Mechanical Properties of Matrix Reinforced Composite Material With Jute Fiber

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Abstract

The Mechanical properties of the matrix reinforced composite material with jute fiber was observed . In this paper a brief introduction to composite materials along with the preparation process of fiber reinforced composite material is presented .In this research the tensile strength, yield stress ,(weight/strength)ratio and percentage of elongation were identified for composite material reinforced with jute fiber .Tests mentioned above have been conducted on mild steel specimen and results shows that mechanical properties of composite material reinforced with jute fiber are high when compared with mild steel specimen.

Keywords: composite material, jute fiber, mechanical properties.

1. INTRODUCTION

Composite materials are simply composites or combination of materials. They are made up of combining two or more materials in such a way that the resulting materials have certain design and improved mechanical properties. Fiber reinforced composite material have many benefits to their selection and use. The selection of materials depends on required performance and intended use of product.

Fibrous composite material consists of fibers in an matrix form .long fibers in various forms are inherently much stiffer and stronger than the same material in bulk form .the strengthening mechanism mainly depends on geometry of reinforcement. The properties varies for conventional materials and fiber reinforced composite materials and the advantages of these fiber reinforced composite materials are reduction of cost ,increase in mechanical properties ,corrosion resistance and by maintaining proper geometry increased strength of material. stress concentration is reduced by increased strength of material and there by failure modes are decreased.

2. DESIGN OF JUTE REINFORCED COMPOSITE MATERIAL

3.

1. Clean the surface with a neat cloth to remove the dust particles present.

2. Apply PVA on the cleaned surface so that the removal of object will be easy.

3. Take equal parts of resin and binder then mix them to make the solution at atmospheric temperature only.

4. Take the matrix of jute in continuous form.

5. Place the jute fiber of one layer on the PVA coated surface and apply the resin on the fiber and arrange one-by-one in parallel direction and roll on the fiber by using PVA pipe to distribute the resin effectively.

6. Place the lamina in open atmosphere to dry.

7. Now prepare the specimen as per the ASTM standards shown below.

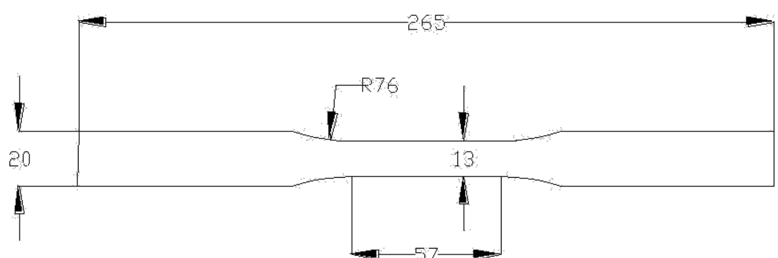

Fig: 1. ASTM SPECIMEN

1. Measure the original gauge diameter (d) and gauge length of the specimen by means of a vernier caliper & steel rule respectively. Mark gauge length by two tiny dots using a dot punch.
2. Grip the test specimen vertically and firmly between the upper crosshead jaws of the UTM by operating the hard wheels provided on the above two crossheads.

3. Adjust the machine to read zero on the elongation scale by opening the left control valve and closing the right control valve.
4. Select the load measuring range according to the capacity of the test piece by operating the load selector knob present on the right side of the control panel. If the test specimen is composite material and choose the suitable load range.
5. Fix the pen in the pen holder of the load elongation recording system.
6. Adjust the load indicating pointer (black needle) and dummy pointer (red pointer) to zero position in the dial of the control panel before conducting the actual test.

7. Now close both the left control valve and right control valve completely.

To apply the load on the specimen press the pump " on " button existing on the control panel and then immediately start opening right control valve gradually. While opening the right control valve, the left control valve should be completely closed the load will not be applied on the specimen.

8. Increase the load on the specimen gradually at equal intervals opening the right valve and then record the corresponding increase in length of the specimen from the elongation scale provided at the load elongation recording system.
9. Continue loading the specimen till the yield point reached. This is indicated by the elongation scale showing high valves of extension for the same amount of increase in load.
10. After yield point is reached, continue to apply the load till fracture of the specimen occurs.
11. Immediately after the specimen breaks, press the pump "off" switch on the control panel, close the right control valve and then open the left control valve slowly to release the load
12. Broken specimen is removed from the machine.
13. By joining the two broken halves of the specimen final length between the gauge points and gauge diameter at neck of the specimen is measured by using a steel rule and vernier callipers respectively.
14. Yield point, ultimate tensile strength, percentage elongation, percentage reduction in area and modulus of elasticity are calculated.

The above test is performed on mild steel specimen and prepared composite material .

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Fig: 3. Specimen in UTM Test Rig

Fig: 2. UTM Testing Machine

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Fig: 4.Composite shaft after test

Fig: 5. Mild steel shaft after test

3. Results and discussion

Two samples of composite materials were prepared and tests have been performed on two composite materials and mild steel specimens. Comparison between the composite material and mild steel specimen are done. Fig.1 shows the composite shaft after the test. Fig.2 shows the MILD STEEL shaft after the test.

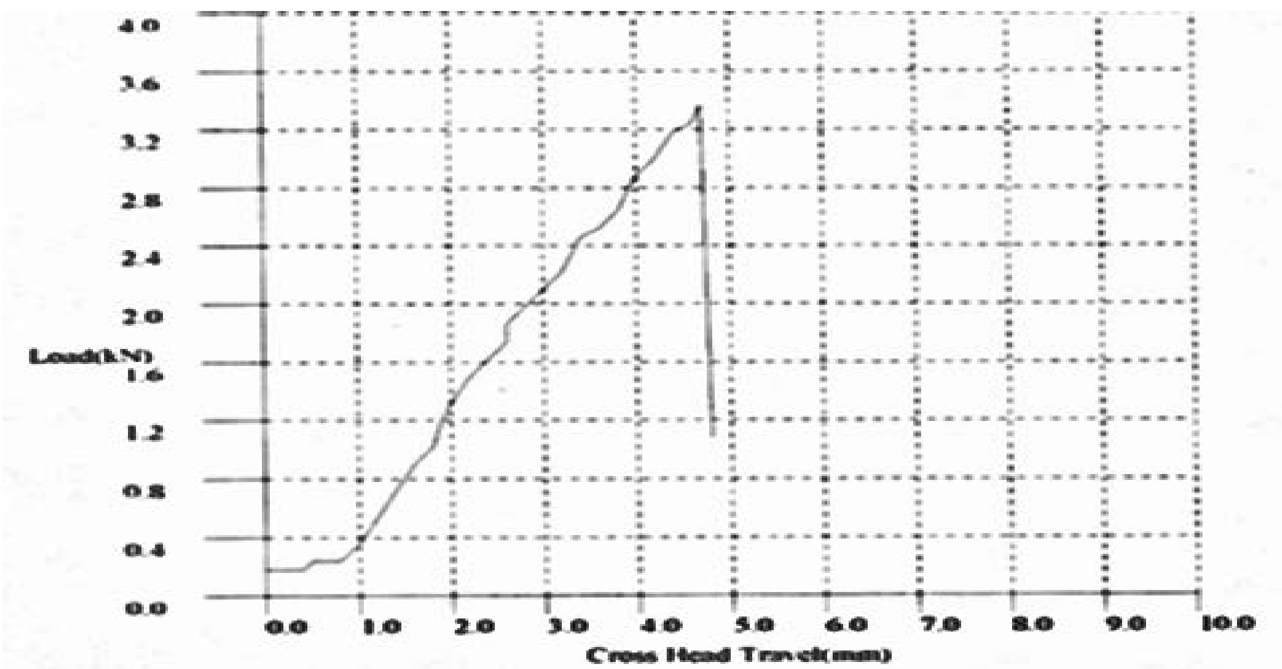

Fig: 6.(a) shows the composite shaft after the test.

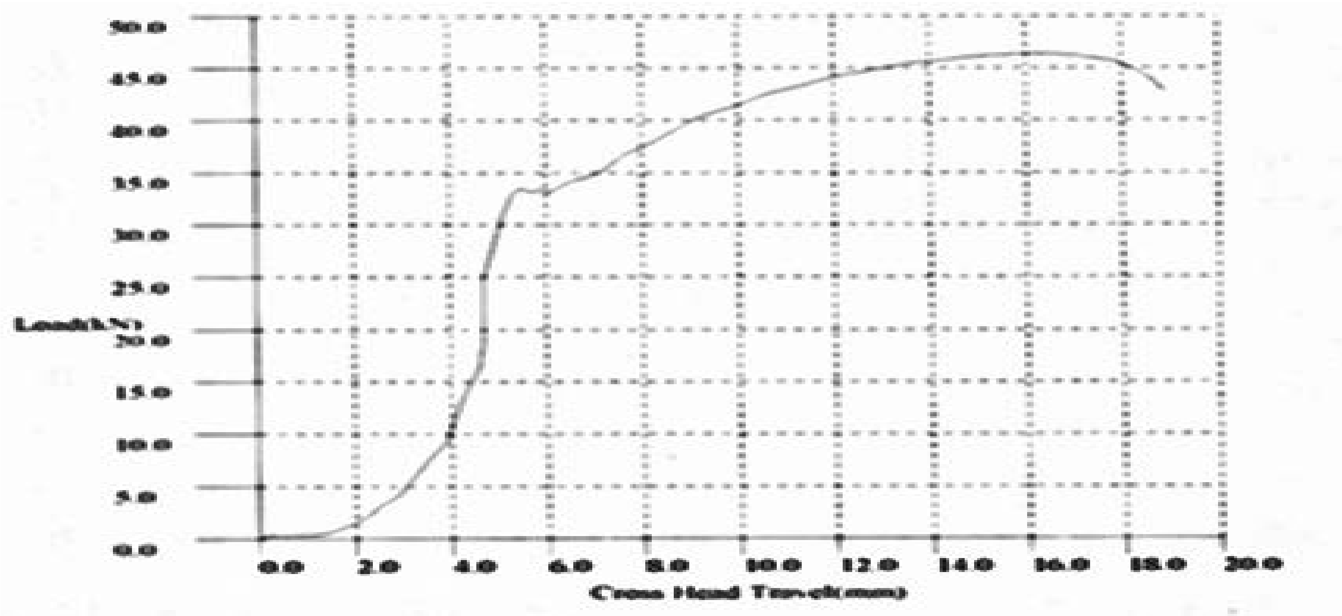

Fig: 7. (a) Shows the mild steel shaft after the test

Fig: 3(a), Fig: 4(a) show the elongation of materials when subjected to load.

S.NO	SPECIFICATION	COMPOSITE LAMINA	MILD STEEL
1	cross-sectional area	118.244 mm^2	102.37mm^2
2	Percentage of elongation	1.02%	19.87%
3	Tensile strength	28.42 N/mm^2	453.06N/mm^2
4	Yield stress	20.80 N/mm^2	327.63 N/mm^2
5	Weight	0.4414 N	2.922N
6	(Weight/strength) Ratio	0.0001312	0.0000641

Table: 1.Propertise of composite lamina and mild steel

Graphs

The below Figure shows the comparison of weight/strength ratio of mild steel and composite material

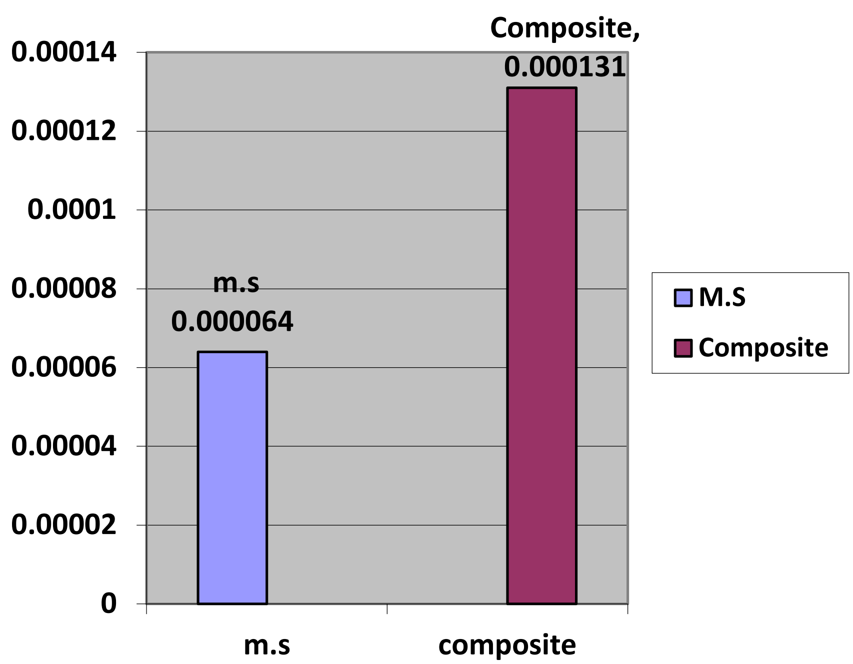

Fig: 8. Relationship between composite material and M.S

Conclusion

- Composite material is seven times less in weight than the mild steel of the same dimensions
- Based on our work we have found that the weight to strength ratio for composite shaft is about two times that of mild steel during tensile test.
- This indicates that the composite material is having less weight and more strength; it is very much useful in practical application.

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