Analysis on Mechanical Characteristics of Hybrid Composite with Silicon Carbide Filler

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Abstract— Composites made of Fiber reinforced polymer, (FRPCs), these structures are used in all progressive engineering, In the arena of composite materials, the fiber reinforced composite, consisting of one fiber is used for long time. The results would have appeared for certain area this is because use of single fiber, consisting of limited property. To stun this problem the use of another fiber is made this results, in the form of hybrid composite in this project basalt, plus glass fibers, are castoff in the process of hybrid composite. In FRPCs vinyl ester is broadly castoff by way of matrix. For polyvinyl ester based fiber laminates the typical reinforcements are glass and basalt fibers have been used to improve the total strength of the composite laminate. By totalling sic, as the filler to the composite.

Keywords: Basalt Fibers, Glass Fibers, Vinyl Ester, Silicon Carbide

I. INTRODUCTION

By introduction of new resin plus matrix the price of the composite has reduced plus its performance was higher. Composite materials can originate in various purposes for examples; normal gas automobile as fuel tank, in marine field also composite are used, it can be routine in road highway bridges plus similarly in paper crusher industry .The key reason of using composite is mainly idea of reducing both price plus weight. Now a days composites can also be used in the flow of machine, composite can definitely substitute by welded part or else metallic part. Composite material has capacity to engross tremor plus these are currently extensively used in strengthening of already surviving structures by seeing the structural part of the composite, plus structure will be designed.

There are several methods are available for the fabrication of the composite sample. Designed sample has two or else more physically plus chemically separates; properly arranged or spread stages; the composite material has in bulk stage plus continuous that is known as matrix plus one more is dispersed plus non continuous known as reinforcement this is normally unbreakable

II. MATERIALS

Composites were made of basalt fiber; glass fiber along with silicon carbide (Sic) will be used as filler material.

Basalt fiber has recently existed in the market manufacture from well fibers of basalt plus self-processed some of crystals like, plagioclase. These are the fibers which has similar mechanical plus chemical properties related with the glass fibers. The price of the fiber very less related to other dominant fibers like carbon, aramid plus some other kind of fibers. In aerospace plus automotive industry uses these kinds of fibers as fire resistance because fire resistance of the basalt will be higher than other fibers.

one of the most vital matrix material is used in the composite because of its outstanding property that is vinyl ester can be sustain any kind of chemical environment,

Fig. 1: Basalt fiber, Glass fiber, polyvinyl ester, Silicon carbide filler

III. METHODOLOGY

SL NO	MATRIX	FIBER	FILLER	COMPOSITE
1	45%	55%	-	100
2	43%	55%	2%	100
3	41%	55%	4%	100

Table 1: Composition of Composite Materials

1) Stage 1: Choice of matrix material – Polyvinyl ester
2) Stage 2: Choice of reinforcement plus fibers- Basalt plus Glass fiber
3) Stage 3: Choosing filler materials – Silicon carbide (Sic)
4) Stage 4: Fabrication technology using vacuum bag process

Initially both the fibers basalt plus glass were cut according to require a dimension that is 300×120 mm. Wax is applied on the surfaces for easy removal of the fabricated part Take 125 gms of vinyl ester plus add 2%,4% filler material. Add accelerator plus catalyst for improving the chemical reaction. Then we are going to put one layer of basalt plus apply matrix then put another layer of glass continue the process up to required 3mm thickness of composite. After completing all the above steps breather stuff is placed on it, plus it will help to absorb extra resin. Perforator will positioned it will help to remove the air gaps formed during fabrication process. Whole composite cover by vacuum bag with anabond sealant after some time composite fully dried plus cut the composite specimen according to required mechanical testing , Tensile, compression, bending.

Fig. 2: Sample preparation by Vacuum bag process

IV. TESTING

A. Tensile Test

For tensile trail the specimen will gripped in the testing machine, plus apply the load until the fracture will take place,

ASTM D3039, is used for measure how much force necessary to break the sample, In this trail material will reaches its ultimate strength limit both stress plus strain will be obtained, plus other parameters like tensile strength, yield stress obtain all these data will be helpful for design the structure.

Fig. 3: Without filler material

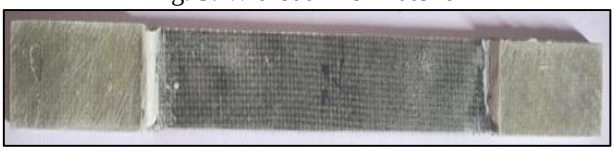

Fig. 4: 2% Sic Filler material

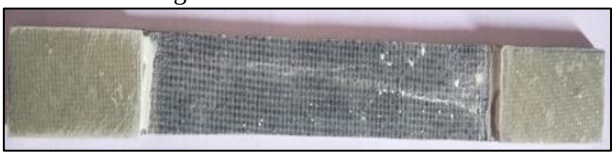

Fig. 5: 4% Sic Filler material

B. Compression Test

For Compression trail the specimen will gripped in the testing machine, plus apply the load until the fracture will take place, ASTM D3410, is used for measure how much compressive force required to break the sample, In this trial material will reaches its ultimate strength limit both stress plus strain will be obtained, plus other parameters like compressive strength, yield stress obtain all these data will be helpful for design the structure.

Fig. 6: without Filler material

Fig. 7: 2% Sic Filler material

Fig. 8: 4% Sic Filler material

C. Flexural/Bending Test

For Bending examination of the sample will carried out by using three point technique sample is supported at the both the end plus weight applied vertically on the specimen until the fracture will take place, ASTM D790, is used for measure how much vertical force required to break the specimen, In this test material will reaches its ultimate limit.

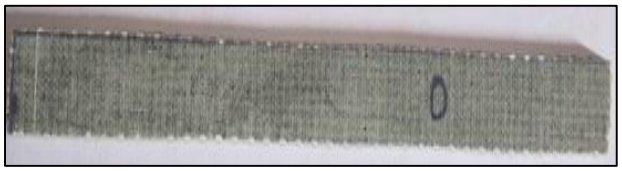

Fig. 9: without filler material

Fig. 10: 2% Sic filler material

Fig. 11: 4% Sic filler material

V. RESULTS AND DISCUSSION

Sample (Wt. %)	Tensile Strength Mpa	Compression Strength Mpa	Bending Strength Mpa
0% filler	87.32	111.87	47.27
2% filler	97.32	297.87	47.39
4% filler	119.21	97.27	174.52

Table 2: Test Specimen Results

From the above table we concluded that composite with 4% silicon carbide filler in case of tensile test and bending/ flexural test will give more strength than other two filler materials and composite made off 2% filler material will give more compressive strength.

A. Tensile Test

Composite specimens were tested in the universal testing machine, Fig.12 stress vs strain and Fig.13 load vs displacement curves were plotted, from these two curves we come to know that composite made with 4% silicon filler will gives more tensile strength than other two filler materials like 0% and 2%

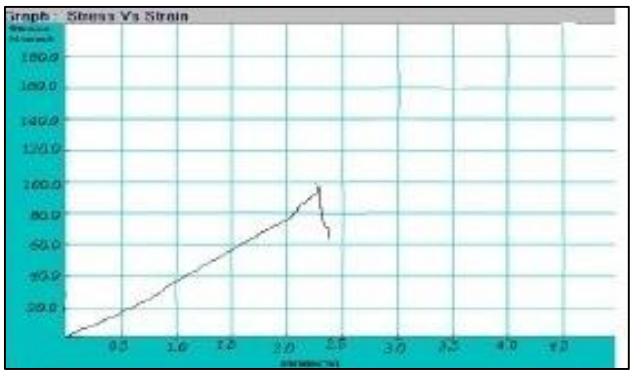

Fig. 12: Stress vs Strain

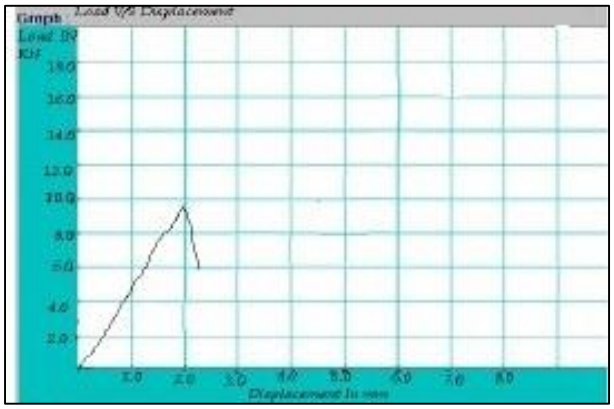

Fig. 13: Load vs Displacement

B. Compression Test

In case of compression test composite made of 2% silicon filler it will give more compressive strength than other two filler material. The curve of load vs displacement is plotted as shown in the Fig.14.

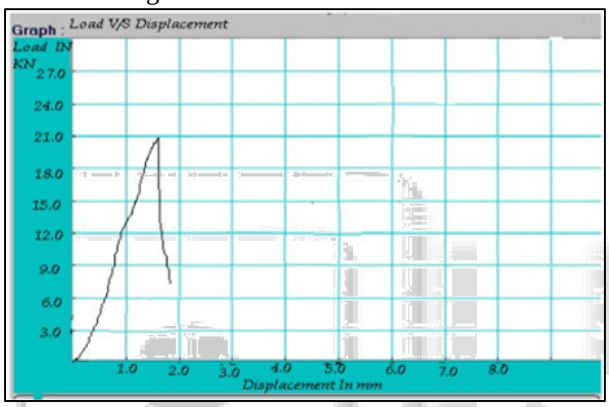

Fig. 14: Load vs Displacement

C. Flexural/Bending Test

From flexural testing we get more strength in composite made of 4% silicon filler than other two filler materials, the curve of load vs displacement is plotted as shown in Fig.15.

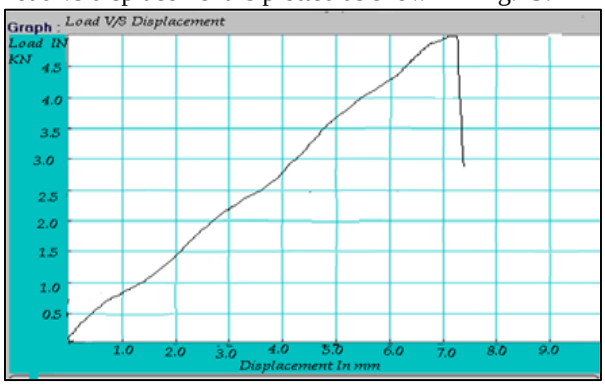

Fig. 15: Load vs Displacement

VI. Conclusion

Since we combining the two fibers (Basalt plus Glass) these fibers have different properties make them as a versatile materials in the field of engineering and technology. Mechanical properties have improved by adding a filler material (Silicon carbide) and improve the surface conditions as well. The tensile strength, compression and flexural/bending strength of hybrid composite materials has high strength than other epoxy/glass and polyester/glass fibers.

VII. Future Works

Mechanical properties can be improved by increasing the thickness/weight of fiber (Glass and basalt fibers). Further strength can be increased by adding more filler material in the composite.

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