Study of Design and Structural Analysis of Hybrid Carbon Jute Material for Improvement of Strength

[1]Mihir M Bhayani, [2]Prof. C. M. Sedani

[1]PG Student, [2]Professor
[1,2]Department of Mechanical Engineering,
PVPIT, Pune, India

***Abstract*: The aim of the project is to study the design and fabrication of carbon- jute based hybrid composite using epoxy resins. The proposed composite were analyzed by computational tools for quantitative deformation and equivalent stress. Therefore the studied parameters can be further explored to use carbon-jute composite for different applications in shock absorption.**

***Index Terms*: Carbon-jute, epoxy resins, fiber, total deformation, equivalent stress.**

I. INTRODUCTION

Currently the need for shock absorbing materials with high strength and eco-friendly properties have increased a lot in various fields. Consequently, manufacturers have started searching and exploring assorted materials that can provide better efficiency, prolonged service life, improved strength to weight ratio and eco-friendly nature (1). In this regards, use of composites made up of combination of different materials that helps in achieving desired properties contributed by each material in the composites is need of the hour. Therefore composites can be used as an alternative for contemporary techniques which involve use of single material (2).

The proposed work focuses at developing carbon- jute based hybrid composite using epoxy resins. A static structural analysis has been done by ANSYS (3) to virtually study material behavior for its strength under maximum loading conditions (3).

II. DESIGN OF THE SPECIMEN

Designing is one of the most important phases of any project work. The main advantage of the latest design softwares is that they provide an opportunity to check the stability of any model before going to actual manufacturing. A CAD model of the proposed specimen is prepared using the design software CATIA. The designed model is shown in Fig 1 is of the dimensions 200mm x 50mm x 2mm.

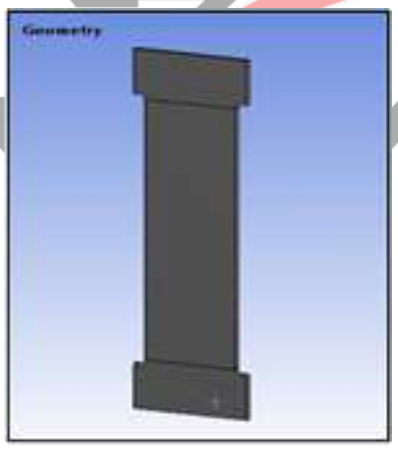

Figure 1: CAD model of specimen

III. STRUCTURAL ANALYSIS

Under static load conditions the structural analysis of material was carried out to study the structural behavior of the material (3). From this study information about total deformation and stress developed during force applications on epoxy carbon material was obtained in comparison with jute material. It may help to evaluate the behavior of the material in real-time work environment.

For structural analysis, ANSYS tool was used by importing the design file of the specimen in the analyzing module (3). In order to get the accurate information from tool about deformations and areas of stress development, selection of correct material properties is mandatory. CAD model was provided with appropriate properties of carbon-jute and jute material (4)(5). (Table 1).

Table 1. Material Properties

Property	Only Jute	Epoxy Jute-Carbon	Unit
Young's Modulus	26.5	26.64	GPa
Poisson's Ratio	0.35	0.27	-

Meshing was done to analyze material at lowest element level. Meshing helps in improving the quality of analysis as it directly breaks the larger components into smaller ones. Meshing was followed by application of the necessary boundary conditions and force values. The deformation and stress was evaluated by providing a force of 10000 N.

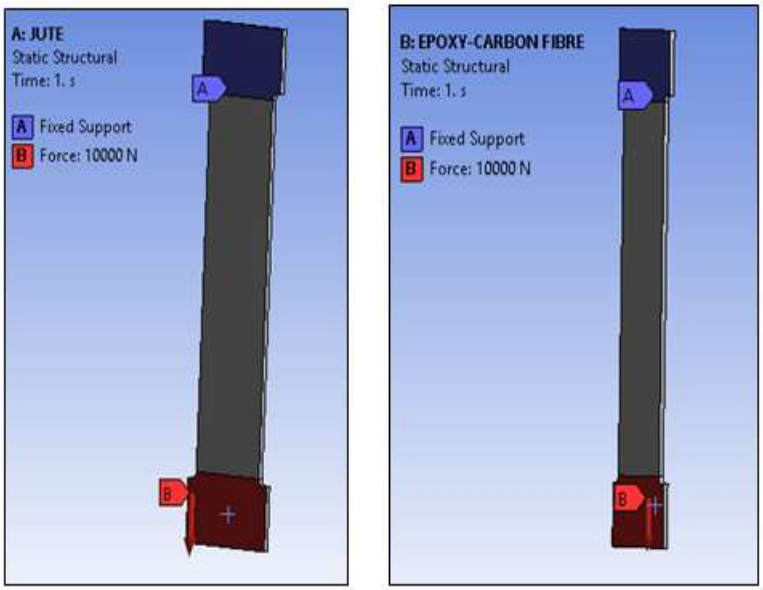

Figure 2: Boundary conditions and force application in ANSYS

IV. RESULT

From ANSYS we have obtained results for deformation developed in the specimen for applied load. The solver also highlights areas of high stress concentration in the specimen. The deformation and stress values are shown in fig 3 and fig 4 below.

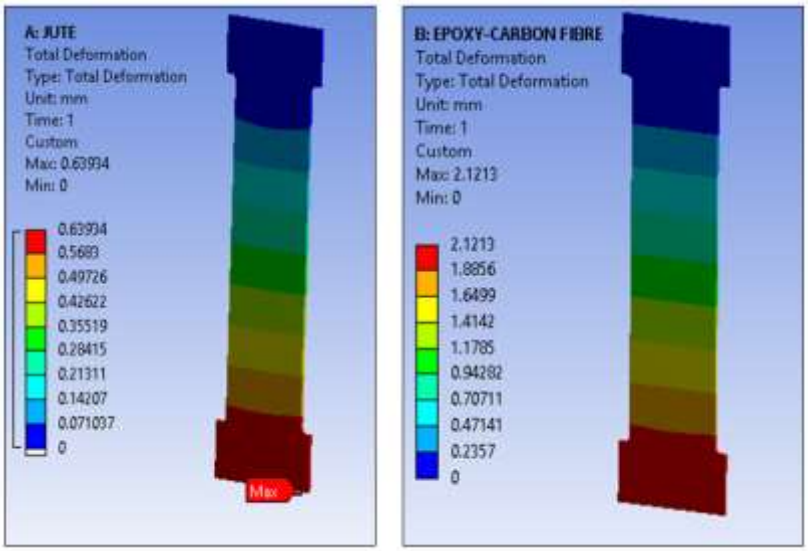

Figure 3: Total deformation values for specimen with Jute and epoxy jute carbon properties

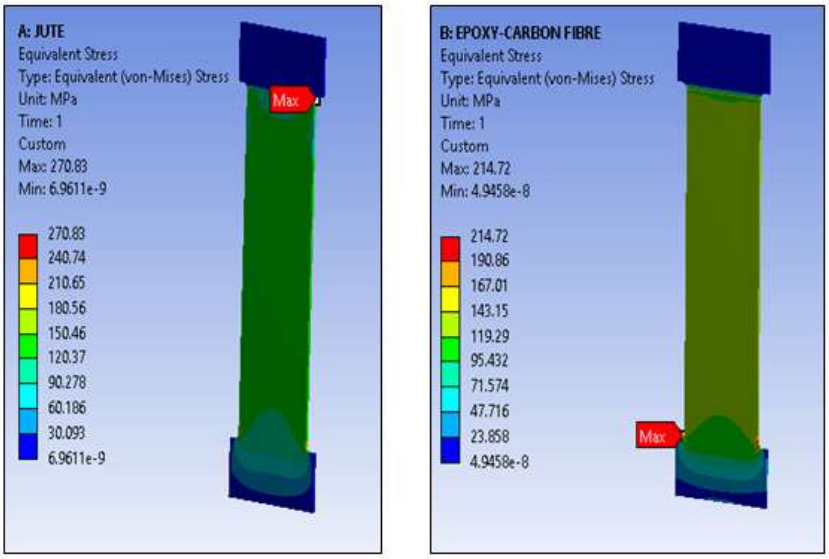

Figure 4: Equivalent Stress values for specimen with Jute and epoxy jute carbon properties

The results from the structural analysis are tabulated in the table 2.

Table 2. Results of structural analysis

Results	Only Jute	Epoxy Jute-Carbon fiber
Max. Total deformation	0.639 mm	2.12 mm
Stress	270.83 MPa	*1.72 MPa*

V. RESULT

The results from the structural analysis show that EPOXY JUTE-CARBON FIBER sustains load as stress was below yield strength of material whereas JUTE fiber fails as stress was above yield limit of material. Therefore, the proposed carbon-jute composite can be used as an effective alternative in shock absorbing materials.

REFERENCES

[1] Abhishek A P, B S K Gowda, G L E Prasad and R Velmurugan, Probabilistic Study of Tensile and Flexural properties of Untreated Jute fiber reinforced polyester Composite, AMMMT 2016.

[2] Shane Johnson, Liping Kang, Hazizan Md Akil, Mechanical Behavior of Jute Hybrid Bio-Composites, Composites part B, 25th December 2015.

[3] M.M.Patunkar, D.R.Dolas, Modelling and analysis of Composite Leaf Spring under static load condition by using FEA, International Journal of Mechanical & Industrial Engineering, Volume 1 Issue 1-2011.

[4] M. Indra Reddy, M. Anil Kumar, Ch. Rama Bhadri Raju, PMME 2016, Tensile and flexural properties of Jute, Pineapple leaf and glass fiber reinforced polymer matrix hybrid composites.

[5] Asheesh Kumar, Anshuman Srivastava, Preparation and Mechanical Properties of Jute Fiber Reinforced Epoxy Composites, Ind Eng Manage 2017, 6:4, DOI: 10.4172/2169-0316.1000234.