MAT JOURNALS

Journal of Automation and Automobile Engineering
Volume 3 Issue 1

Protection of Head From Tbi Using Helmet By Improving MaterialProperty With Bamboo

[1]Jawahar K, [1]Rajapandian B, [1]Shanker Gandhi M, [2]Jegadheeswaran S, [3]Boopalan N
[1]UG Student, [2]Professor and Head, [3]Assistant Professor
[1,2,3]Automobile Engineering
[1,2,3]Bannari Amman Institute of Technology Sathyamangalam, Erode, Tamilnadu, India

Abstract

Helmet can protect the passengers from the road accidents. There are more than 1 lakh peoples die in the accidents because without wearing the helmet. During the accident the head region facing the major effects. During accident situations the head facing three challenges like front, rear and side strike by Newtons third law of motion others are happening. In order to reduce the passengers the government forcing them to wear helmets. The head injury is also depends upon the helmet design structure and the materials what we selected. Previously they were using several materials in helmet design. Now we design a 3D model helmet in CATIA V5 R20 and meshing the model in HYPERWORKS 14.0 and analyzing the model in ANSYS WORKBENCH R16 using bamboo as shell material with 1mm thickness and polystyrene as foam material with 20mm thickness.

Keywords: *Bamboo, Directional deformation on X Y Z, Helmet, Polycarbonate, Polystyrene, PPA, Stress, Weight*

INTRODUCTION

Helmet can protect the passengers from accidents. The accidents are happening due to population of automobile vehicles in India with proportional to population of people. Accidents are mainly happened due to the absence of drivers thinking. Helmets are weird by the two wheelers. Bicycle accidents are increasing gradually with rise in population. Due the accidents we can face more medical lost and economical lost. In order to reduce the death of riders the government forcing the riders to wear the helmet.

The helmet is made up of two materials on is outer shell is made up of (thermoplastic and composites) and the inner foam layer (EPS, PU, PP, PE, PB, PVDC) Function of foam in order to absorb most of the impact energy and function of shell to resist penetration from foreign object from touching head and the head and resulting in skull damage. The load acting on the shell layer to be transferred to the foam (energy absorbing capacity) and linearly lowering the force transferring to the head. . This penetration take a look at is the principle standards for shell thickness dedication and, in reality, ensuing in a helmet with a thicker shell and therefore a weight of about 6-eight instances compared to the foam liner. If a thicker shell is chosen, the power will boom, lamentably, in addition to price and weight. Or an opportunity fabric need to be considered. it is very important to test out all the nearby rules of the target marketplace. Violations of legal guidelines and standards may also result in re-layout and unexpected put off and price. [1] avenue injuries are caused due to the growth in vehicle populace about 50% of accidents are came about due to bicycles. The accidents are bobbing up particularly due to the low great helmet manufactures in India. on this we can see the helmets to be had within the marketplace and overall performance of the helmets available in marketplace.[2] the model is performed with the impact analysis of composite helmet the use of FRP and glass fiber.

thesector is transferring with the studies towards the composite substances synthesized using glass fiber as bolstered together with matrix. in this new composite is produced with herbal fiber reinforcement with right mechanical homes as compared with pure matrix fabric. however the new complicated cloth is inexpensive and feature appropriate mechanical residences. [3] in the present day accidents are happening every minute. foremost accidents are results in head harm. The helmet should face up to surprising effect load, pressure and light weight. We the usage of the glass fiber strengthened polyester foam sandwich. testing the helmet performance by means of making use of the impact load with velocity of 30, forty, 50 kmph. via designing this cloth we will reduce the top harm. [4] Helmet of wheeler is designed and drop check is finished with extraordinary velocities. The helmet is designed and analysized in catia and Ansys express Dynamics. ultimately we've deliberate to layout the exact helmet model with outer layer as Bamboo material and internal layer with polyester and comparing the effects with other substances.

Scope of research

In this paper the bamboo material has less deformation ,stress and weight when compared due to other materials. We have planned mainly to reduce the head injury Traumatic Brain Injury(TBI). During accident the major affecting area is head. The head consist of three major region brain stem, cerebrum and cerebellum. The cerebellum consist of four major parts

1. Frontal lobe
2. Occipital lobe
3. Parietal lobe
4. Temporal lobe

Design Criteria

Preventing from TBI During the accidents or crash of anything on the head will look like

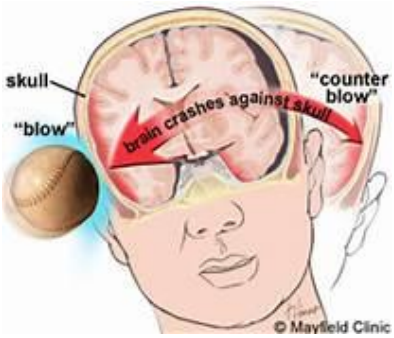

Fig 1: *Reaction of head during hitting*

Due to the effects of four major parts **traumatic brain injury** occurs. During accident time if the head gets affected the major reason is traumatic brain injury. We can prevent the passengers from TBI by proving perfect quality of helmet.

COMFORT The helmet which we designing should good in appearance and comfort. By perfect fitting to the head and preventing the inside material from sweetEasy air flow, Light weight, Ear protection

Methodology

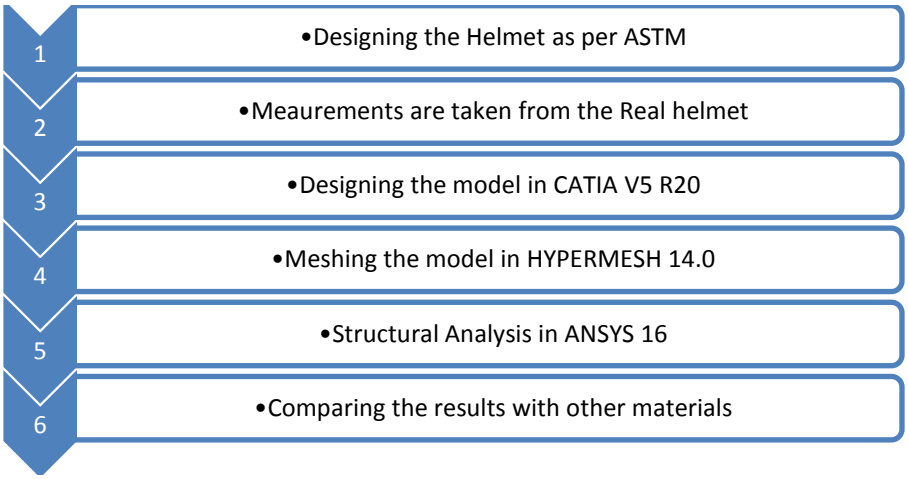

Fig 2: *methodology of helmet design and analysis*

Protection

Protection of head using helmet up to 64% and prevent from TBI

Fig 3: *protection percentage of head by wearing helmet*

Designing and Material Properties

When the helmet is subjected to an impact load it gets deformed and injuries the head region. The following parameters are considered during the analysis of helmet such as directional deformation, von mises stress and weight of the material selected. It is very important to analyze the helmet under static and dynamic condition but carried out our analyses in static method only. In static analysis we have carried out a various studies on helmet testing methods like deformation, stress and strain energy. We have choose various materials like Bamboo, polycarbonate, Polystyrene and PPA. From this we going to find which material is good in performance and all other formats.

Table 1: *material properties*

Materials	Polyester	Polycarbonate	PPA	Bamboo
Density(kg/m^3)	1400	1200	1100	700
Young's modulus(pa)	4.41e+009	2.4e+009	2.2e+009	140GPA
Poisons ratio	0.33	0.37	0.4	0.29
Shear modulus(pa)	1.6579e+009	8.75e+008	7.8571e+007	
Tensile strength(pa)	5.5861e+007	6.55e+007	6.9e+007	120Mpa
Compressive strength(pa)	2.588e+009	8.27e+007	0	55Mpa

Cad Model

Helmet model is created as per ASTM standard it is created in CATIA V5 R20 modeling software and then imported to the HYPERMESH 14.0 for meshing the created model with element side of 5

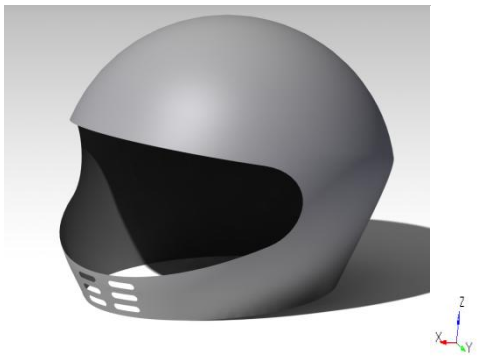

Fig 4: *CAD model of helmet*

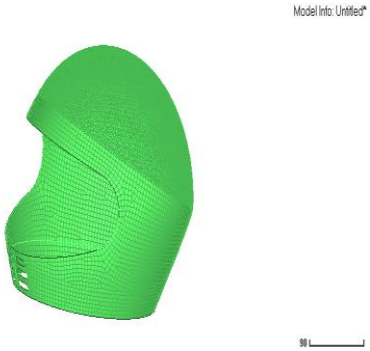

Fig 5: *Mesh model of helmet*

The outer shell of the helmet is assigned with the material property of bamboo, polycarbonate and PPA each and every time the property of the material to be changed after analysis and the inner shell of the material is provided with property of polystyrene for all analysis.

RESULTS AND DISCUSSION

This describes the results obtained from the static structural analysis of helmet. By applying the constrains and load the results are obtained from the ANSYS WORKBENCH 16.0. Basically the two types of results are taken like applying the force in side and back direction. We can obtain directional deformation in X, Y, Z,Von Mises stress and weight. Finally the results are compared with other published papers.

Static analysis of helmet

The designed helmet model is analyzed by providing by fixing the bottom side of the helmet a load of 1000N by two direction in side direction and back direction to protect the head from injuries we undergoing this type of analyses

Case1: fixed at bottom side and force acting on side direction

The equivalent Von Mises stress and Directional deformation values of the helmet are shown in following figure.

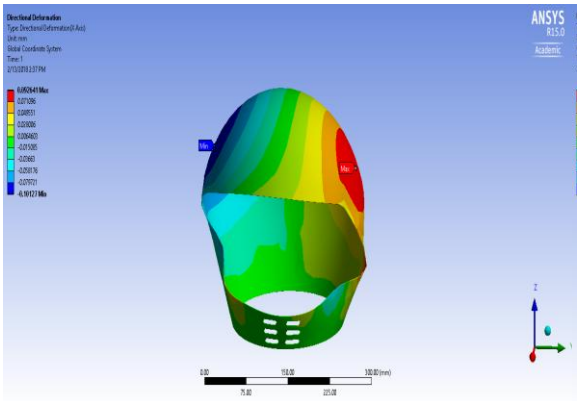

Fig 6: *deformation of bamboo at X axis*

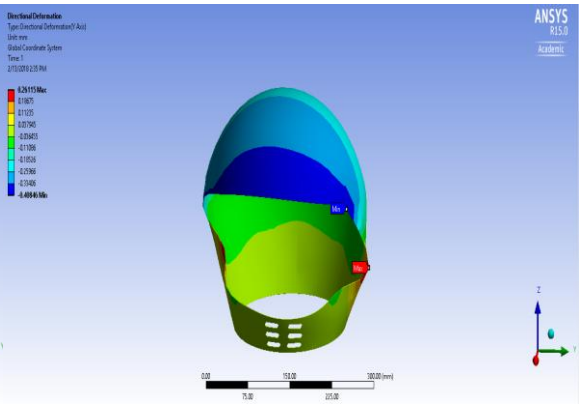

Fig 7: *deformation of bamboo at Y axis*

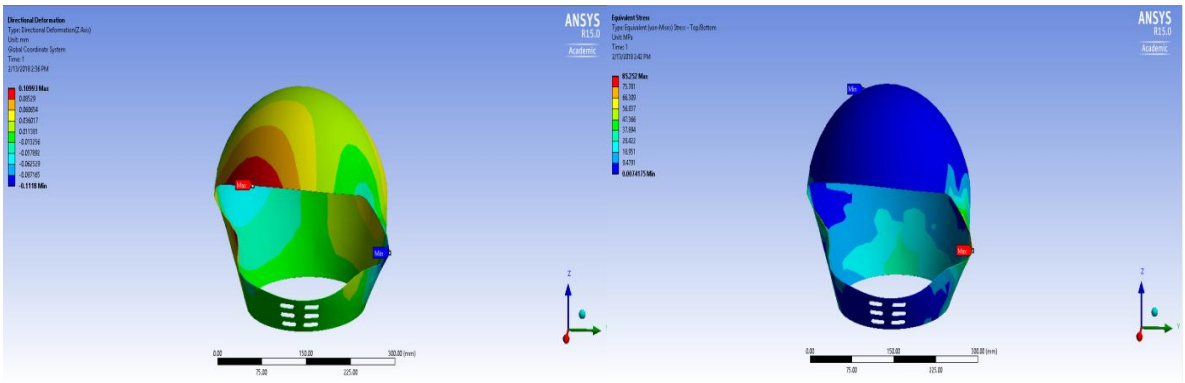

Fig 8: *deformation of bamboo at Z axis* ***Fig 9:*** *stress of bamboo*

Case 2: fixed at bottom side and force acting on back direction

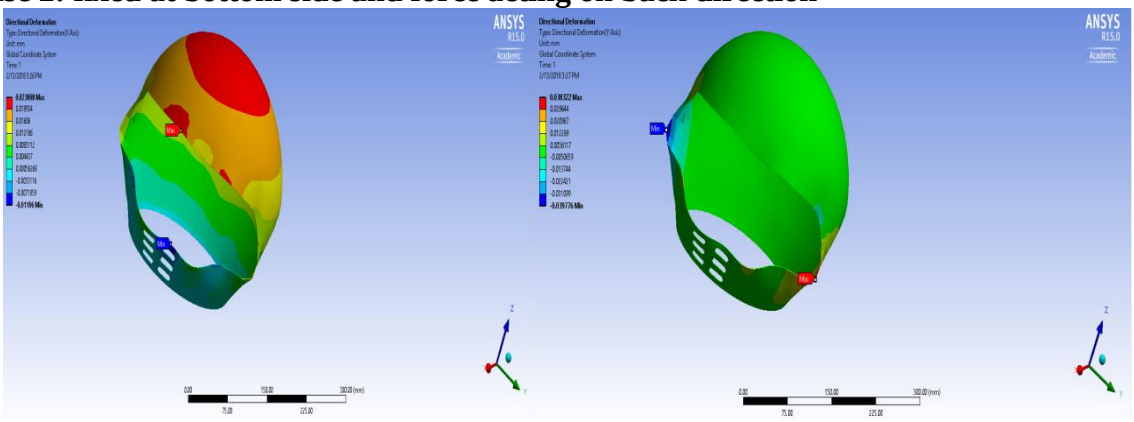

Fig 10: *deformation of bamboo at x axis* ***Fig 11:*** *deformation of bamboo at y axis*

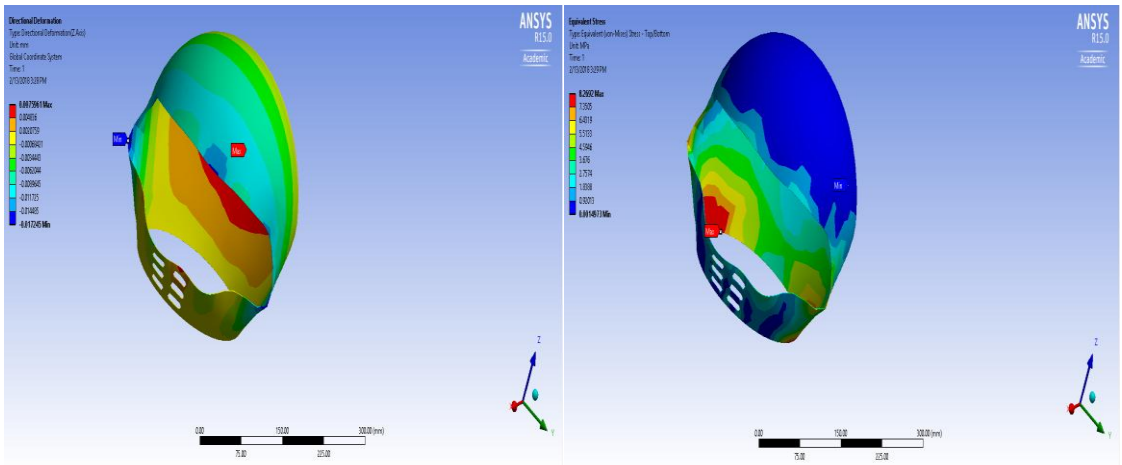

Fig 12: *deformation of bamboo at Z axis****Fig 13:*** *stress of bamboo*

Table 2:*Maximum displacement and stress side force*

Materials	X axis	Y axis	Z axis	Stress
Bamboo	0.009261mm	0.26115mm	0.10993mm	85.252 Mpa
Polycarbonate	1.969mm	5.7681mm	2.4208mm	61.363Mpa
PPA	3.9443mm	11.261mm	4.7846mm	56.868Mpa

Table 3:*Minimum displacement and stress side force*

Materials	X axis	Y axis	Z axis	Stress
Bamboo	-0.10127mm	-0.4084mm	-0.1118mm	0.0074175Mpa

Polycarbonate	-1.9873mm	-7.5818mm	-2.5673mm	0.00332Mpa
PPA	-3.7968mm	-14.309mm	-5.0103mm	0.00385Mpa

Table 4:*Maximum displacement and stress back force*

Materials	**X axis**	**Y axis**	**Z axis**	**Stress**
Bamboo	0.0238mm	0.03822mm	0.00758mm	8.2692Mpa
Polycarbonate	1.2475mm	2.0979mm	0.44335mm	8.1628Mpa
PPA	1.374mm	2.3015mm	0.48965mm	8.158Mpa

Table 5:*Minimum displacement and stress back force*

Materials	**X axis**	**Y axis**	**Z axis**	**Stress**
Bamboo	-0.01106mm	-0.03966mm	-0.01724mm	0.00149Mpa
Polycarbonate	-0.60645mm	-2.1455mm	-0.94449mm	0.004304Mpa
PPA	-0.7095mm	-2.35454mm	-1.037mm	0.004992Mpa

Table 6: Mass of the helmet

Material	**Weight (kg)**
Bamboo	2.4228 kg
Polycarbonate	2.5192 kg
PPA	2.4999 kg

CONCLUSION

In this paper we reviewed and analyzed with different types of materials and modes of directional deformations and stress. Finally the pure bamboo material has better characteristic in the entire test when compared with other materials. Bamboo material has good mechanical property as compared with other properties. Bamboo material is used in automobile vehicle in seat belts, air bags and internal structure of the body. Bamboo material is easy availability in India, low cost of manufacture when compared to other and undergoing further research in Bamboo materials.

REFERENCE

1. Saurabhsingh, hrishabhsinghfinite element analysis of protective helmet using different materials parameters ISSN:2319-8753
2. Amal Thomas, Dr.suresh P, AnishJafrin Thilak J, Subramani Nimpact analysis of composite helmet by using FRC and Glass fiber ISSN: 2395-0056
3. Karthiga devi Elangovan, Sohithan Gopisetty, Lokchandu Kummara impact scrutiny of a glass fiber reinforced polystyrene foam sandwich bike helmet
4. Naresh, RAmdas, HabibulRehaman, Dushyanth design of helmet and fracture analysis to identify the crack formation