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Manufacturing of Radiator Mounting Bracket using Composite Material

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Abstract - *Now a days highly important research is going in this modern world is the reduction of weight while increasing or maintaining strength of products.*

This paper describes manufacturing of radiator mounting brackets using composite material. The objective also aims to compare the strength and weight reduction of composite mounting brackets with that of conventional steel mounting brackets .The automobile industry also shows great interest due to this not only saves nature's resource of metal but also offers better performance with reduction in weight. In replacement of steel mounting radiator bracket with that of composite bracket. since the composite material has a high strength to Weight ratio, corrosion resistances .

***Key Words*: Radiator mounting bracket, Hand Lay-Up, Testing, Weight Reduction, Carbon fibre ,Glass fibre Reinforced Plastic.**

1. INTRODUCTION

Today, Composites are used in a wide variety of markets, including aerospace, architecture, automotive, energy, infrastructure, marine, military, and sports and recreation .A composite material is a material made from two or more constituent materials with significantly different physical or chemical properties that, when combined, produce a material with characteristics different from the individual components. Through this project we desire to develop a composite that will be a substitute to most of the automobile components, primarily to the radiator mounting bracket.

The polymer matrix composite is the major material which is used in this application due to its high strength and lightweight properties. , the use of composite materials has increased to a great extent Of all the different composite materials used to manufacture automobile components, PMC is the most widely used, as polymer composites can directly reduce the weight of a vehicle body and chassis by up to 50%, which subsequently reduces the vehicle's fuel consumption.Carbon fiber has been used in high-performance vehicles for many years, and now new high-speed manufacturing technology is allowing carbon fiber to move into production vehicles. The durability of composite materials is also quite impressive. Composite materials include some of the most advanced engineering materials today. The addition of high strength fibers to a polymer matrix can greatly improve mechanical properties such as ultimate tensile strength, flexural modulus, and temperature resistance. Lightweight materials play an important role in the automotive industry. In fact, the use of these materials is estimated to grow from 30% to 70% in the upcoming years . This is because even a 10% decrease in vehicle weight reduces fuel consumption by roughly 6%, which in turn results in reduced CO_2 emissions.

One of the main attractions to composite materials is that they're extremely lightweight, 30% lighter than aluminum and 25% the weight of steel. . This strength extends to their ability to resist damage from corrosion from chemicals such as acid rain that would otherwise damage alternative metals.

2. LITERATURE REVIEW

[1] A.R. Jaware, DR. K.B. Kale**, studied** weight reduction for compressor mounting bracket using composite material. weight abridgement is not alone about the raw material cost, but as well as increase the efficiency. [2]Kulkarni vipul V., Prof. Ghodke Arvind P.they studied the running inconvenient weight and weight to strength ratio of the components of vehicle as weight directly affects on mileage and running cost so they replace the current material by low weight material.they design the axle shaft and manufactured by glass fiber and epoxy resin.[3] Prof. Dr. Santosh G. Taji, Prof. Prabhuling G. Sarasambi,studied the intends to analyse the the bracket and optimize the weight .they designed glass fiber bracket using the design of experiments and analysed in ansys. [5]Senthilkumar Mouleeswaran.He deals with a 7-leaf steel spring used in a passenger car is replaced with a composite multi leaf spring made of glass/epoxy composites.There primary objective is to compare their load carrying capacity ,stiffness and weight saving of composite leaf spring. [6]Sang-Young Kim ,Chun sik Shim,Dave Kim, they investigate the mechanical properties and failure mechanism of the hybrid GFRP composites formed by applying the hand lay up processed exterior and vacuum infusion processed interior layups providing benefits for structural performance and ease of manufacturing.

3. Manufacturing Process

There are three types of composite manufacturing processes: open molding, closed molding and cast polymer molding. There are a variety of processing methods within these molding categories, each with its own benefits.

- Lay-up Process
- Compression Molding Process
- Resin Transfer Molding (RTM) Process
- Filament Winding Process
- Injection Molding Process
- Pultrusion Process
- Vacuum Infusion

3.1 Manufacturing method used

Hand layup method

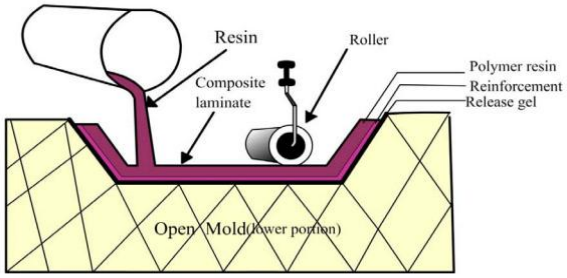

fig.; 1 Hand-layup method.

Hand lay-up is a molding process where fiber reinforcements are placed by hand then wet with resin. The process consists of building up or placing layers of composite fiber in a sequenced layup using a matrix of resin and hardener. In this lab, the we will fabricate by a sequenced two layer layup of composite material using epoxy resin as matrix and fiberglass woven cloth as reinforcement.

The samples are prepared by respecting some steps. First of all, the mold surface is treated by release antiadhesive agent to avoid the sticking of polymer to the surface. Then, a thin plastic sheet is applied at the top and bottom of the mold plate to get a smooth surface of the product. The layers of woven reinforcement are cut to required shapes and placed on the surface of the mold. Thus, as previously mentioned, the resin mixed with other ingredients and infused onto the surface of reinforcement already positioned in the mold using a help brush to uniformly spread it. And then the other mats are placed on the preceding polymer layer and pressured using a roller to remove any trapped air bubbles and the excess of polymer as well. The mold is then closed and pressure is released to obtain a single mat. After curing at room temperature, the mold is opened and the woven composite is removed from the mold surface.

4. Existing Radiator mounting bracket

This bracket is made up of alloy steel, used in Tata Indica cars usually there are 3 brackets used for mounting the radiator.

fig.2 Original components

5. Manufacturing of wooden patterns.

Fig.:3 wooden block

Hand layup method requires the pattern above which is placing layers of composite fiber in a sequenced layup using a matrix of resin and hardener.So first we measured the dimensions of original component with the help of vernier caliper. Then drew a component on paper, then marked dimensions with pencil on rectangular wooden block. Then cut the block using a carpentry tool, circular saw into the required dimension.

5.1 Materials that are required for manufacturing of components

1) Hand glose (Rubber glose)
2) Tesco
3) Brushes
4) Masks
5) Transparent papers
6) Wooden pattern (block)
7) Resin & hardener

6. Procedure that we are adopted for making the component is as follows:

A) For a glass fiber component

1] Manufacturing method – Hand layup method.

2] 1st we take the wooden block, on that block, with the help of tesko we try to stick the transparent paper for good finishing.

3] After that we make the solution of the resin and hardener by mixing it together in proportion.

For glass fiber component we use polyester as resin and the composition of resin & hardener is 80: 20 (i.e 80% polyester and 20% hardener.)

4] Then we cut the glass fiber in proper dimension we cut around 12 pieces of this materials

5] After that we started to apply the solution of resin and hardener on the 1st layer with the help of a brush.

6] Then layer by layer we add the pieces on top of each other.

7] Around 12 pieces we used for that making of component

8] After finishing all this we add another transparent paper on top similar reason ie. For good finishing.

9] Then we put some weight on it. For proper holding purpose.

10] Then allow it for some time around 6.7 hours for proper drying.

11) Finally we get the required component, of thickness 5mm.

Fig.4 radiator mounting bracket made up of GFRP material

B) For carbon fiber component

1] Manufacturing method – Hand layup method.

2) Here also the procedure is the same as that it is made in the previous component.

3) But here for carbon fiber the resin used is epoxy and the composition of resin & hardener.

i.e 50% epoxy & 50% hardener.

4) Here around 10 pieces we used for that making of components.

5) The rest procedure is the same as that used in making the previous component.

6) The final product we get from thickness upto 2.5 to 3mm.

Fig.5 carbon fibre component.

6.2. Machining operations performed:

After completing the final product we did some cutting and machining operation.

1) Cutting and filing :

Initially we mark on the component with the help of markers as per our drawing .After that, in our department workshop we cut our job as per drawing .With the help of hacksaw we cut the job, After that filing is done on the particular surface of the component for smoothing & finishing purposes.

2) Drilling operation:

After cutting and filing the next process is machining i.e. carried out the drilling operation.

At the base, 3 holes of 6mm diameter are to be drilled as per position & on the top surface there is 1 hole of 23mm diameter is drilled.

After the drilling & cutting operation, we clearly noticed that the component which is manufactured by us, is having a good strength ,toughness as similar to original component because the machining (i.e. drilling) is easily carried out.

7. Testing of the GFRP material:

We were manufactured the strips or plates of GFRP material as well as the carbon fiber material for the tensile and compressive testing on UTM machine.

Fig.6 GFRP material strip before tensile testing

Fig.7 GFRP material strip after tensile testing.

Fig.8: GFRP Specimen for compressive testing

Fig.8 Strip loaded on UTM machine for Tensile and compressive testing.

8. Result and Discussion:

SR. N0	MATERIAL	Weight (grams)	% Reduction in weight
1	Alloy steel (Existing material)	88	0
2	Glass fiber Reinforced plastic (GFRP)	51	42.04%
3	Carbon Fibre	29	67.04%

Table.1 Results of % reduction in weight.

Material	Tensile strength (Mpa)	Compressive strength (Mpa)
Glass fibre Reinforced plastic(GFRP)	83	142.76

Table.2 Strength

9. CONCLUSIONS

From this project we studied how to manufacture the components from composite materials through the Hand-Layup method. we realise that composite materials have somewhat similar strength as that of engg. metals (i.e steel, alloy steel, mild steel etc).

The existing radiator mounting bracket of alloy steel had 88gm weight when Utilizing the Glass fibre reinforced plastic (GFRP) material for a similar application section weighs 51 gm. Which is 42.05% less weight than the alloy steel.Similarly we tried another composite material i.e carbon fiber, we made a mounting bracket of this material which weights 29 gm. Which is also 66.02% less weight than alloy steel.

REFERENCES

[1] Abhishek R. Jaware, Dr. K.B. Kale, Vibration Analysis and Weight Reduction for Compressor Mounting Bracket Using Composite Material, International Research Journal of Engineering and Technology (IRJET), ISSN: 2395-0056, 2018.

[2] Kulkarni vipul V., Prof. Ghodke Arvind P. Design,Analysis And Manufacturing Of Axle Shaft By Alternate Material.International Journal Of research-Granthalayah ISSN-2350-0530(O),ISSN-2394-3629(P).

[3] Prof. Dr. Santosh G. Taji, Prof. Prabhuling G. Sarasambi, Design and Analysis of AC Mounting Bracket Using Composite Material, IJSART, ISSN: 2395-1052, 2017.

[4] Shishay Amare Gebremeskel. Design, simulations, and prototyping of single composite Leaf Spring for Light Weight Vehicles. Global Journal of Researches in Engineering Mechanical and Mechanics Engineering Volume 12, Issue 7, Version 1.0, Year 2012.

[5] Senthilkumar Mouleeswaran. Design, Manufacturing and Testing of Polymer Composite Multi-Leaf Spring for Light Passenger Automobiles - A Review. www.intechopen.com.

[6] Sang-Young Kim, Chun sik Shim, Dave Kim, Mechanical properties and production quality of hand lay-up and vaccume infusion processed hybrid composite material for GFRP marine structure.IJNAOE-2013-0208. pISSN:2092-6782,eISSN:2092-6790.