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Static Analysis and Experimentation of Jute Fiber Reinforced with E-Glass

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Abstract

A composite is a heterogeneous material created by the synthetic assembly of two or more components constituting reinforcing matrix and a compatible matrix to obtain specific characteristics and properties. In this project we selected jute fiber, E-Glass and it is embedded in a biopolymer matrix system (epoxy), the task of which is to hold the fibers together, this provides and stabilizes the shape of the composite structure, transmits the shear forces between the mechanically high-quality fibers, and protects them against radiation and other aggressive media and the specimen is prepared. The component is conditioned and prepared for testing and subjected to tensile, compression, hardness and bending test calculating the element results with ansys by using the test results. The main aim of this project is to reduce the impact on the environment, by preparing specimen using recyclable natural fibers.

Keywords: Jute; E-glass; Epoxy; Ansys

Introduction

India endowed with an abundant availability of natural fiber such as Jute, Coir, Sisal, Pineapple, Ramie, Bamboo, Banana etc. has focused on the development of natural fiber composites primarily to explore value-added application avenues [1]. Such natural fiber composites are well suited as wood substitutes in the housing and construction sector [2]. The development of natural fiber composites in India is based on two pronged strategy of preventing depletion of forest resources as well as ensuring good economic returns for the cultivation of natural fibers [3].

The developments in composite material after meeting the challenges of aerospace sector have cascaded down for catering to domestic and industrial applications. Composites, the wonder material with light-weight; high strength-to-weight ratio and stiffness properties have come a long way in replacing the conventional materials like metals, wood etc. The material scientists all over the world focused their attention on natural composites reinforced with Jute, Sisal, Coir, Pineapple etc. primarily to cut down the cost of raw materials [4].

Experimental

Materials: E-Glass (density 2.44 gm/cm^3, Tensile strength 2000 Mpa), Jute (density 1.3 gm/cm^3, tensile strength 393-793 Mpa), Epoxy (Density 1.44 gm/cm^3, tensile strength 2860-3750 Mpa).

Compounding: Wax is applied to frame and as well as to GI sheet of 200 mm×100 mm with a height of 10 mm 3 layers and 4 layers. Then GI sheet is placed in the frame and resin is mixed with hardener with required proportions and adhesives are applied.

Specimen preparation: The moldedsample for testing were compression molded using compression molding at 150°C and 50 mpa for 10 mins. After pressing the sheet is removed from the press and cooled by water.

Characterization techniques

Tensile strength: Tensile Properties are evaluated according to FIE-40 and UTN-40 of universal tensile machine (Figures 1 and 2).

Bending: Bending Properties are evaluated according to Universal testing machine UTE-60 (Figures 3 and 4).

Shore hardness: Hardness test is carried out by ASTM D 2240: 2003 of shore hardness tester.

Results and Discussions

The mechanical properties of tensile strength, bending and hardness are compared to both the 3-layered (Table 1) and 4-layered specimens (Table 2).

The analysis of the specimen is carried out in Ansys software in which designing, meshing are done for both the layers. Designing is done with respect to XY coordinates and in meshing [5] "Preprocessor-meshing-mesh-areas-3 or 4 sided-ok".

Conclusion

The following conclusions are drawn from the present work.The 4 layered jute glass jute glass specimen is more stiffer than 3 layered jute glass jute specimen because the percentage reduction in deflection is 37.5%, and also it is 3.2% more hard enough than 3 layered one (Figures 5 and 6) [6-10]. The interlinear shear stresses are 81.23% more in 3 layered one than the 4 layered one. The bending strength of 3 layered specimens is 16.6% more than the 4 layered one. The tensile and the compressive strength of 4 layered jute glass jute glass specimen is 18.75% and 30.76% more than the 3 layered jute glass jute specimen [11-13].

Tensile Test (N)	Bending Test (N)	Compression Test (N)	Shore Hardness Test (N)
1520	600	900	88

Table 1: For 3-layered specimen.

Tensile Test (N)	Bending Test (N)	Compression Test (N)	Shore Hardness Test (N)
1960	500	1300	91

Table 2: For 4-layered specimen.

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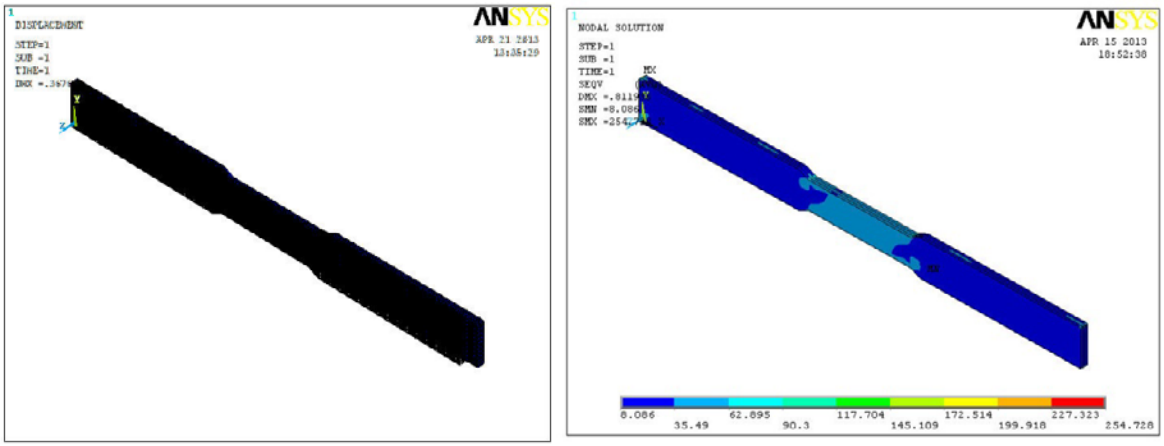

Figure 1: Tensile Test Results of Jute Glass Jute Specimen (3-Layer).

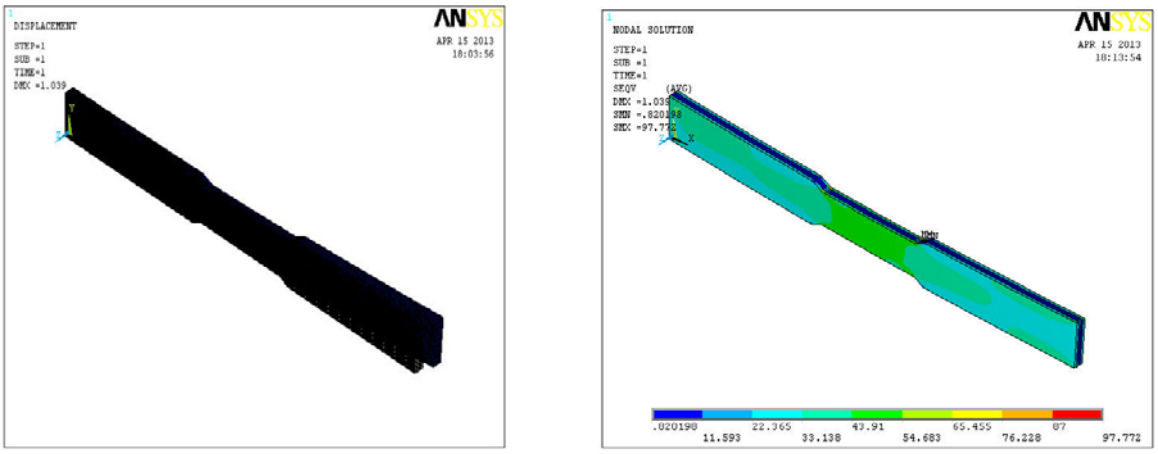

Figure 2: Tensile Test Results of Jute Glass Jute Glass Specimen (4-Layer).

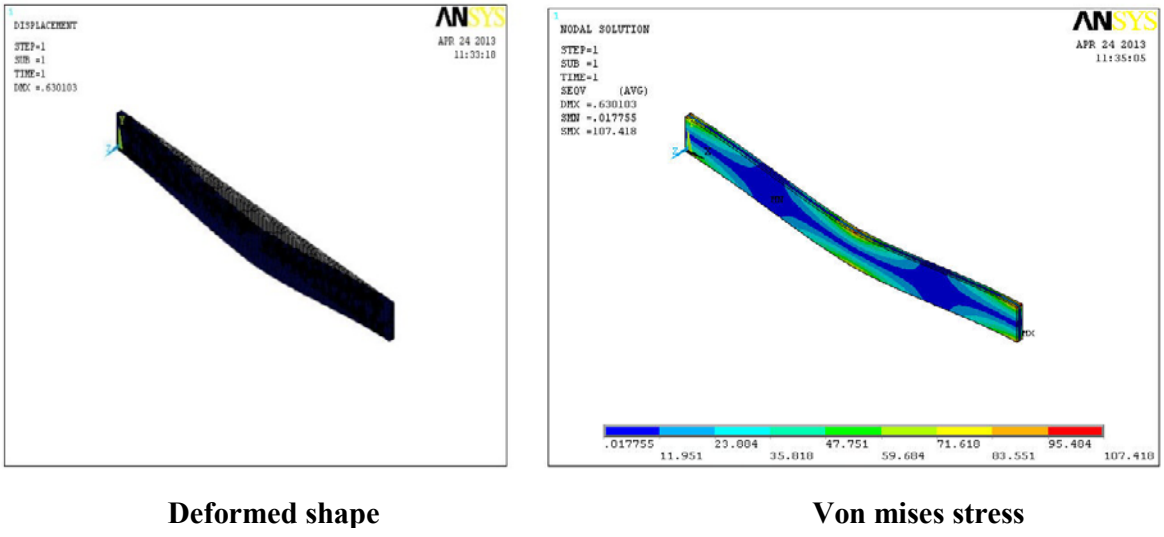

Figure 3: Bending Results of Jute Glass Jute Specimen (3-Layer).

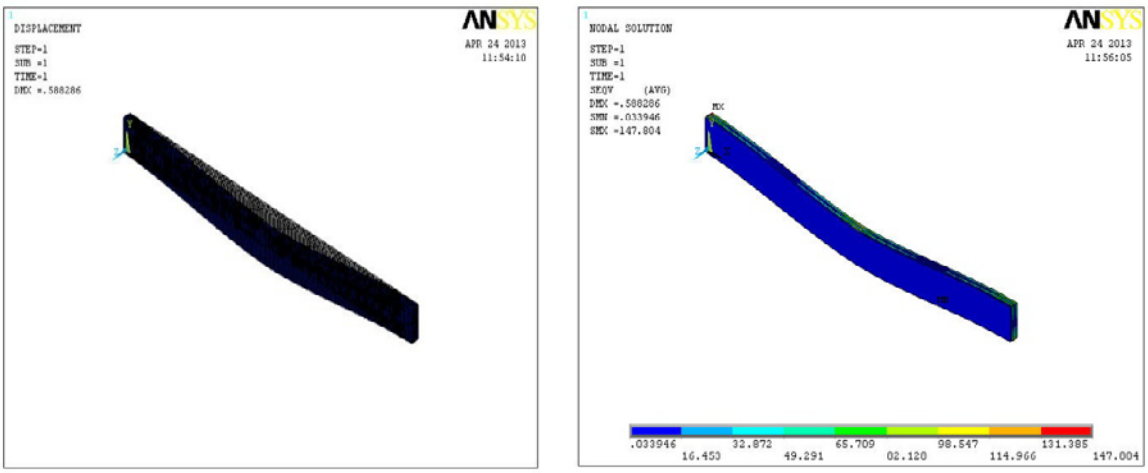

Figure 4: Bending Results of Jute Glass Jute Glass Specimen (4-Layer).

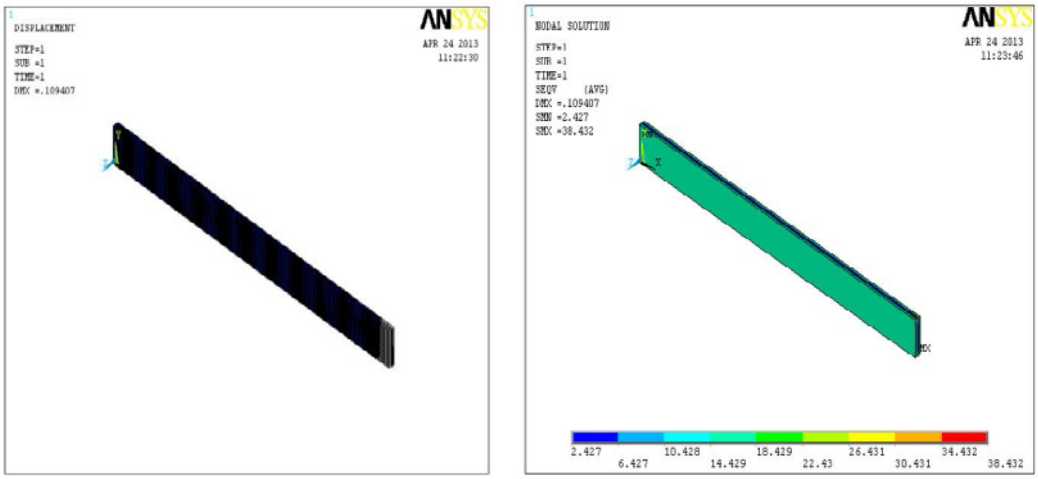

Figure 5: Compression Results of Jute Glass Jute Specimen (3-Layer).

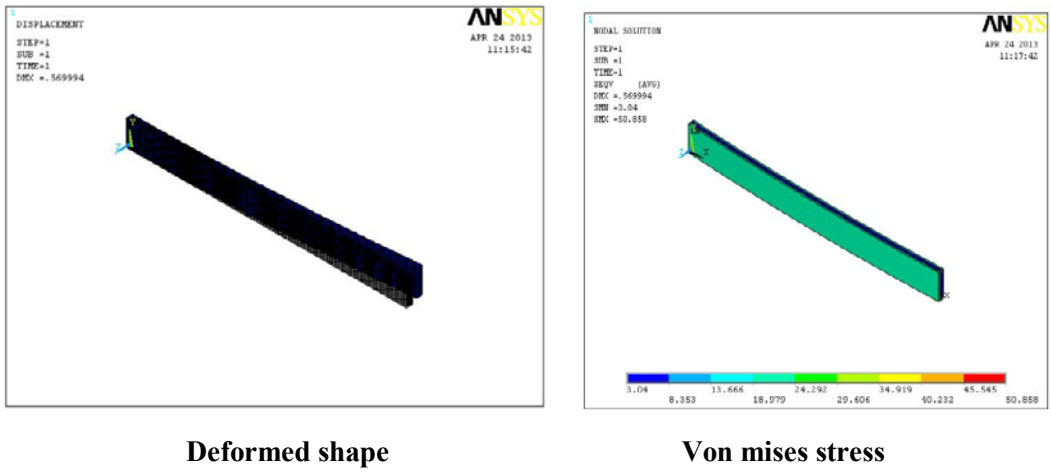

Figure 6: Compression Results of Jute Glass Jute Glass Specimen (4-Layer).

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