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Investigation and Improving the Impact Strength of Hybrid Composites on two Wheeler Side Box

Prasanna S, Mohanraj A
KSR institute for Engineering and Technology,
Tiruchengode

***Abstract*—The composite materials are replacing the traditional materials, because of their superior properties such as high impact strength, to weight ratio. The developments of new materials are on the anvil and are growing day by day. Natural fiber composites such as sisal fiber became more attractive due to their high specific strength, lightweight and biodegradability. Mixing of natural fiber with Glass-Fiber is finding increase in applications. In this project, sisal – glass fiber reinforced epoxy composite is developed and its mechanical properties such as tensile strength and impact strength are evaluated .The results indicated that the incorporation of sisal fiber with glass fiber can improve the physical properties and can be used as an alternate material to glass fiber. The two wheeler side box is currently made of Polypropylene and metallic materials, which increases cost, weight and sometimes it may break due to low impact strength. In this project the experiment is carried out to reduce the cost and weight, and also to increase the impact strength, composites are used to manufacture the two wheeler side box. For high impact strength, hybrid composite with epoxy is used as reinforcement and matrix of the composite. In this work, an attempt has been made to recommend Plastic-free automotive two wheeler side box produced from hybrid composites (glass fiber/ sisal fiber) with epoxy-resin binder to replace plastic (polystyrene) and sheet metal due to their improved physical strength, low cost and eco-friendly nature.**

Keywords- Glass fiber, two wheeler side box, resin.

I. INTRODUCTION

Composite materials are traditionally used in the aerospace industries. These composites have high performance reinforcements of a thin diameter in a matrix material such as epoxy and aluminum. Examples are graphite/epoxy, Kevlar epoxy, and boron/ aluminum composites. These materials have now found applications in commercial industries as well. Composite material are materials 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. The individual components remain separate and distinct within the finished structure. The new material may be preferred for many reasons: common examples include materials which are stronger, lighter or less expensive when compared to traditional materials.

II. LITERATURE REVIEW

Davoodi et al [1] had undergone research on study of Environmental regulations, costs and lightweight encourage car manufacturers to develop new reliable products. Epoxy provides a reliable fiber impregnation and creates substantial three-dimensional (3D) cross linking for proper load transmis- sion and impact strength improvement, but their low toughness decreases their energy absorption. Thermoplastic toughening improves the epoxy impact property with a low thermo- mechanical defect. AmalBadawy et al. [2] had undergone research on study of the impact behavior of glass fibers reinforced polyester (GFRP) was experimentally investigated using notched Izod impact test specimen. The experimental program was carried out on unidirectional laminate of GFRP in directions 0, 45and 90in addition to cross-ply laminates. The effect of fiber volume fraction, Vf% (16%, 23.2% and 34.9%) was considered. Pegoretti et al [3] showed experimentally that it is possible to obtain different delamination strengths within the same laminate by interleaving perforated PET film. In a nanofibrous mat has been interleaved between laminate plies in order to control the interlaminar delamination strength In previous works, the authors tested delamination toughness and identified the cohesive zone properties of nanomats with varying fiber diameter, fiber arrangement (random, aligned), mat thickness. Clamping mode, matrix properties and rein- forcement geometry. Furlotti et al [4] had undergone research on study of composite laminates in modern aircrafts, vehi- cles and other applications are related to their high specific strength and modulus, together with their flexibility in design. Delamination is one of most common failure mechanisms for composite materials. By interleaving a nanofibrous mat between laminate plies it can be possible to control the inter laminar delamination strength.

III. EXPERIMENTAL STRUCTURE AND METHODOLOGY

Two wheeler side box is used in motor cycles for carrying gift items, accessories and other important items.Two wheeler side box materials range from plastic (Polystyrene) and steel.Plastic materials are widely used in two wheeler side box for its low impact strength but, due to health risks, it has been replaced with alternative materials, such as hybrid composite.

IV. SPECIMEN PREPARATION

In order to achieve the high level of mechanical properties in the composite, a good interfacial bonding (wetting) between the dispersed phase and the liquid matrix has to be obtained. Hand layup method is one such simplest and cost effective method to fabricate the composites which has been adopted by the many researchers. This method is most economical to fabricate composites with Glass fiber and sisal fiber with

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Fig. 1. Two wheeler side box

epoxy resin of different wt. % 2- 10% etc. and was used in this work to obtain the as specimens. Specimen of size 100mm in diameter and 10 to 15mm length to be of cast samples and then surface to be grinded. Before fabrication, the test specimens were subjected to various mechanical tests as per ASTM standards. The standards followed are ASTM- D 638-03 for impact test with the test speed of 5 mm/min. Test was carried out using izod impact test machine make. In each case, four specimens were tested to obtain the average value. Impact test specimens of varied volume fractions are shown.Mold used in this work is made of glass of 100 mm _ 10 mm _ 3 mm dimension with beadings. The fabrication of the composite material was carried out through the hand lay-up technique. The top, bottom surfaces of the mold and the walls are coated with remover and allowed to dry. After arranging the fibers uniformly, they were compressed for a few minutes in the mold. Then the compressed form of fibers (glass and epoxy resin) is removed from the mold. The epoxy mixture is then poured over the fiber uniformly and compressed for a curing time of 24 h. Fiber volume fraction of the composite was fixed to 0.4Vf, with in this fiber volume fraction glass fibers volume fraction was varied from 0 to 100%. Glass Fiber specimen is shown in the Figure.

After the impact test, the glass with sisal fiber gives greater strength than that of the glass fiber. Thus glass with sisal fiber is a better replacement for plastic and sheet metal side box.

V. RESULTS FOR IMPACT RESULTS

From the Figure shows observed that glass and sisal fibre combination provide better impact strength then other material. So sisal and glass fiber combination suitable to produce composite side box in a two wheelers.

VI. CONCLUSION

From the literature review it is observed that glass fiber + sisal fibre and epoxy resin is most suited for the manufacturing of two wheeler side box. The Hybrid composites (sisal and glass) was successfully developed using a hand layup method. The hybrid composite samples are fabricated and tested. The hybrid composite are subjected to mechanical testing such as impact test. Based on the results, the following conclusions are drawn. The weight of the product is reduced 50% compared with the existing product. And the cost of the product is reduced to 30.67% as compared with the existing product. The impact strength of the two wheeler side box increased from 35 to 40 J.

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Fig. 2. Fibre Specimen

Fig. 3. Glass Fibre Specimen

TABLE I TEST VALUE

S.No	Specimen	Impact Test Value
1	Glass fiber withepoxy resin	25J
2	Glass fiber andsisal fiber withepoxy resin	35J

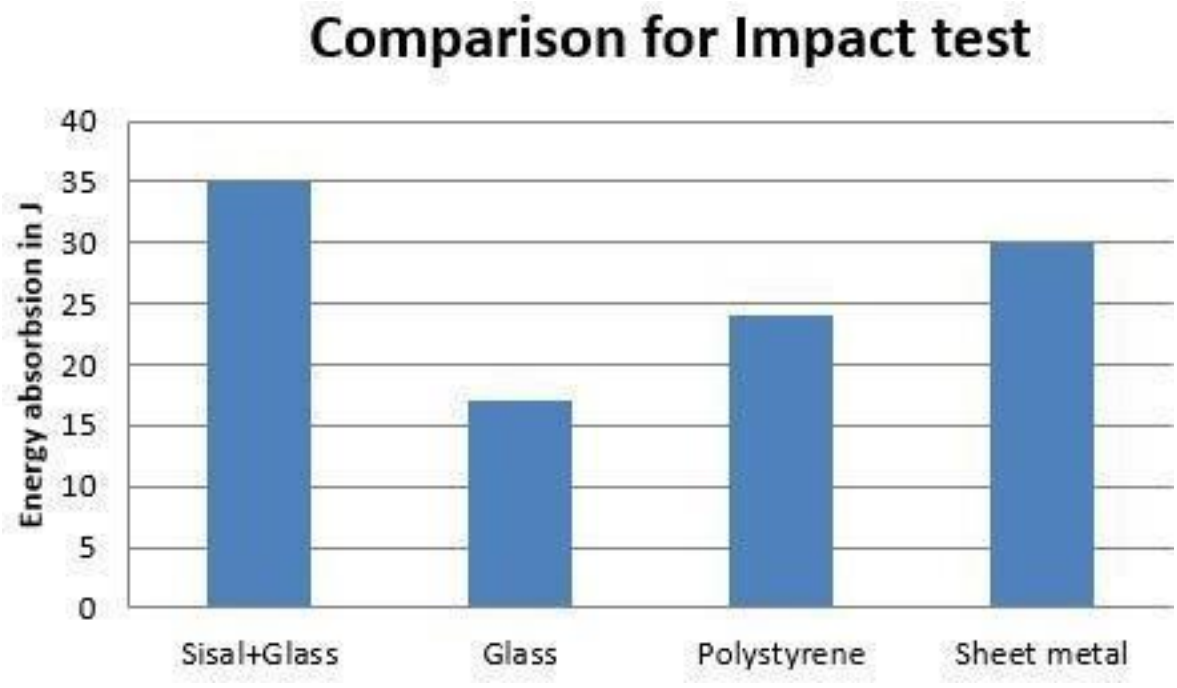

Fig. 4. Impact Test