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A Review of Comparative Analysis of Bamboo Fiber Reinforced Glassfiber Leaf Spring with Conventional Leafspring

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Abstract: ***Leafspring is one of the oldest and most effective suspension systems. Today it can be seen used in all heavy commercial vehicles the leaf spring used conventionally was made up of plain carbon steel, silicon manganese steel etc. but as steel is heavy it increases the overall weight of vehicles and decreases its performance, but nowadays after the advent of composites many researchers are trying to replace conventional leafspring with new composite leafsprings which are light in weight. In our project we are trying to compare and analyse two such composite material made up of bamboo fiber reinforced with s-glassfiber and bamboo fiber reinforced with e-glass fiber using epoxy resin matrix with conventional leafspring.***
Keywords: Bamboo fiber ,s-glass fiber, e-glass fiber, leafspring, epoxy resin

I. INTRODUCTION

The origin of leaf spring can be traced back to year 1804 when Obdiah Elliot used it as a suspension system in horse drawn cart. Even today it is one of the most successful system as they can be seen in almost all heavy vehicle, but one disadvantage it carries is that these leaf spring are made conventionally from plain carbon steel or other varities of steel which increases vehicles overall weight hence compromises the performance of vehicle. As the world is heading toward new high efficiency light weight automobiles replacement of conventional leafsprings with new light weight but highly efficient composite materials such as fiber reinforced plastics seems to be possible. Fiber reinforced plastic is a composite material made up of a polymer matrix reinforced with fibers, the fibers can be natural fiber or artificial fibers , also if we use glass fiber to reinforce natural fibers it is called as Glass fiber reinforced plastics or GFRP materials . Leafsprings are designed using bending beam equations , High fatigue resistance is one the most desired properties of leafspring, since they carry the entire load of vehicle and experience dynamic load under various driving conditions

II. OBJECTIVE

The objective of project is to make two separate leaf of leafspring of two composite material i.e bamboo-s glass fiber and bamboo-e glass fiber and then compare and analyse different properties with respect to single conventional stemel leaf of a leafspring.

III.METHODOLOGY

The method used for manufacturing composites will be manual layup method, here bamboo fibers will be treated with 1perc.NAOH solution for 12 hrs. and then dried in sun, Then in a die fibers will be placed in die and reinforced with glass fiber then epoxy resin will be applied which will be kept for 24 hrs. After that various tests such as tensile test, hardness test etc. will be conducted and comparative analysis with conventional leafspring will be performed and results will be shown in form of graphs.

IV.LITERATURE REVIEW

1) T.Keerthi vasan, S.M.Shibi, C.K. Tamilselvan in their research paper titled *"Fabrication and testing of composite leafspring using carbon, glass and Aramid fiber"* carried out their research inorder to reduce weight of leafspring using composite material like Glass, Carbon and Aramid fibers with epoxy resin. The different specimen were prepared using manual layup method, they are then taken up for flexural, tensile and impact test.
2) Nishant Varma, Ravi Ahuja, T.Vijayakumar, C.kannan in their research paper *"design and analysis of composite mono leafspring for passenger cars"* investigated the suitability of of hybrid composite spring which incorporates carbon and flax fibers as primary and secondary reinforcements respectively. In their research they found out that incorporation of flax layers in between carbon fibers increased the factor of safety and strain energy owing to its high damping properties, as well as natural frequency of composite leafspring was found out to be 93percent more than steel.

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3) Fabian Becker, Christian Hopmann, Francesco Italiano, Alberto Girelli in their research paper "*Fatigue testing of GFRP materials for application in automotive leafsprings*" used unidirectional E-glass fiber reinforced epoxy composite leaf spring and carried out three point bending experiment , as the aim of their work is to develop a simplified testing program that is able to reproduce the damage and the fatigue behavior which occurs in real composite components since the loading of the real component introduces additional transverse stresses in the region of the clamping group, the results on specimen level are not transferable to component level. For this purpose, a special clamping group is developed on specimen level to enable a better prediction of fatigue life and transferability of results of fatigue tests to component level .as a result of this research a higher safety margin in design phase of such component and less testing time is achieved.

4) Chirag D.Bhatt, Mukesh Nadarajan,R.Balaji,Isukapalli Rohith, Ashish Selokar in their research paper titled "*leafspring model for heavy load vehicle using solidworks and ANSYS analysis"*, carried out their analysis on leafspring 3D model made up of FRP, superbainite, Titanium alloy and structural steel in solid works and analysis was carried out using ansys software. Here it is ensued that the FRP leaf spring is light-weighted and stronger material. It is also highly economical compared to other materials with same design specifications. The weight reduction of the leaf spring was made possible due to the utilization of composite and alloy materials, without any decline on load carrying capacity and stiffness. This is also due to the high normal elastic strain and high strength-to-weight ratio of these composite and new variety of steel materials. It is also observed that the Super Bainite shows high deflection and strain energy than that of other materials such as stainless steel. Though its total deformation is slightly higher, FRP composite as well as the Super Bainitic Steel gave similar outcomes during analysis. The Titanium Alloy showed a lesser but a good out-turns, compared with these three materials.

5) Vikas Khatkar , B.K.Behera, R.N.Manjunath in their research paper titled "*Textile structural composites for automotive leafspring application"* used textile structural reinforced composites prepared by different textile like structures as reinforcement in epoxy by employing vacuum assisted resin infusion molding process .The textile structures used in form E-glass unidirectional tow, bi directional plain woven fabric and 3D woven orthogonal fabric. Here influence of reinforcement architecture on the static and dynamic mechanical performance of composites were investigated for their applicability in automotive leafspring compared to conventional steel. TSRC were analyzed for mechanical properties like tensile strength, flexural strength , izod impact test , also damping and wear behavior was also investigated to know their applicability as leaf spring material. Mechanical performance of 3D woven based composite leafspring was found better than UD and 2D counterparts.

6) S.Rajesh, G.B.Bhaskar, J.Venkatachalam, K.Pazhanivel and Suresh Sagadevan in their research paper titled "*Performance of leaf spring made of composite material subjected to low frequency impact loading"* checked the possibility of replacing existing conventional steel leaf spring by leaf spring made by tailoring the layup of composite laminates .here leaf springs of composites of different layups with glass and carbon fiber were fabricated and tested for flexural response. By using UTM, load per deflection and maximum load for each of composite leaf spring was evaluated, also the specimen was subjected to low frequency impact loading. The experimental results indicated composite with glass fiber at starting and carbon fiber at the end gave superior flexure response compared with conventional leafspring.

7) Sudhakar behera, Dr Naresh Prasad, Sandip kumar in their research paper titled "*study of mechanical properties of bamboo fibers before and after alkali treatment"* proved that bamboo fibers treated with 4% NAOH have highest optimum tensile strength , while treated fiber show decrease in impact strength.

8) K.Vijayakumar, A.Arul Marcel Moshi, j. Selwin Rajadurai in their research paper "*Mechanical property analysis on bamboo-glass fiber reinforced hybrid composite structures under different lamina orders* "used hybrid composite laminates in 5 different orientations (B/B/B/B, B/G/B/B,G/B/G/B,G/B/G/G and G/G/G/G) using compression moulding machine and were subjected to various strength tests , the strength values of these 5 specimen were compared for choosing the better combination of hybrid composite structure exhibiting high strength.

9) Siew choo chin, kong fah tee, foo sheng tong, huei rui ong, jolius gimbun in their research paper titled "Thermal and Mechanical properties of bamboo fiber reinforced composites",here The bamboo fibers were prepared through chemical treatment by sodium hydroxide (NaOH) followed by physical milling method. The thermal characteristics of the bamboo fiber and its polymer composite were analysed using a thermogravimetric analysis and differential scanning calorimetric. The functional groups and crystallinity of the fiber were analysed with Fourier transform infrared and x-ray diffraction spectroscopy. Meanwhile, the fiber morphology was examined using a scanning electron microscope. The BFRCs with fiber volume fractions ranging from 0% to 40% embedded in three thermoset resins (epoxy, polyester, vinyl ester) were subjected to tensile and flexural tests and the fracture pattern was examined. The NaOH concentration of 10% with soaking duration of 48

hours was found to produce a bamboo fiber with the highest ultimate tensile and modulus strength. The tensile and flexural properties of all the BFRCs were found to be directly proportional to the fiber volume fractions. It was found that the bamboo fiber reinforced epoxy composite (BFREC) with 40% fiber volume fraction exhibited the highest tensile and flexural strength compared to polyester and vinyl ester composites.

10) M. Jawaid ,Sameer Awad,H. fouad,M.ASIM,N.Saba,Hom N. Dhakal in their research paper titled "improvements in thermal behavior of Date palm/bamboo fibres reinforced epoxy hybrid composites" represented the results of thermal, dynamic mechanical, and thermal mechanical properties of date palm fiber(DPF)/bamboo fiber(BF) hybrid compared to bamboo fiber reinforced epoxy composite to demonstrate the importance of hybridization .the thermal stability was improved when DPF/BF fillers were added in epoxy resin comparatively BF reinforced epoxy . the glass transition temperature was increased incorporating the date palm fiber/bamboo hybrid fiber composite to the BF reinforced epoxy. The thermal expansion was enhanced by modifying hybrid composites in epoxy in contrast to single fiber composites without hybridization .here it is seen that hybridization technique of DPF with bamboo has improved the thermal and thermal mechanical properties suitable for several applications including non structural application

V. CONCLUSIONS

Various studies are being carried out in order to replace conventional leafsprings with polymer composites using aramid fibers , bamboo fibers , glass fibers , carbon fibers and other textile fiber etc. .It can be seen in study conducted by sudhakarbehera et al [7] tensile strength of bamboo fibers increase when treated with alkali solution .hence using alkali treated bamboo fibers reinforced with s-glass and e-glass might make an effective composite material .so my objective is to make a comparative analysis between these GFRP material and conventional leaf spring.

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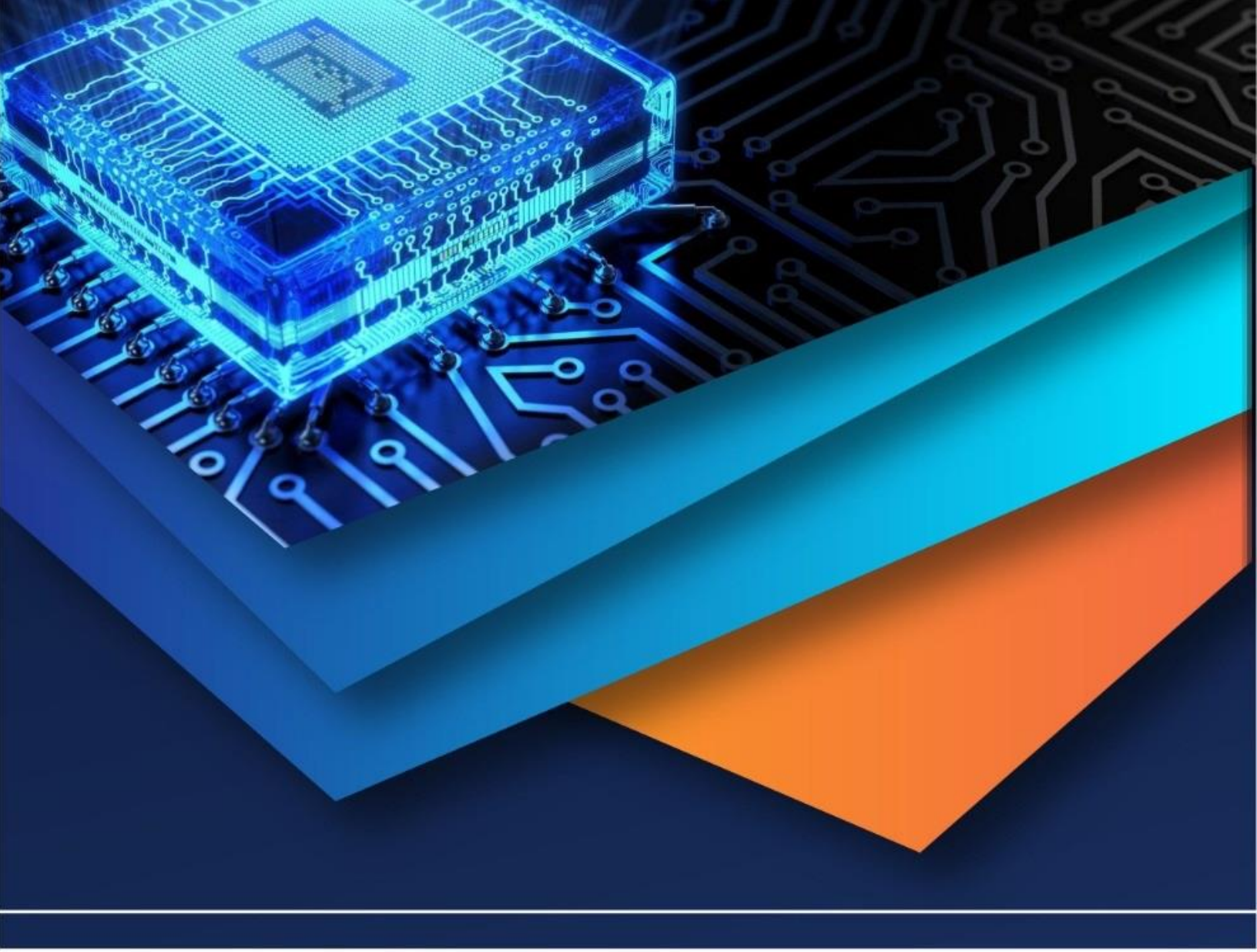
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