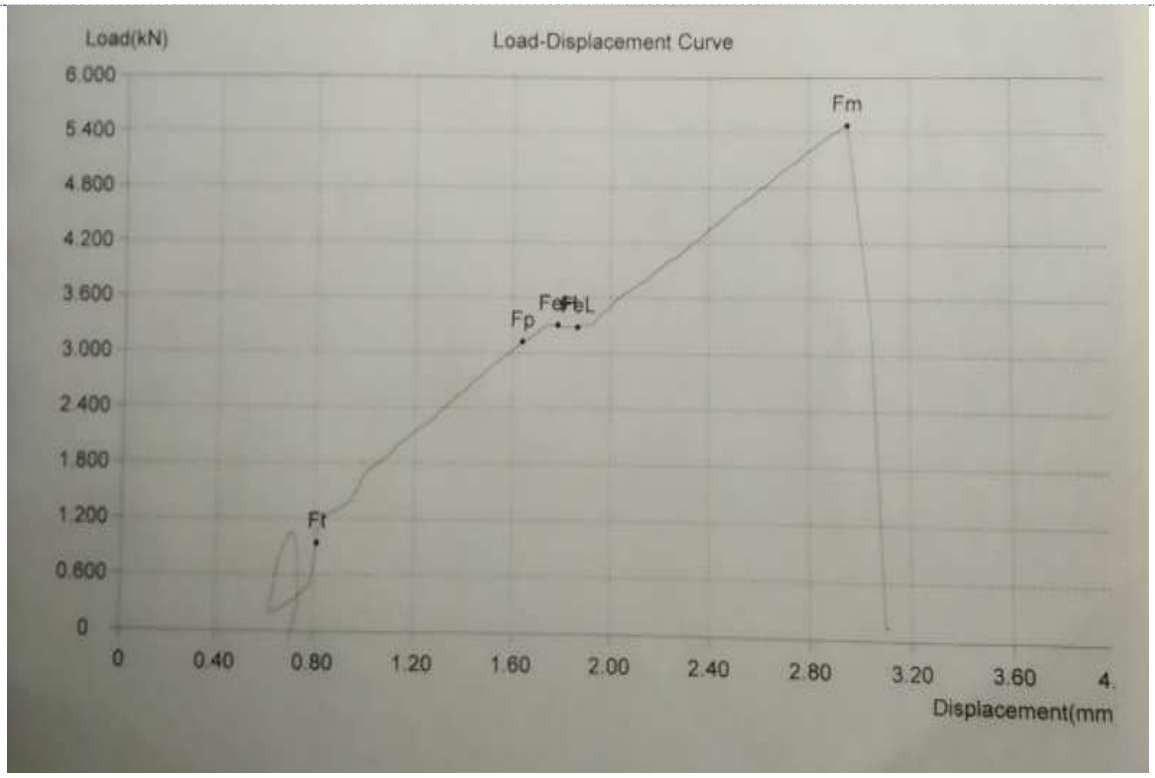

Graph 1. Tensile test

Fig. 8 Specimen after the test

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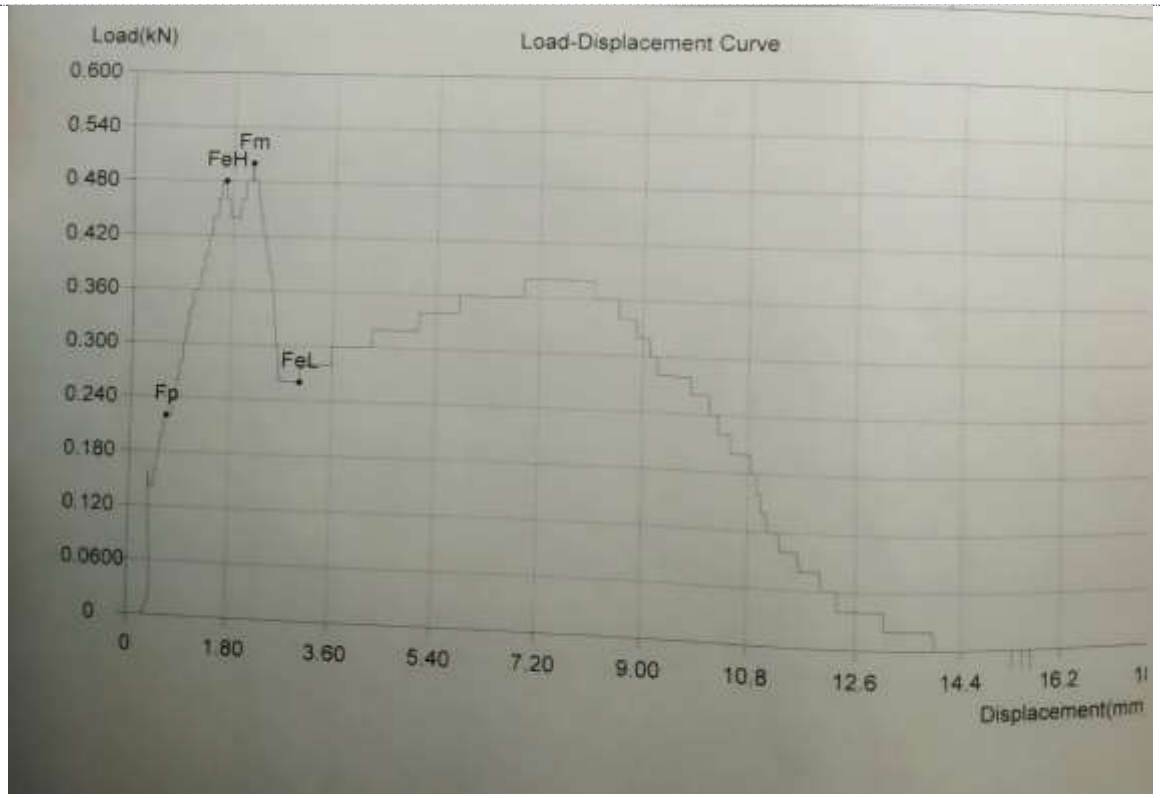

Graph 2. Compressive test

Fig. 9 Specimen after test from jute side

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Fig.10 Specimen after test from glass fiber side

VI. CONCLUSION

This research presents the fabrication of hybrid composite using jute and glass fiber reinforced epoxy composite by hand layup method.The system in both the tensile test and compressive test gave precise results. In the tensile test, the failure happened on the gaugelength of the specimen showing that the holding specimen worked correctly. The Ultimate tensile strength and Flexural strength in both tensile and compressive tests were calculated respectively. Young's modulus was calculated using the stress and strain graph. Final value of young's modulus come out to be 3690.5N/mm². In previous research the maximum improvement of tensile stress, young's modulus observed to be about 48.74 MPa, 1949.6 MPa respectively [5].Hybrid composites gave excellent mechanical properties.The adding of glass fiber in jute fiber composites enhances the mechanical properties and it leads to the increase of the use of natural fibers in various applications. It is recommended to use more samples for clear results. Mixture of jute andglass fiberwill increase the strength and reduce the cost of the material as compared to glass fiber alone and glass fiber composite reinforced with carbon respectively. This structure can be used in thefurniture and Jute composite boat with outer coating because of its good strength

VII. REFERENCES

[1] Sreekala M.S., George, J., Kumaran, M.G. and Thomas, S. (2002) The Mechanical Performance of Hybrid Phenol Formaldehyde-Based Composites Reinforced with Glass and Oil Palm Fibers. Composites Science and Technology, 62,339-353. http://dx.doi.org/10.1016/S0266-3538(01)00219-6

[2] Mishra, S., Mohanty, A.K., Drzal, L.T., Misra, M., Parija, S., Nayak, S.K. and Tripathy, S.S. (2003) Studies on Mechanical Performance of Biofiber/Glass Reinforced Polyester Hybrid Composites. Composites Science and Technology,63, 1377-1385. http://dx.doi.org/10.1016/S0266-3538(03)00084-8

[3] Gowda, T.M., Naidu, A.C.B. and Chhaya, R. (1999) Some Mechanical Properties of Untreated Jute Fabric-Reinforced Polyester Composites. Composites: Part A, 30, 277-284. http://dx.doi.org/10.1016/S1359-835X(98)00157-2

[4] Kin-takLauabPui-yanHungaMin-HaoZhucDavidHuidhttps://doi.org/10.1016/j.compositesb.2017.10.038

[5] B.Madhusudhan ReddyaY.Venkata Mohan ReddyaB.Chandra Mohan Reddyb https://doi.org/10.1016/j.matpr.2017.02.195Get

[6] https://www.google.co.in/search?ei=c42NWrGVFYKd0gSWmoHgCg&q=young%27s+modulus++of+glass+fiber&oq=young%27s+modulus++of+glass+fiber&gs_l=psy-ab.3..0.17050.23948.0.24999.33.21.0.0.0.0.391.2862.0j1j5j4.10.0..2..0...1.1.64.psy-ab..25.8.2186...35i39k1j0i7i10i30k1j0i7i30k1.0.a4ZdTcmFkFU

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