



e-ISSN: 2319-8753 | p-ISSN: 2320-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 4, April 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.512

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

Fabrication and Mechanical Characterisation of E-Glass and Carbon Honey Comb Sandwich Composites

A.Rebison¹, I.Praveen Jose², A.Ram Chandru³, B.Nirmal⁴, K.Robinston Jayasingh⁵

UG Student, Department of Mechanical Engineering, Francis Xavier Engineering College, Tirunelveli, Tamilnadu, India ¹⁻⁴

Assistant Professor, Department of Mechanical Engineering, Francis Xavier Engineering College, Tirunelveli, Tamilnadu, India ⁵

ABSTRACT: One of the major scientific challenges for the composite engineers is the development of new stronger and tougher lightweight structural materials supporting latest technologies and design concepts for the complex shaped structures like aircraft, automotive structures, and large wind turbine blade structures. The development of composite materials improving their performance limits based on the reinforcement of two or more fibres in a single polymeric matrix, which leads to the advanced material system called hybrid composites. This is a major challenge that can only be met through an understanding of the relationships between materials architecture and mechanical response. The hybrid effect of selected mechanical property from the rule of mixture behavior of glass, carbon and epoxy resin added with mwcnt composites were studied. The effectiveness of reinforcement essentially depends on the adhesion between matrix and fiber, so this is a key factor in determining the final properties of the composite material. In the present work, an attempt has been made to study the influence of glass fiber and carbon fiber with carbon nanotube reinforced epoxy polymer matrix on the mechanical properties. The various mechanical properties were studied as per the ASTM standards. The carbon and glass fiber with Honey Comb Structure has a shows a high mechanical strength of the materials.

KEYWORDS : CarbonFiber, Glass Fiber And Carbon Honey Comb Structure

I. INTRODUCTION

One of the major scientific challenges for the composite engineers is the development of new stronger and tougher lightweight structural materials supporting latest technologies and design concepts for the complex shaped structures like aircraft, automotive structures, and large wind turbine blade structures. The development of composite materials improving their performance limits based on the reinforcement of two or more fibres (synthetic fibre with another synthetic fibre or synthetic fibre with natural fibre or synthetic fibre with metallic fibres) in a single polymeric matrix, which leads to the advanced material system called hybrid composites.

Recently, hybrid composite is being investigated throughout the globe as it has enhanced properties than their mother composites which is relatively cost effective method. This is a major challenge that can only be met through an understanding of the relationships between materials architecture and mechanical response. The positive or negative hybrid effect of selected mechanical property from the rule of mixture behavior of glass, carbon and epoxy resin added with mwcnt composites were studied. The effectiveness of reinforcement essentially depends on the adhesion between matrix and fiber, so this is a key factor in determining the final properties of the composite material. In the present work, an attempt has been made to study the influence of glass fiber and carbon fiber with carbon nanotube reinforced epoxy polymer matrix on the mechanical properties. The various mechanical properties were studied as per the ASTM standards.

II. LITERATURE SURVEY

S.y.fu, B.Lauke, E.Mader (2000):In this study was carried out the tensile properties of injection melted composites reinforced with SGF and SCF have been investigated and the result indicate that the mean glass and carbon fiber

lengths decrease with increasing fiber volume fractions and the combined effect of fiber volume fraction and fiber length determines the final tensile properties of the composites.

K. Poyyathappan (2014):In this study was carried out the tensile strength of the hybrid composites lie in between the CFRP and GFRP. From the flexural results obtained in this investigation on the 0 ± 90 fiber orientation sample, it is observed that the hybrid samples have intermediate strength after the specimens were subjected to cyclic load. But, the hybrid composites have more flexural strength than that of the GFRP laminates after cyclic load.

T D Jagannatha (2015) :In this study the inclusion of carbon fiber mat reinforcement composite significantly enhanced the ultimate tensile strength, yield strength and peak load of the composite. the micro hardness and ductility of the hybrid composite were also found by doing experiments like tensile test and hardness test as per ASTM standard.

Karthick Saravanan.S(2016):In this study to understand the improvement in the mechanical properties due to the changes made in the carbon/ glass fiber ratio in three different laminates. As you can see the tensile strength, flexural strength and the impact strength increases as the ratio of the carbon fiber reinforcement is increased in the matrix.

III. EXPERIMENTAL DETAILS

Material selection:

Carbon fiber and E-glass fiber were selected as reinforcement and epoxy and matrix material

Bidirectional glass fiber-300 GSM - 40 Grams per layer

Bidirectional carbon fiber – 300 GSM – 20 Grams per layer

Matrix: Epoxy resin – grade LY556 – 250ml

Hardener – grade HY 951 – 50 ml

Honey Comb Structure shell size – 0.6mm

Fabrication:

Bidirectional GFRP, CFRP and multiwalled carbon nanotube hybrid composite of 3mm thickness have been prepared. Epoxy resin LY-556 has been used as the matrix and HY 951 has been used as hardener. The laminates have been made by hand-lay up method. Required layers of fibers were taken as a $300\times 300\times 3$ mm. The thickness of the laminates was maintained approximately 3mm. equal amount of resin is taken in a ratio 10:1 hardener is added.



Figure 1 :Fabrication Process

the vacuum bag technique is carried out on the laminate to uniformly distributed the resin and also to remove any trapped air the process time required for 2 hours then the specimen will be placed in atmospheric condition for 5-6 hours and cured in 100° C temperature about 1 hour. In CFRP and GFRP laminates all the layers are carbon fiber mat and glass fiber mat respectively. hybrid laminates made by three layer of carbon and eight layer of glass fiber added to 3% and 4% of multi walled carbon nano tube was fabricated.



Figure 2: Vacuum Bag Technique



Figure 3: Fabricated Material



Figure 4: Test Specimen

The specimen was cut as per the ASTM standard for tensile and compressive tests and tested for its tensile and compressive strength respectively

TESTING DETAIL:

Mechanical properties like ultimate Compressive Strength, ultimate Tensile Strength, Impact Strength, Hardness And Water Absorption test will be evaluated.

Tensile test:

The tensile tests can be performed on unidirectional composites. Fiber glass tabs are placed on either side of straight sided specimens which, are gripped in the testing machine. Streamlined (reduction-section) specimen can also be used.

ASTM A 378:2017 is followed for tensile test. The specimen was fixed between two adjustable grips of computerized Universal Testing Machine (UTM) at room temperature and load was applied till it fractures. The elongation and maximum load is noted during the experiment.

Compressive test :

Compressive strength or compression strength is the capacity of a material or structure to with stand loads tending to reduce size, as opposed to tensile strength, which with stands loads tending to elongate. Here the test spicemen should be prevented from buckling

Impact test :

ISO 148-1-2016 Method is followed for charpy impact test. The test is performed by fixing the specimen at the both ends and the striker impacts the specimen.



Hardness Test:

Hardness is defined as the resistance to indentation, and it is determined by measuring the permanent depth of the indentation. More simply put, when using a fixed force and a given indenter, the smaller indentation, the harder the material. ASTM D 2240 method is followed for the Shore-D Hardness test.

IV. RESULT AND DISCUSSION

TENSILE STRENGTH:

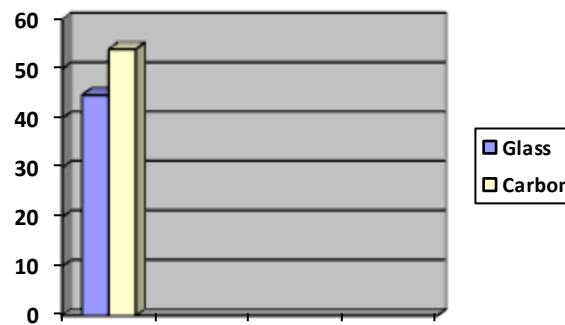


Figure 5: Tensile Strength

The above chart shows the effect of reinforcements on UTS of the Fibers reinforced composites as can clearly see the increase in the ultimate tensile strength in different proportion of CNT specimens. This proves that the strength of the material increases as the CNT content in the material increases.

COMPRESSION TEST:

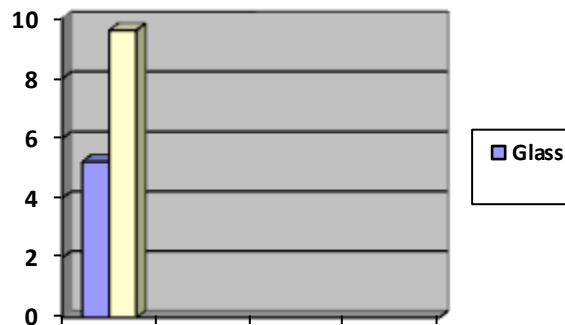


Figure 6: Compressive Test

The test specimens were mounted with strain gauges on both sides of the specimens to observe test specimen bending ratio. The test setup and test specimen before the test and after the test

IMPACT TEST:

Charpy impact testing involves striking a standard specimen with controlled weight pendulum swung from a particular height. The specimen is fixed in an anvil and struck by the pendulum. The amount of energy absorbed in fracturing the test piece is measured

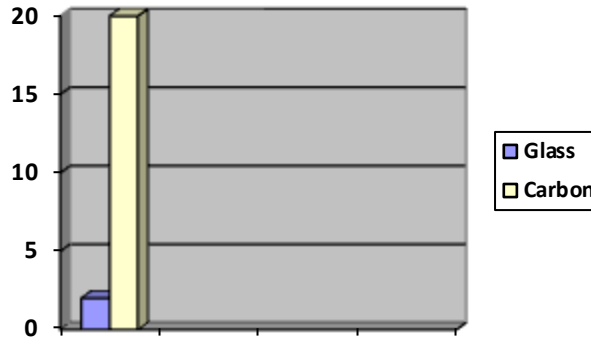


Figure 7: Impact Result

HARDNESS TEST:

Hardness is defined as the resistance to indentation, and it is determined by measuring the permanent depth of the indentation. More simply put, when using a fixed force and a given indenter, the smaller indentation, the harder the material. ASTM D 2240 method is followed for the Shore-D Hardness test.

V. CONCLUSION

By comparing Tensile stress Results of Experimental Analysis. From the test results of nano composites based on mechanical tests conducted a conclusion is reached from the study. All the results are compared to various proportions of carbon nano tube to increase the strength.

From the study it is concluded that the composites used in aerospace and automobile applications are abundant and highly reliable.

Nowadays, in the automobile field, the glass fiber and carbon fiber hybrid composite material results in an increase in tensile strength in carbon HoneyComb composites.

REFERENCES

1. Autar K. Kaw, (2006) 'Mechanics of Composite Materials'
2. K. Poyyathappan et al. / International Journal of Engineering and Technology (IJET) : Tensile And Flexural Studies On Glass - Carbon Hybrid Composites Subjected To Low Frequency Cyclic Loading
3. Palanikumar, L. Karunamoorthy, R. Karthikeyan, and B. Latha, "Optimization of machining parameters in turning GFRP composites."
4. Jones, (1990), R.M., "Mechanics of Composite Materials", McGraw-Hill Book Company,
5. Carl T. Herakovich, (1997) 'Mechanics of Fibrous Composites'
6. Daniel Gay, Suong V. Hoa, Stephen W. Tsai, (2003) 'Composite materials'.
7. Donald H. Middleton, 'Composite Materials in Aircraft Structure'.
8. Michael Chun-Yung Niu, (2000) 'Composite Airframe Structures'.
9. R. Sakthivel*, D. Rajendran. "Experimental Investigation And Analysis A Mechanical Properties Of Hybrid Polymer Composite Plates".
10. Stephen R. Swanson, (1997), "Introduction to Design and Analysis with Advanced Composite Materials",
11. Hyer, Michael W. (1998), "Stress Analysis of Fiber Reinforced Composite Materials",
12. Ya. S. Karpo, 'Structural optimization of composite material for aircraft panels'.
13. B. Liu, R. T. Haftka; 'Single-level composite wing optimization based on flexural lamination parameters'.
14. R. K. H. Ng, A. Yousefpour, M. Uyema, M. N. Ghasemi Nejjhad; 'Design, analysis, manufacture and test shallow water pressure vessels'.
15. W. J. Liou, C. I. Tseng and L. P. Chao; 'Stress analysis of laminated E-glass epoxy composite plates'. Lalit S. Gupta; 'Advanced composite materials'



**Impact Factor:
7.512**



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details