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Design and Analysis of Composite Material for Automobile Bumper Application

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ABSTRACT: Now a day's to manufacturing of parts with reduced weight is challenging for industry, that's why we are trying to manufacturing such material which gives us high strength to weight ratio. This can be achieved by composite material which has better properties. Selective composite materials and its composition are Kevlar (0.8%) and carbon fiber (2.0%). Material with different structure is also important while increasing the material properties like high strength to weight ratio, rigidity etc. After analysis of different structures, honeycomb structure gives better result. Therefore, manufacturing of specimen according to standard dimensions by using honeycomb structure is always gives better result than the other structure. Results are obtained for compressive, tensile and Impact test.

KEYWORDS: Kevlar, carbon fiber, S/W ratio, composite, structures.

I. INTRODUCTION

The materials are made up from combination of two or more material is called as composite materials. Composite material gives different chemical and physical properties than the individual material and light weight, high strength, stiffness properties. Properties of composite material are depending upon composition of material, type of fiber and its quantity. Composite materials have significant properties like high strength to weight ratio, high strength and low weight that's why composite materials are used in industries for different purposes. Selection of composition for material is also valuable part of composite part manufacturing. Carbon fiber and Kevlar has better properties than the others so that composite material with carbon fiber and Kevlar is a perfect combination to reduce weight, increase strength etc. Selective composition for composite materials is carbon fiber (2.0%) and Kevlar (0.8%). By using these compositions, we can manufacture the light weight bumper with high strength. Structure is very important for manufacturing specimen with this composition. Different structures are used for manufacturing of the specimen like rectangular, circular and Honeycomb. After analysis of above structures, analysis gives better results for Honeycomb structure. Honeycomb structure can be man-made or natural structure that have internal geometry of honeycomb gives minimal weight and minimal material cost.

II. ANALYSIS OF STRUCTURES

2.1 Analysis of Honeycomb structure:

It can be constructed with honeycomb as core can be effective means of absorbing impact in different application. It exhibits high passion ratio than other structures, also it has light weight and high stiffness.

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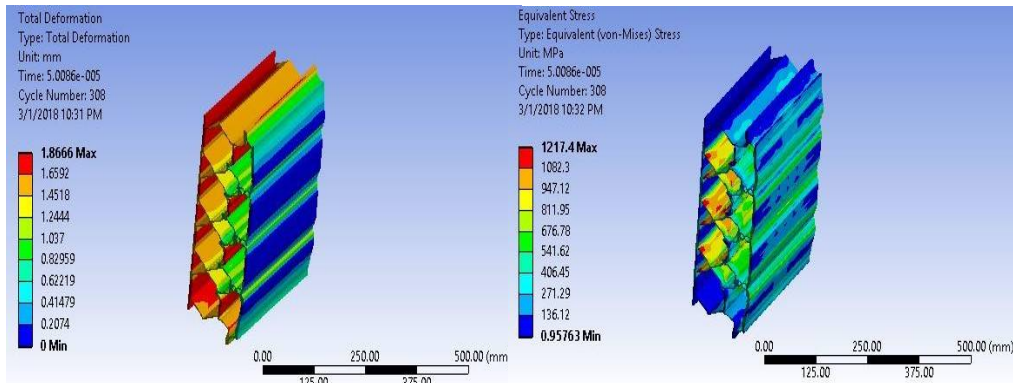


Figure 1 Analysis of Honeycomb structure.

2.2. Analysis of Round structure

The energy absorption capacity is less as compare to other structure, hence it increasing problem like more damage to system as well operators, hence strength of structure is very less.

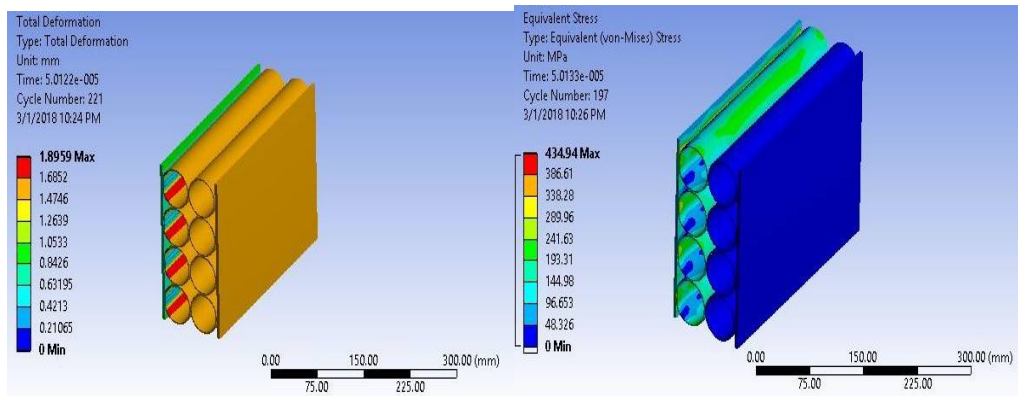


Figure 2 Analysis of Round structure.

2.3 Analysis of Square structure:

This structure absorbs more energy as compare to Round and less as compare to the Honeycomb structure.

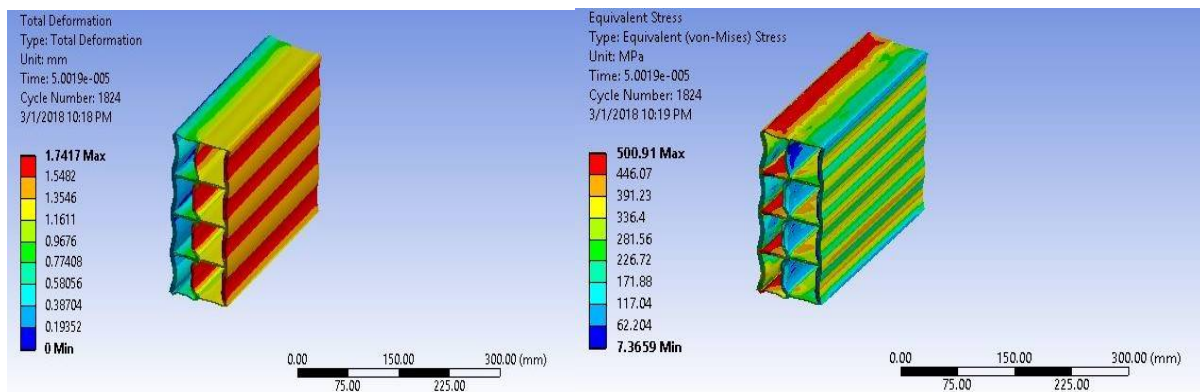


Figure 3 Analysis of Square structure.

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From analysis result we know the better structure for composite manufacturing is the Honeycomb structure, hence we have manufacturing specimen with the honeycomb structure.

III. MANUFACTURING PROCESS (HAND LAY-UP)

It is one of the oldest methods used to manufacture composite product. It does not require any kind of machinery and technical skills. It is easily handle by labor i.e. no requirement of skill labor. It is low volume process used to manufacture both small and large component. In this process single cavity mold of fiber glass composite are generally used. It can range from small to large and are low cost in spectrum of composite molds. Firstly, the gel coat is applied on the mold to avoid the sticking of polymer to the mold. Thin plastic plates are used at the top and at bottom to achieve the fine surface finishing of component. Reinforcement used in this process is carbon fiber and it is in the form of woven mats and it is cut as per the size of the mold i.e. the size of components and then it is placed in the mold. Then the Kevlar in the liquid form is mixed or poured onto the surface of mat of carbon fiber which is already placed in the mold. Amount of Kevlar used is based on component and the amount of carbon fiber used, 0.8% of Kevlar is suitable for the 2.0% of carbon fiber and it improves the strengths and reduces the cost. After this the layer of carbon fiber in the form of mat is applied over the Kevlar and the roller is moved over the surface of both Kevlar and carbon fiber with the suitable pressure to get the desired shape. Then this process is of adding layer by layer of carbon fiber and Kevlar is repeated until the suitable thickness or component gets stacked into the molds. Then the various types of pigments are added over the surfaces and desired color is obtained. After this the gel is released from the top side and it is exposed to the air for drying purposes. Time required for drying is known as the curing time and it is depends upon material used or reinforcement used and polymer used in the process.



Figure 4. Manufacture Specimen.

Specimen is manufacturing for carried out test is shown in figure. The tests carried out are tensile, bending and impact test. The results obtained by the test are shown in figure below.

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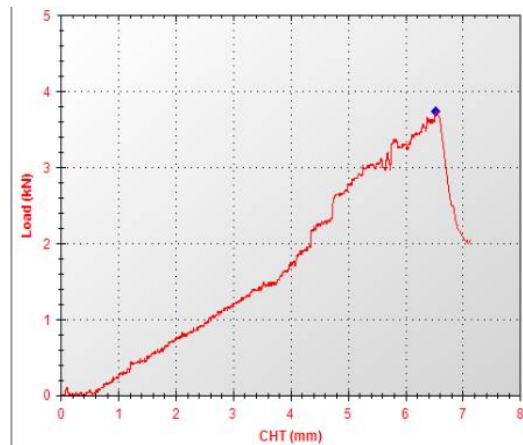
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IV. TESTING OF SPECIMEN

4.1. Bending test

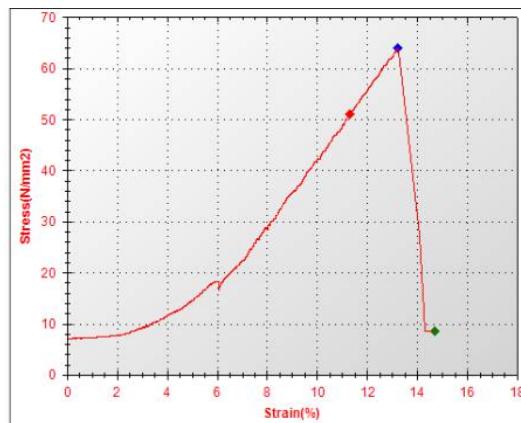


The above graph is plotted load versus CHT. The graph shows CHT increases with increase in load up to a certain limit and then suddenly falls down. The color point shows maximum bending strength of the specimen while the start point shows the minimum bending strength of specimen.

From the test the results are as follows:

- ❖ Load at peak: 3460N
- ❖ Bending strength: 175.33 Mpa
- ❖ Specimen standard: 40*10*125

4.2. Tension test



The above graph is plotted stress versus strain. The graph shows stress increases with increase in strain up to a certain limit and then suddenly falls down. The color point shows maximum stress of the specimen while the start point shows the minimum stress of specimen. The red point shows the specimen start elongating.

From the test the results are as follows:

- ❖ Load at peak: 41500N
- ❖ Tensile strength: 63.83 Mpa
- ❖ Specimen standard: 65*10*100

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4.3. Impact test:

- ❖ The impact strength of specimen is 120 J

V. CONCLUSION & FUTURE SCOPE.

It is used in industry and products to reduce their weight and increase strength effectively. Honeycomb structure has more strength than circular and rectangular structures. We Conclude that the composition of 2% C and 0.8% K gives better result than the other two composition. Honeycomb structure gives most stress resistant. We can achieve high strength to weight ration.

Future Scope

- ❖ Because of best construction capability and also resist the vibration and absorb the shock it will widely use in automotive bumper.
- ❖ Various parts of automobile and aerospace are manufactured by composites material due to its various properties.
- ❖ Composite materials have great potentiality of application in structure subjected primarily to compressive load.
- ❖ Composite materials are attractive aspect like the relatively high compressive density.
- ❖ The composite material has wide advantages and applications in various industries; we can make batter life style with the help of composite material.

REFERENCES

- [1] N.Tanlak, F.O.SOnmez, M.Senaltun, "Shape optimization of bumper beam under high velocity impact" vol.95 page 49-60 (2015).
- [2] Yunho Kim, Chunghyeon Choi, Sarath Kumar, Sathish Kumar, Chun-gun Kim, "Hypervelocity impact on flexible curable composite and pure fabric layer bumper for inflatable space structure", vol.176,page 1061-1072 (2017).
- [3] Dubem Ezekwem., "Composite materials literature review for car bumper" page 1-7 (2016).
- [4]S. Prabhakaran, K. Chinnarasu, M. Kumar, "Design and fabrication of composite bumper for light passenger vehicles" ,vol.2.(2012).
- [5] P. Kumar, S. Belagali, Bhaskar, " comparative study of automotive bumper with different materials for passenger safety" ,vol.11,(2014).
- [6] Ayyappa Swamy GV, P Satish Reddy, Matta Manoj, P.Bhaskar , "Impact Analysis of A Car Bumper Using Carbon Fiber Reinforced PEI And S2 Glass/Epoxy Materials By Solid Works Software" , Vol. 2, page 565-568.(2014).
- [7] Vysyaraju Neelima, J.Bala Bhaskara Rao, K.Viswatej, M.Tech, "Design and Analysis of Bumper Beam with Composite Materials" , vol. 3 , Page 253- 257. (2016).
- [8] Alen John, Sanu alex, "A review on the composite material used for Automotive bumper in passenger vehicles", vol.4. page no.98-101.(2014).
- [9]Alen john, Nidhi M.B., "Modeling and Analysis of an automotive bumper used for low passenger vehicle", vol.15.page no.344-353.(2014).
- [10] Tie Wang, Yonggang Li, "Design and analysis of automotive carbon fiber composite bumper beam based on finite element analysis", vol.7.page1-12.(2015).