INTERNATIONAL JOURNAL OF RESEARCH IN MECHANICAL, MECHATRONICS AND AUTOMOBILE ENGINEERING (IJRMMAE)
ISSN: 2454-1435 (Print) | 2454-1443 (online)
Volume 4 Issue 3 , October 2018-December 2018– www.ijrmmae.in – Pages 24-35

DEVELOPMENT OF CAR BONNET

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Abstract : In recent technologies, the composite materials are growing up in the various sectors like automobiles, aerospace applications etc., In which the composite materials are synthesized by synthetic fibers, as reinforced together to get a material, which have attracted the attention of researchers due to their low density with high mechanical strength, availability, renew ability, degradable and being environmental- friendly. Our present project work attempts to make a hybrid fibre reinforced composite material. This composite material is suggested to replace the existing Car Outer bonnet materials and automobile panels. The Composite material is to be prepared with the synthetic fibres such as Kevlar, E glass and Basalt fibres by using hand lay-up method with appropriate proportions to get a required composite material. The final prepared composite material is planned to evaluate its mechanical properties such as tensile strength, flexural strength, compression strength and impact strength. The final result is to be compared with the replaced material.

Keywords: “Ansys Workbench, HRFCM, Basalt Fiber, Kevlar Fiber, E-Glass Fiber,Sudden Impact Test”

I.NTRODUCTION

1.1 INTRODUCTION OF COMPOSITES

The material of choice of a given era is often a defining point. Phrases such as Stone Age, Bronze Age, Iron Age, and Steel Age are great examples. These days people more concentrate for composite materials. Composites are becoming the essential part of today‘s materials because they offer advantages such as low weight, corrosion resistance, high fatigue strength, faster assembly etc. Composites are used as material ranging from making aircraft structure to golf club, electronic packaging to medical equipment and space vehicles to home buildings. Composites are generating curiosity and interest in student all over the world. They are seeing everyday application of composite material in commercial market and job opportunities are also increasing in this field. In most cases, the reinforcement is harder, stronger, and stiffer than the matrix. The reinforcement is usually a fiber or a particulate. Particulate composites have dimensions that are approximately equal in all directions. They may be spherical, platelets, or any other regular or irregular geometry. Particulate composites tend to be much weaker and less stiff than continuous fiber composites, but they are usually much less expensive. Particulate reinforced composites usually contain less reinforcement (up to 40 to 50 volume percent) due to processing difficulties and brittleness.

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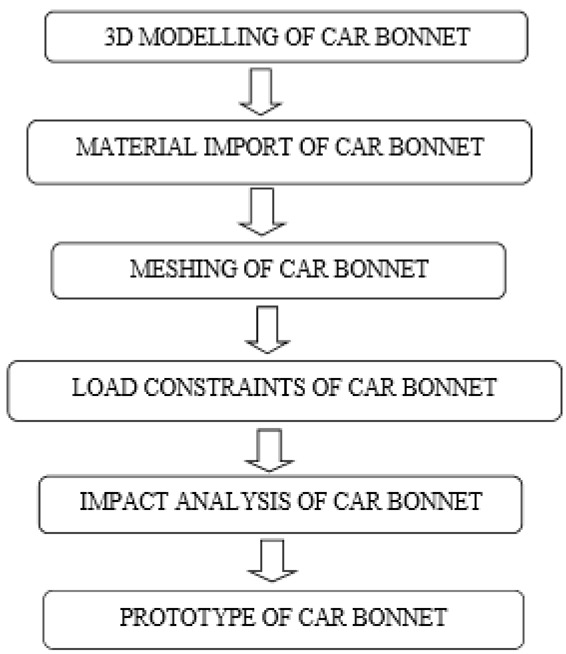
Fig 1.1 Car Bonnet

The figure 1.1 shows the picture of the Car bonnet (Hood) The hood or bonnet is the hinged cover over the engine of motor vehicles that allows access to the engine compartment, or trunk on rear-engine and some mid- engine vehicles) for maintenance and repair. Hoods are typically made out of the same material as the rest of the body work. This may include steel, aluminum, fiberglass or carbon fiber. In our project, we are going to replace the mentioned material, which is used to manufacture the hood with the Composite Fibers.

METHODOLOGY

3.1. METHODOLOGY FOR ANALYSIS



Flow Chart 3.1 Process of Methodology

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Thus the above mentioned methodology flow chart represent the work flow of the Analysis which is going to be formed on the Composite fiber [6].

3D MODELLING OF CAR BONNET

Car bonnet was designed using solid-Works software as per the physical model dimension shown below:

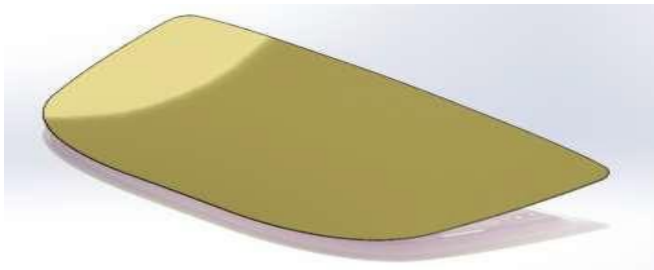

Fig 3.2.1 CAD model design

The figure 3.2.1 shows the image of the CAD model design of Car bonnet

PROPERTIES FOR SYNTHETIC FIBRES

This chapter describes the details of processing of the composites and the experimental procedures followed for their mechanical characterization [2]. The raw materials used in this work are,

MATERIALS ¬
Epoxy resin (Araldite LY-556). ¬
Hardener(HY-951) ¬
Synthetic fibres ¬
Kevlar fibre. ¬
Basalt fibre. ¬

E Glass fibre. Fibers Density (g/m3) Tensile Strength (MPa) Young'sModulus (GPa) Shear Modulus(Gpa) Kevlar fibre(K49) 1.47 3620 76 29 Basalt fibre 2.67 3020 72 21.7 E Glass fibre 2.6 3200 74 30 Table 3.1 Properties for synthetic fibres

Fibers	Density (g/m^3)	Tensile Strength (MPa)	Young'sModulus (GPa)	Shear Modulus(Gpa)
Kevlar fibre(K49)	1.47	3620	76	29
Basalt fibre	2.67	3020	72	21.7
E Glass fibre	2.6	3200	74	30

Table 3.1 shows the properties of the synthetic fiber. 3.3

MANUFACTURING PROCESS

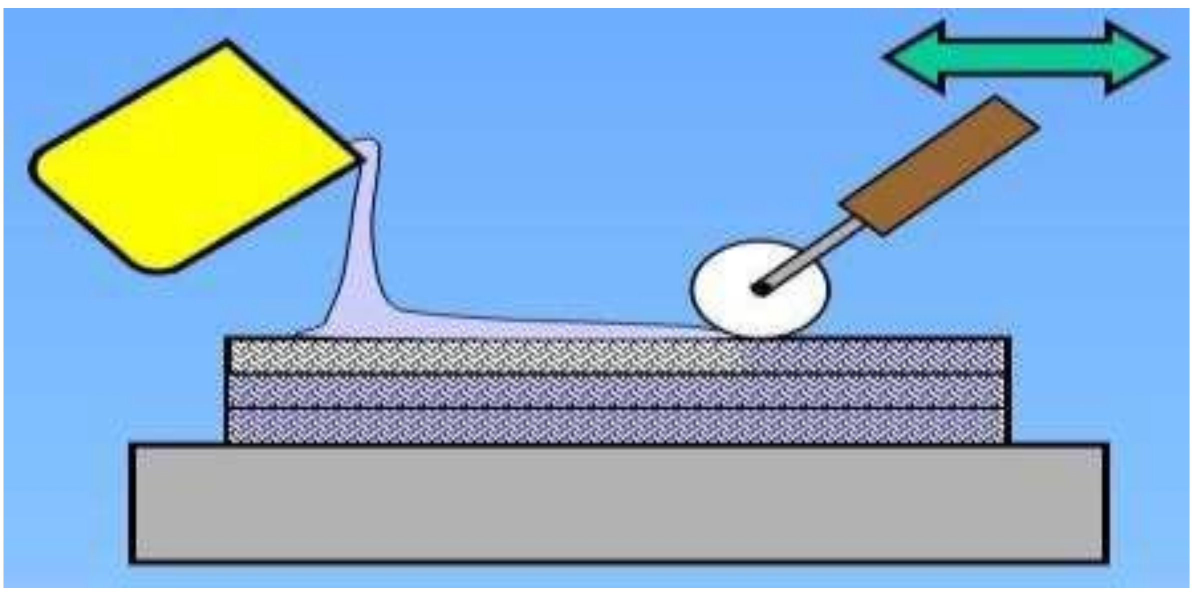

Fig 3.3.1. Schematic Diagram of hand lay-up process

The figure 3.3.1 shows the schematic diagram of hand lay-up process.The first layer is Kevlar fibre is placed. The resin is uniformly spread with the help of brush. Second layer of E glass fibre is then placed on the polymer surface and a roller is moved with a mild pressure on the fibre layer to remove any air trapped as well as the excess fibre present [1]. The process is repeated for each layer of fibre, till the required set of combination attained. Thickness Laminates 0.20 Basalt fibre 0.20 E glass fibre 0.20 Kevlar fibre

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Thickness	Laminates
0.20	Basalt fibre
0.20	E glass fibre
0.20	Kevlar fibre

Fig 3.3.2 Configurations of lay-up

The Figure 3.3.2 shows the thickness of fibre used [3]. After fabricating the specimen we have to keep them at either at room temperature or at some specific temperature for 2-3 days for perfect bonding [7]. Stainless steel plate, which is used as a mother plate to hold the layers of fiber to attain the position of the bonnet. International Journal of Research in Mechanical, Mechatronics and Automobile Engineering (IJRMMAE)Volume 4 Issue 2– July - Sep 2018 www.ijrmmae.in–Pages 1-9 3.4

MPORTING THE CAD MODEL:

The CAD model was designed using Solid-Works Software, then imported in ANSYS Workbench software as shown below:

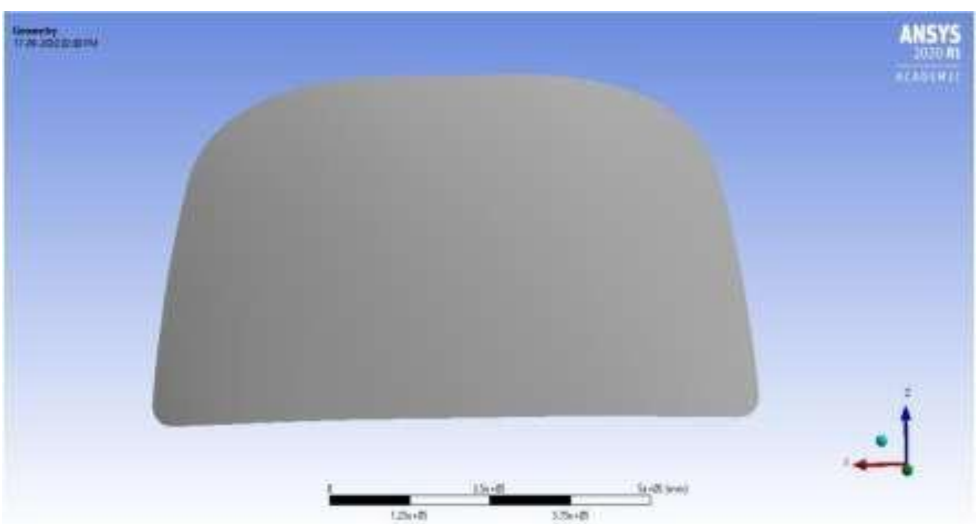

Fig 3.4.1 CAD model design

The figure 3.4.1 shows the image of the CAD model design of Car bonnet 3.5

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MESHING THE CAD MODEL:

Once after importing the model, the outer extract was Meshed and prepared for the analysis, discretization process is carried to reduce the model complexity. .

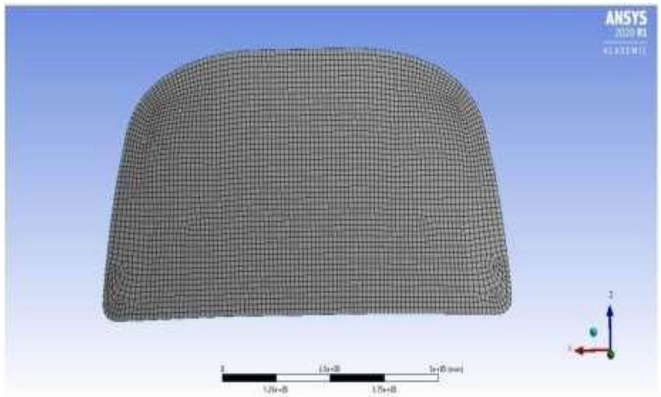

Fig 3.5.1 FEA Model

The figure 5.2 shows the image of the FEA model of Car bonnet 3.6

BOUNDARY CONDITION:

Load of 300N was applied on the bonnet by constraining its edges, in order to get the real time results.

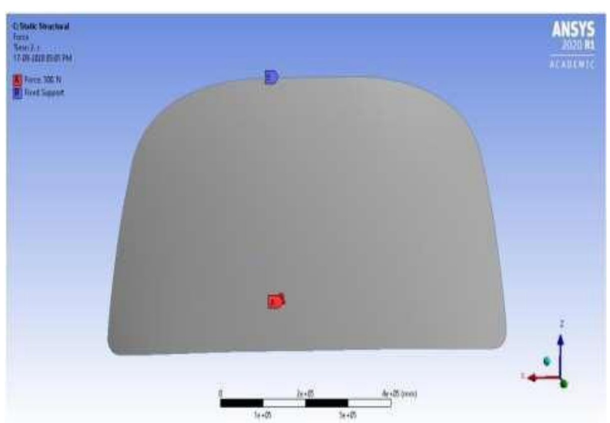

Fig 3.6.1 BOUNDARY CONDITION

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The Figure 3.6.1 shows the image of the Boundary Condition applied 3.7

DUAL LAYER COMPARISON ON THE FIBERS:

Thus the hood made up of fiber composite are under analytically tested and the test results are displayed below: 3.7.1

COMBINATION OF BASALT WITH EGLASS:

Results taken for Equivalent von-Mises Stress(a) and Strain(b) and Total Deformation(c)

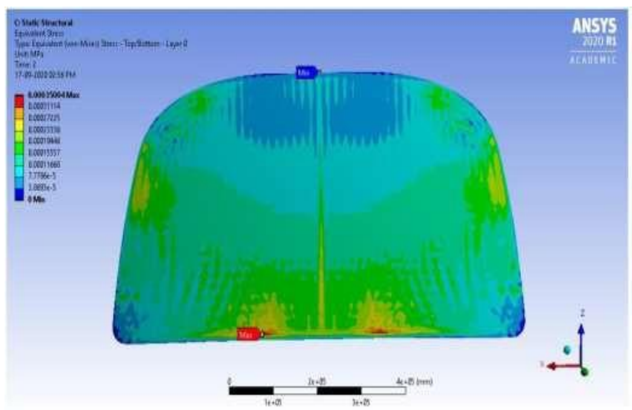

Fig 3.7.1.1 Equivalent von-Mises Stress(a)

The figure 3.7.1.1 shows the image of the Equivalent von-Mises Stress (a)

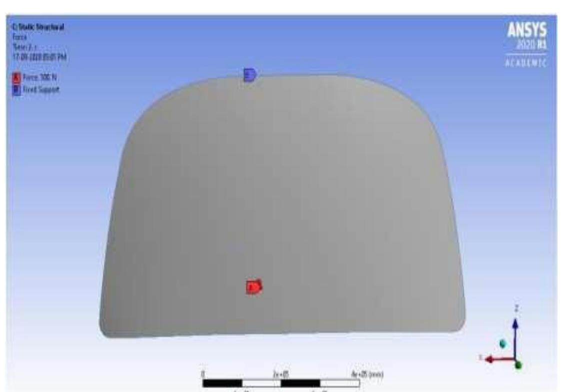

Fig 3.7.1.2 Equivalent von-Mises Strain(b)

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The figure 3.7.1.2 shows the image of the Equivalent von-Mises Strain (b)

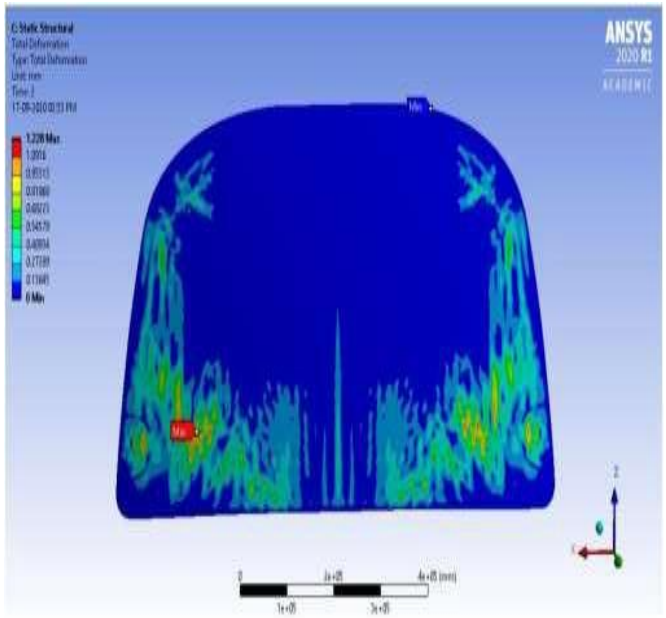
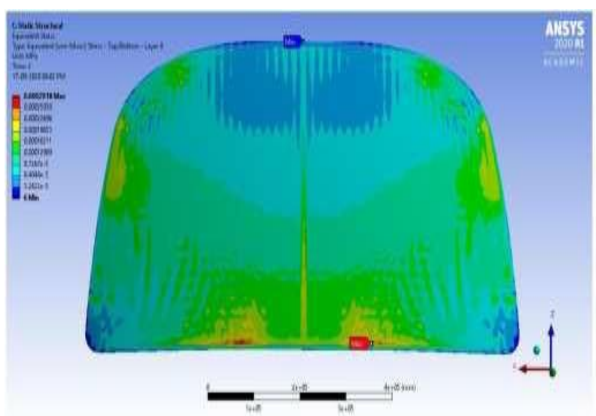


Fig 3.7.1.2 Total Deformation(c)



The figure 3.7.1.2 shows the image of the Total Deformation(c)

COMBINATION OF KEVLAR WITH EGLASS:

Results taken for Equivalent von-Mises Stress(a) and Strain(b) and Total Deformation(c)

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COMBINATION OF KEVLAR WITH BASALT:

Results taken for Equivalent von-Mises Stress(a) and Strain(b) and Total Deformation(c)

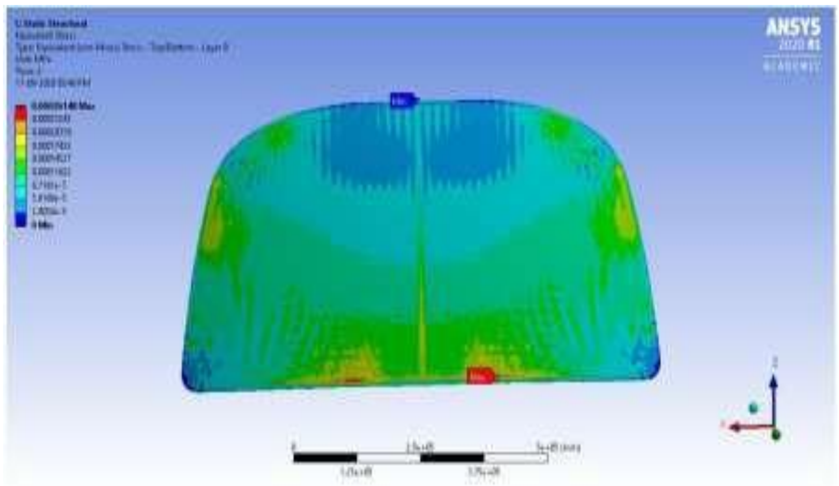
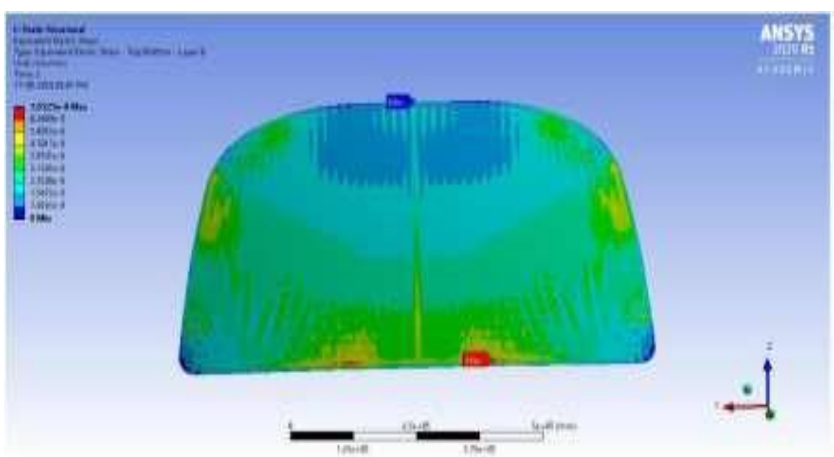


Fig 3.7.3.1 Equivalent von-Mises Stress(a)

The figure 3.7.3.1 shows the image of the Equivalent von-Mises Stress (a) Fig 3.7.3.2Equivalent von-Mises Strain(b)



The figure 3.7.3.2 shows the image of the Equivalent von-Mises Strain (b)

Fig 3.7.3.3 Total Deformation(c)

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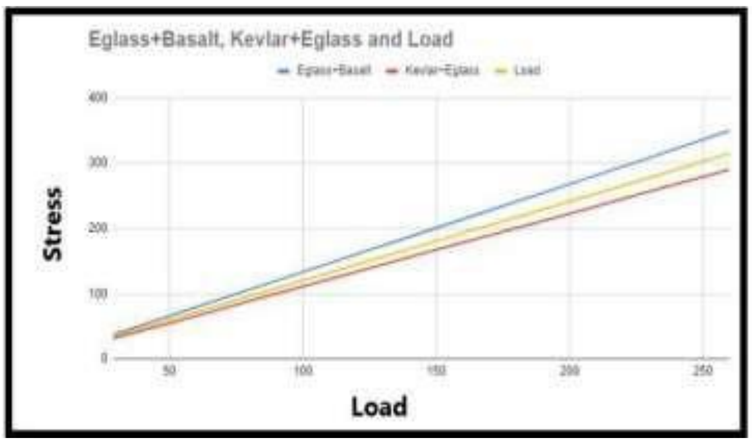
The figure 3.7.3.3 shows the image of the Total Deformation(c) International Journal of Research in Mechanical, Mechatronics and Automobile Engineering (IJRMMAE)Volume 4 Issue 2– July - Sep 2018 www.ijrmmae.in–Pages 1-9

4. RESULT:

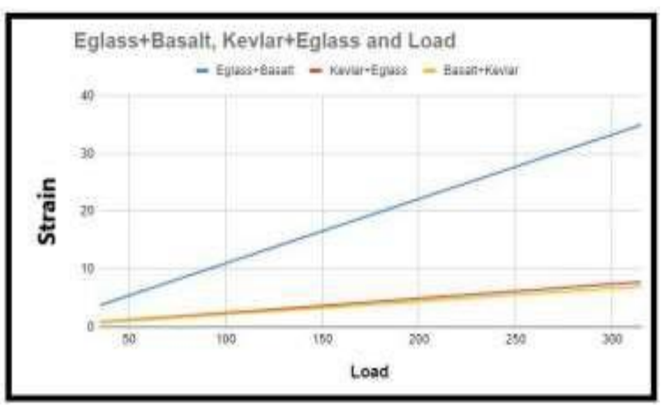
From the above obtained results, the graph was plotted between Stress vs Load, Strain vs Load and Deformation vs Load.

Graph 4.1 Stress vs Load



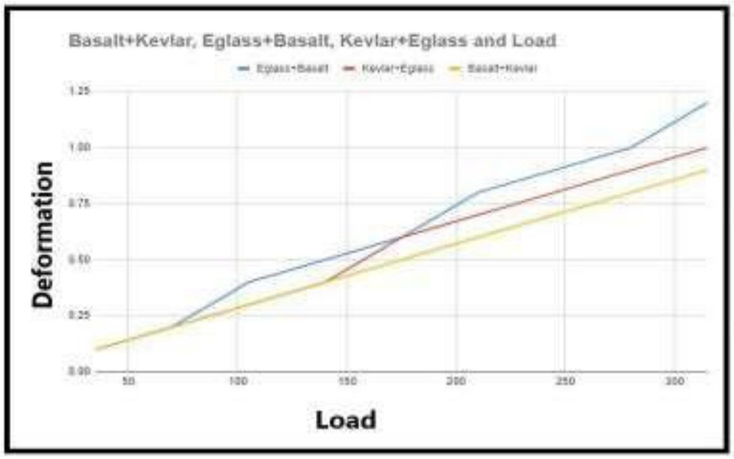
The graph 4.1 shows the image of the Stress vs Load.

Graph 4.2 Strain vs Load



The graph 4.2 shows the image of the Strain vs Load

Graph 4.3 Deformation vs Load



The graph 4.3 shows the image of the Deformation vs Load

CONCLUSION

The synthetic fibers have been successfully reinforced with the epoxy resin by simple hand lay-up technique. The aim of this project is to find the tensile, compression, flexural, impact strength and hardness of hybrid fibre reinforced composite material (HFRCM).The synthetic fibers like Electrical grade glass fiber, kevlar, basalt fibers are successfully used to fabricate the HFRCM. The new hybrid composite Bonnet produced with synthetic fibers reinforcement gives good mechanical properties as compared with Stainless Steel and Aluminium Bonnet. The hybrid composite can be used in aerospace, defense and automobile applications. In the present work, the hybrid composite with multiple synthetic fibers such as Kevlar, basalt, alkaline resistance glass fibres and additionally the aluminium laminate have been successfully reinforced with the epoxy resin by simple and inexpensive hand lay-up technique. The mechanical testing results of fabricated HFRCM indicate that, concept of using multiple synthetic fibers is viable for many applications. However, there is a scope to optimize the volume fraction of synthetic fibers as reinforcements to achieve enhanced mechanical properties of material. So, it is clearly indicates that reinforcement of synthetic fibers have good and comparable mechanical properties as conventional composite materials.Thus the comparison among the three different combination were made, we can infer that Kevlar with Basalt combination will be the suitable to replace the Car bonnet model which we took for our analysis.

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