ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT1836

Estimation of Tensile and Flexure Strength of Hybrid Composites along with Epoxy as Matrix and Jute & E-Glass as Reinforcements

Dr. A. B. Vinayaka Patil
Assistant Professor
Department of Mechanical Engineering
Bapuji Institute of Engineering & Technology, Davangere, Karnataka, India– 577 004

Abstract:- The natural fibers have the good properties such as mechanical and physical than artificial fibers in a many cases during the fabrication of composite materials that are used in many engineering applications. Also hybridization of fibers leads to impotent of mechanical properties these composites used in interior of aerospace vehicles, automobiles bumpers, decorative items, window panels, interior paneling, etc. where application pf load is very less. This research work is concentrated on the evolution of hybrid composite of Jute/E-glass reinforced with matrix epoxy using Hand layup method. Laminated composites specimens are prepared by calculating the required number of fiber layers and quantity of matrix based on the different volume fraction. The testing specimens are prepared for Tensile and Bending test as per standard of ASTM. The Universal Testing Machine is used to conducted Tensile and Bending test and results are plotted the graphs.

Keywords: *- Natural Fiber, Jute, E-Glass, UTM, Hybrid Composites, Mechanical Properties, Epoxy.*

I. INTRODUCTION

A composite material made up of two or more different materials which are physically or chemically well-defined distributed phase with a better interface between each other. The composite material which is not illustrate by any one of the material which is in isolation. A composite material made up matrix which is in bulk form and other one is reinforcement with in non-continuous and dispersed form.

Many industries acknowledged the many applications in transportation sector rather than aerospace industries. So, there is large movements in other commercial applications other than aircraft in nowadays.

The composite materials are made up of 2 or more different reinforcement fibers with one type of matrix are called as hybrid composites. Even though different types of fiber may use in hybrid composites, the present work suggested that which combination of fibers are more beneficial than others. The Hybrid composites are manufactured to get better properties than the composite which contains only one type of reinforcement fiber from economic point of view. For example, boron and graphite fibers are more expensive which are replaced by glass and Kevlar fibers are less expensive fibers. The carbon-aramid reinforced epoxy hybrid composite gives more mechanical and impact strength. Also, Glass-carbon reinforced epoxy hybrid composite have better mechanical properties.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT1836

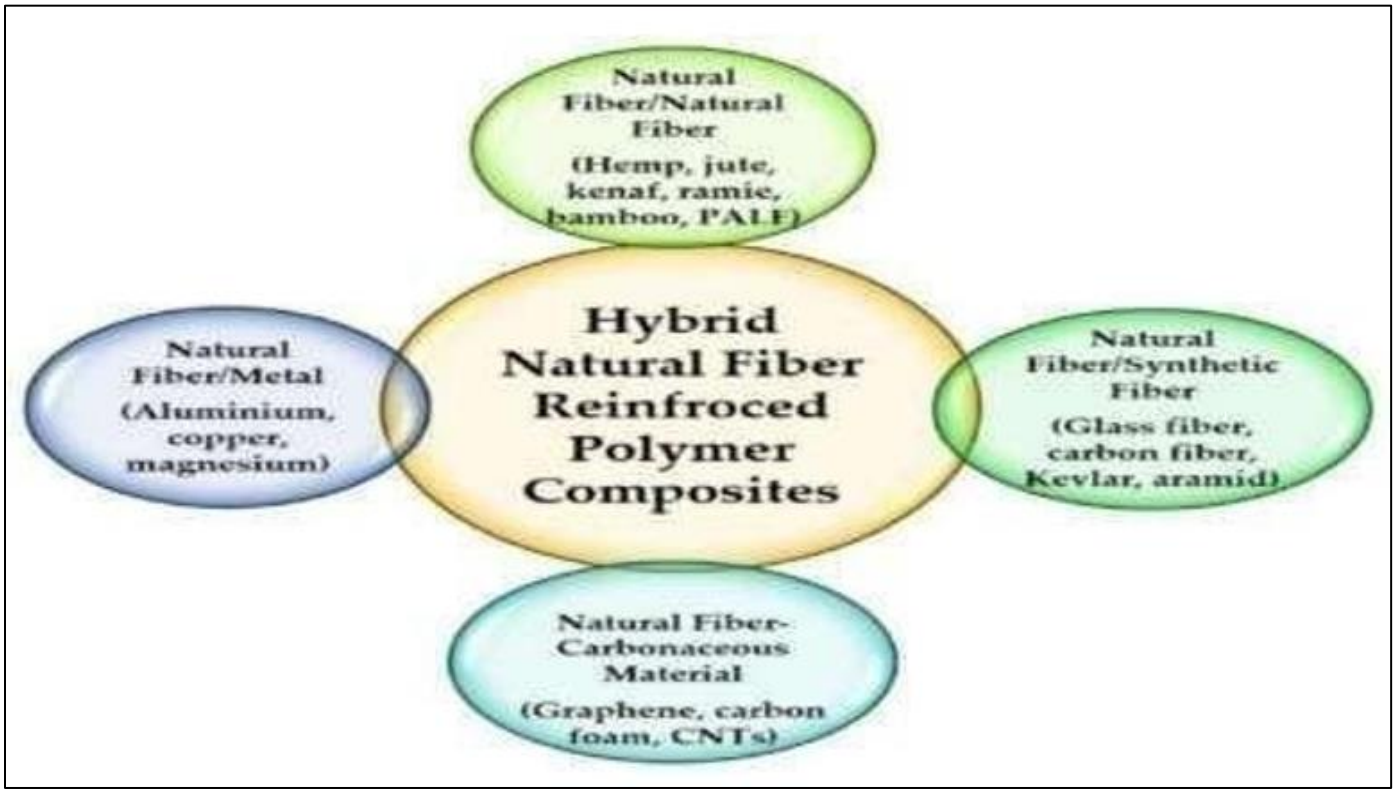

Fig 1: Hybrid Composites

M.R. Sanjay. et.al (1) shows that production of the hybrid composite with Jute/ E-glass fiber reinforced epoxy composite by using a hand layup technique. The introduce of glass fiber between jute fibers in hybrid composites which increases the properties of mechanical and also increase of the usage of natural fibers in many applications rather than artificial fibers. M. Pradeep, B. et.al (2) shows that Jute fiber composite along with glass fiber as filler material have good mechanical properties when compared to Jute fiber epoxy resin composite. M. Muthuvel. et.al (3) present work was to determine Mechanical properties of glass fibers with natural fibers hybrid composite which are used in the naval industry and aerospace. Pramendra Kumar Bajpaia et.al (4) shown that the fabrication and characterization of Jute/glass reinforced epoxy hybrid composite which used for manufacture of safety helmet in industries. Vijayakumar M.D et.al. (5) the present work focuses on usage of natural fibers for Researchers and scientist work. Because of their weight to strength ratio, low price and renewable. In this work, compression molding is used. Maleic Anhydride & some other materials are used as reinforcement. Elkington, D. et.al. (6) Ward Hand layup: understanding the manual process. It shows that hand layup process used for pre-impregnated materials is as yet a large size of the composite which assembled in industry. This process is costly and variable procedure which is suitable for delivering elite and complex parts. Bharath et al. (7) studied that the mechanical behavior of coconut leaf sheath/jute/glass fibers hybrid composites with different stacking percentage of three fibers. The hybrid composites are produced by the hand layup technique which is less cost and easy. The coconut leaf sheath/glass hybrid composites have most favorable mechanical properties compared to other combination of hybrid composites. Jute/Kenaf/E-glass hybrid composites (8) are manufactured by using vacuum bagging technique and evaluated the mechanical properties of jute/Kenaf/E-glass hybrid composites. Doors and furniture panels, Storage tanks, roofing sheets, interior paneling, household products, etc. are produced by these Jute/Kenaf/E-glass hybrid composites.

➢ *Aim and Objectives of the Study*

This research aims to examine the mechanical properties of hybrid composites. However, the specific objectives of the research include:

- To prepare Jute composites, E-glass composites and hybrid composites of Jute/E-Glass with epoxy resin and hardener by hand lay-up technique.
- The weight fractions of fiber (reinforcement) will
- be kept constant at 40%, and matrix will be 60%.
- Test specimens are prepared as per the standards of ASTM to conduct tensile and flexural tests to determine the Mechanical properties and results are evaluated by comparing with other results of different composites used in engineering fields.
- Compare the tensile and flexure properties Jute composites, E-glass composites, Jute/E-Glass composites to understand their relative strengths and weakness.

II. MATERIALS AND METHODOLOGY

- Natural fiber (Jute mat)
- Synthetic fiber (E-Glass)
- Epoxy resin(L-12)
- Hardener(K-6)

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT1836

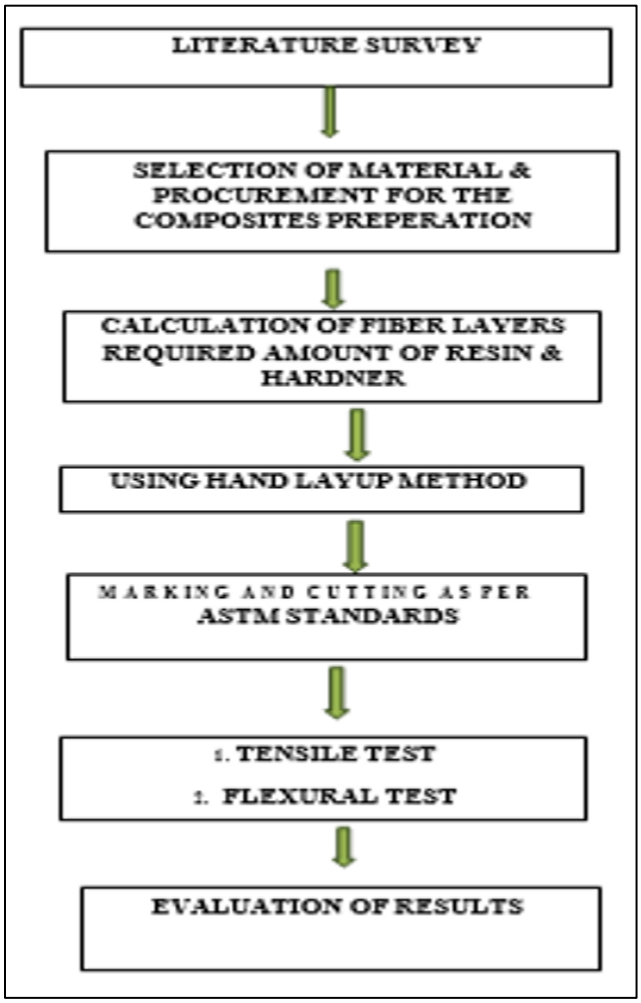

Fig 2: Flowchart of Methodology

III. SPECIMEN PREPERATION

In order to obtain the required specimens initially we prepared composite board of 260×260×3 mm size by hand lay-up technique. Initially for glass fibers, jute, and hybrid and then this fabric material is cut into required dimensions. For each volume fraction of composite same combinations of layers are laminated one above the other, for every single layer certain calculated amount of epoxy resin is added. After placing of all the layers, it is compressed by the constant load and it is allowed for curing nearly 36 hours. After preparing the composite specimen, specimens are cut out from the board using cutting machine according to the ASTM standards.

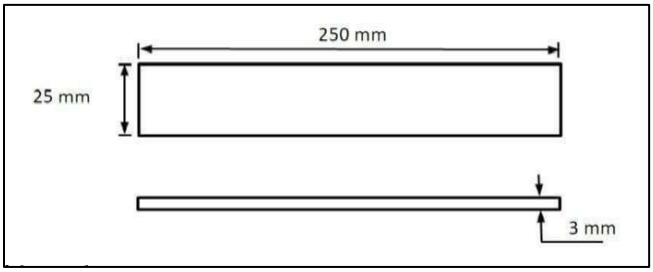

Fig 3: Drawing of Tensile Specimens as per ASTM Standards

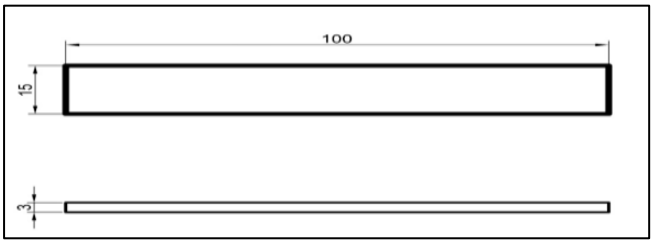

Fig 4: Drawing of flexure specimens as per ASTM standards

IV. TESTING

A. Tensile Test:

The tensile test is performed according to ASTM D-3039, the specimen size is 250×25×3 mm. Specimens were rigidly fixed at both ends and tested under the different loads until the specimen material fractures and brakes.

Fig 5: Tensile Test on Universal Testing Machine

B. Flexure Test:

The flexural test is performed by three-point bending method as per to ASTM D790, the specimen size is 100 X 15 X 3 mm. The specimen was freely supported by a beam, two specimens were tested under maximum loading at middle of the specimen until it fractures and breaks and the average value of two will consider for flexural strength and displacement.

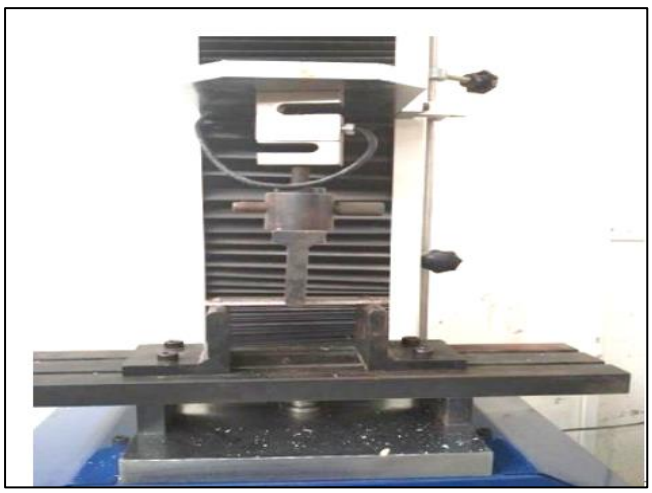
Fig 6: Flexure Test on UTM

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT1836

V. RESULTS AND DISCUSSION

➢ *Tensile Test Result of Jute:*

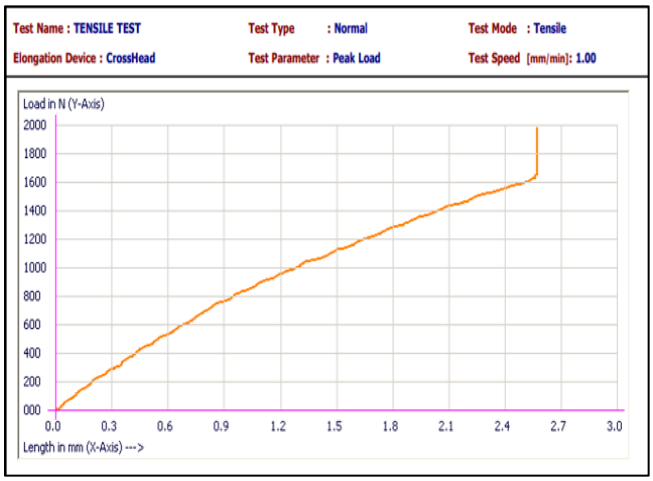

Fig 7: Tensile Test of Graph, Load v/s Length of Jute

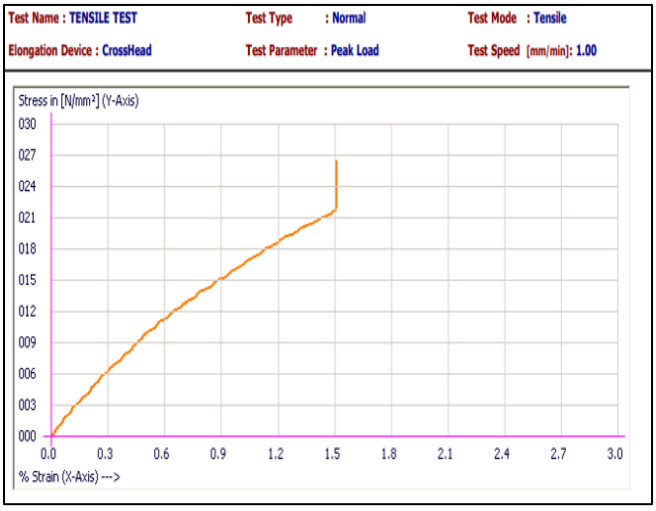

Fig 8: Tensile Test of Graph, Stress v/s Strain for Jute

➢ *Tensile Test Result of E-Glass:*

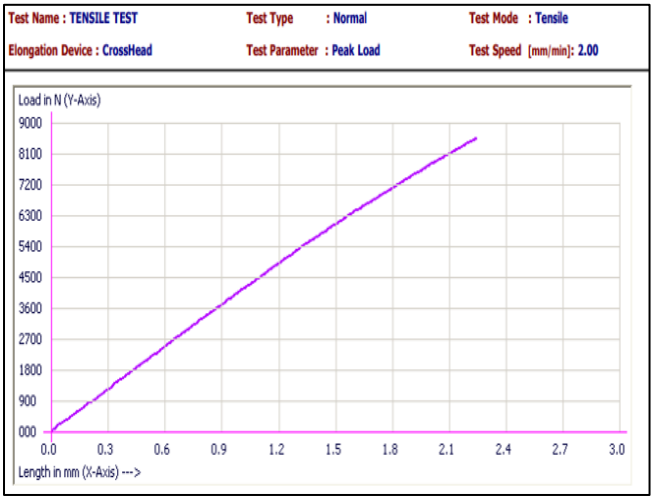

Fig 9: Tensile Test of Graph, Load v/s Length of E-Glass

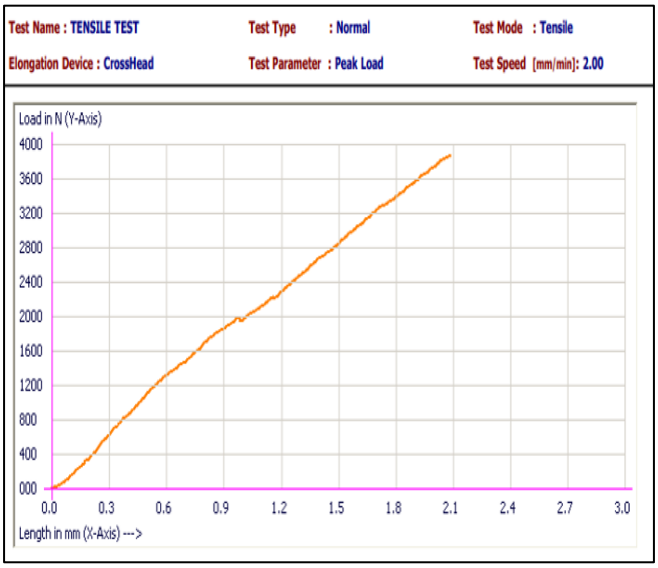

Fig 10: Tensile Test of Graph, Stress v/s Strain for E-Glass

➢ *Tensile Test Result of Hybrid:*

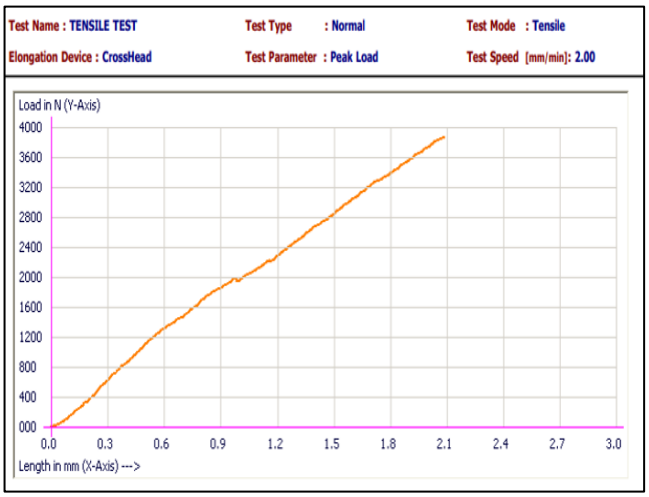

Fig 11: Tensile Test of Graph, Load v/s Length of Hybrid

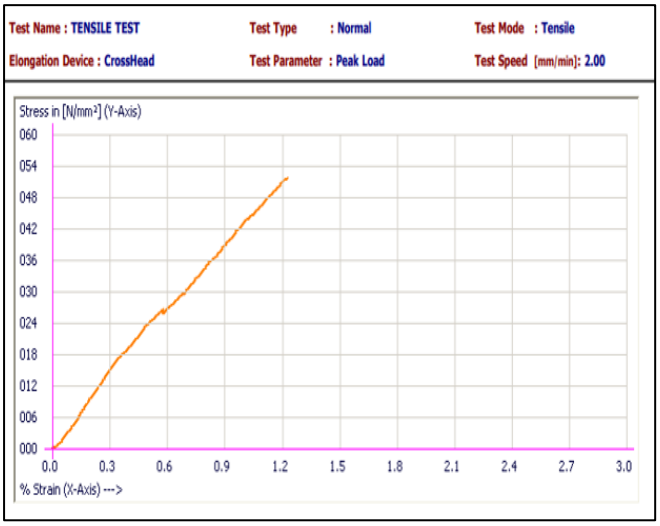

Fig 12: Tensile Test of Graph, Stress v/s Strain for Hybrid

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT1836

➢ *Flexure Test Results of Jute:*

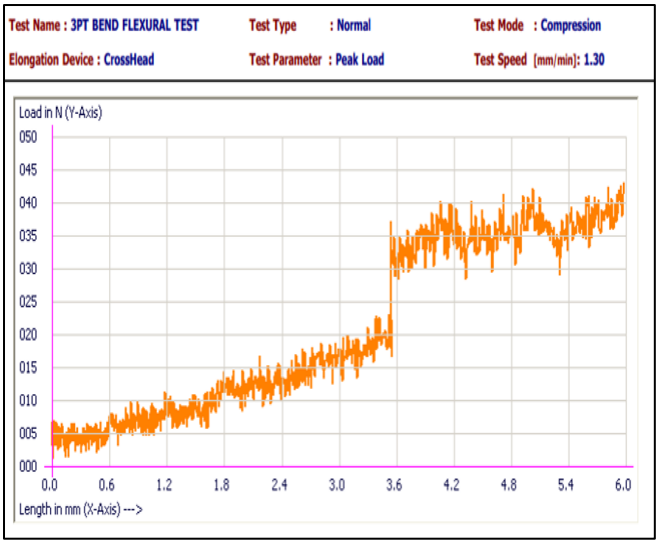

Fig 13: Flexure Test of Graph, Load v/s Length for Jute

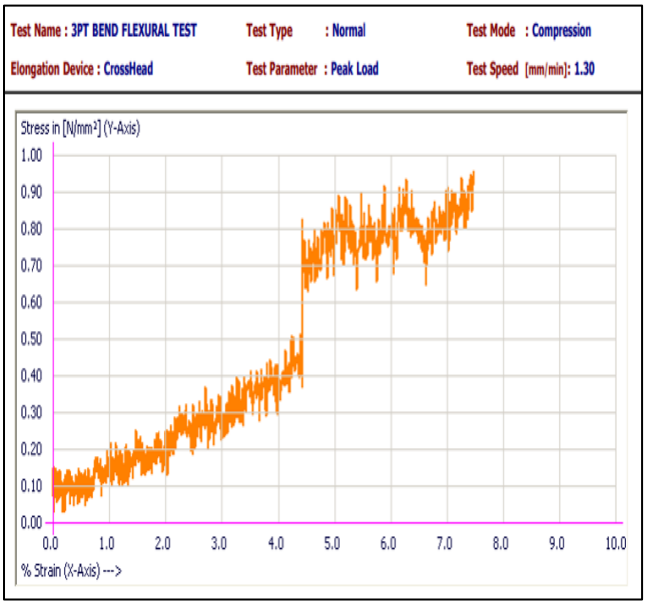

Fig 14: Flexure Test of Graph, Stress v/s Strain for Jute

➢ *Flexure Test Results of E-glass:*

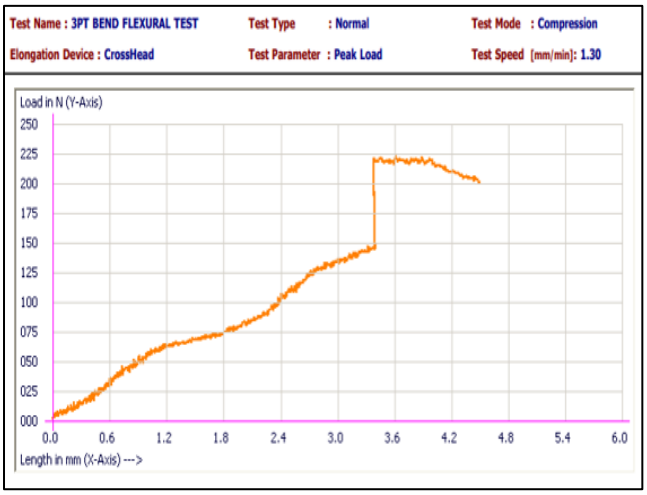

Fig 15: Flexure Test of Graph, Load v/s Length for E-Glass

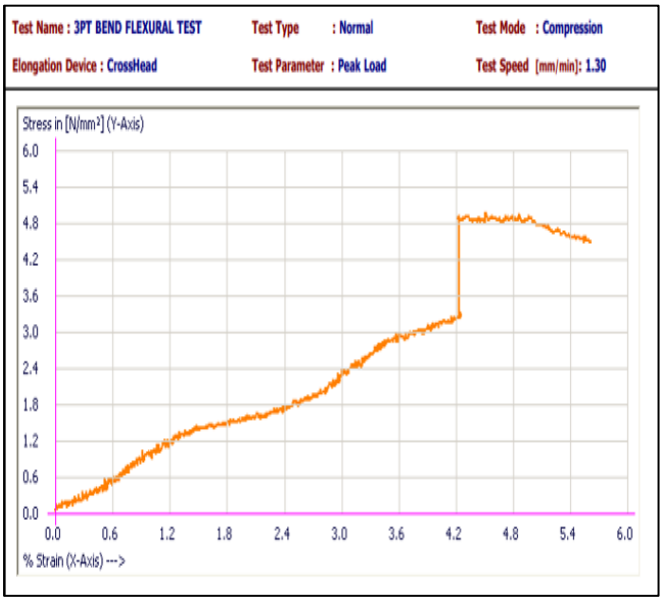

Fig 16: Flexure Test of Graph, Stress v/s Strain for E-Glass

➢ *Flexure Test Results of Jute/E-glass Hybrid:*

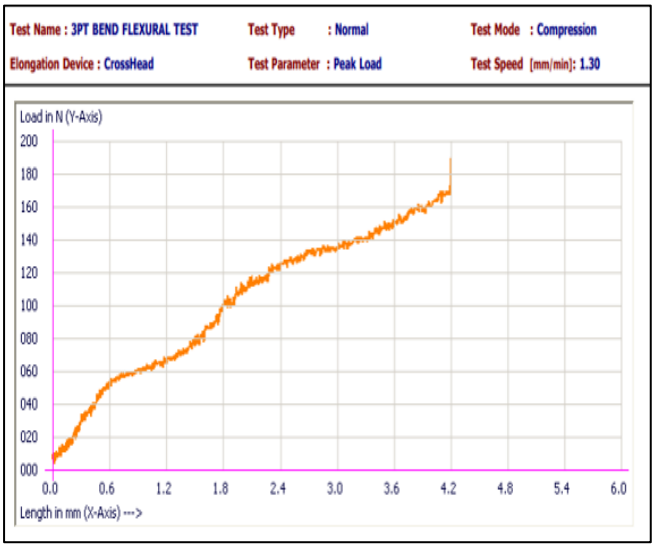

Fig 17: Flexure Test of Graph, Load v/s Length for Hybrid

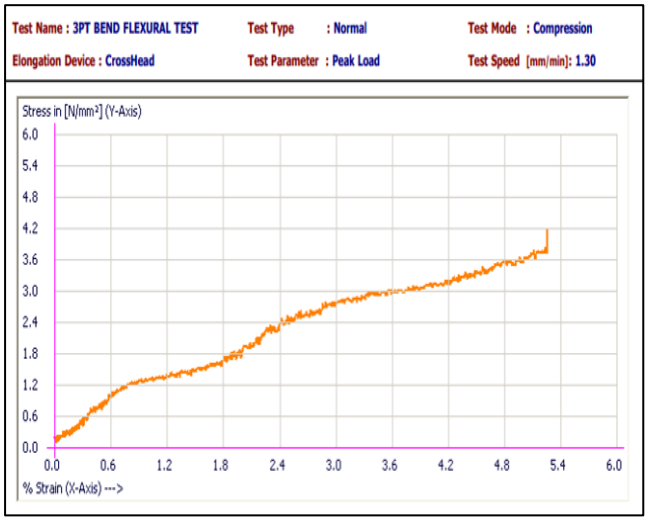

Fig 18: Flexure Test of Graph, Stress v/s Strain for Hybrid

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT1836

VI. CONCLUSION

The experimental study on the investigation on mechanical behavior of Jute/E-Glass fiber reinforced hybrid composites leads to the following conclusions:

The successful fabrications of a new class of Jute/E-Glass fiber reinforced hybrid composites have been done. The present investigation revealed that different fibers and percentage of fibers significantly influences the different properties of composites. A major conclusions that are drawn from this investigation are highlighted in this section.

- The fabrication of laminate composites using Hand lay-up technique is economical and low cost process.
- The tensile and flexural strength for Jute/E-Glass fiber reinforced hybrid composites depends on different fibers and percentage of fibers. Both tensile and flexural strength is more for Hybrid composites compared Jute fiber composites and E-Glass fiber reinforced composites to Hence this composition of the composite finds its use in structural applications.

REFERENCES

[1]. Xess, P.A., "Erosion Wear behaviour of Bamboo Fiber Based Hybrid Composites", Thesis NIT Rourkela, (2012).
[2]. John, M. J., & Anandjiwala, R. D. (2008). "Recent developments in chemical modification and characterization of natural fibre-reinforced composites", Polymer composites, Vol. 29(2), pp. 187- 207.
[3]. Amash, A. & Zugenmaier, P. (2000). "Morphology and properties of isotropic and oriented samples of cellulose fibre-polypropylene composites", Polymer, Vol. 41(4), pp.1589-1596.
[4]. KS Ahmed and S Vijayarangan, "Tensile, Flexural and Inter-Laminar Shear Properties of Woven Jute and Jute/Glass Fabric Reinforced Polyester Composites", Journal of Materials Processing Technology,2008, 207 (1), 330-335.
[5]. Chandra Mohan, D., & Mari Muthu, D. K. (2011), "Tensile and hardness tests on natural fibre reinforced polymer composite material", International Journal of Advanced Engineering Science and Technology, 6(1), 97 -104. Chow, C. P. L., Xing, X. S., & Li, R. K. Y. (2007).
[6]. James F. Shackelford, Madanapalli K. Muralidhara "Material Science for Engineers", sixth edition.
[7]. KS Ahmed and S Vijayarangan, "Tensile, Flexural and Inter-Laminar Shear Properties of Woven Jute and Jute/Glass Fabric Reinforced Polyester Composites", Journal of Materials Processing Technology, 2008, 207 (1), 330-335.
[8]. Monteiro, S.N,, Terrones, L. A. H. & D'Almeida, J,R.M, "Mechanical performance of coir fiber/polyester composites", 2008.
[9]. Biswas s., Kindo s., Patnaik A.,(2011), "Effect of length on coir fiber reinforced epoxy composites, fiber and polymers".