International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 1899-1901 www.ijaem.net ISSN: 2395-5252

Design and Analysis of Composite Bumper

Akash Paul Savio[1] , Kurian Benny[2] , Sravan Sunil C M [3] , Vijay N Ravi[4] , Alex Thomas[5]

[2,3,4,5]*Student, Department of Mechanical Engineering, Viswajyothi College of Engineering and Technology Vazhakulam, Kerala.*

[1]*Assistant Professor, Department of Mechanical Engineering, Viswajyothi College of Engineering and Technology Vazhakulam, Kerala.*

Submitted: 01-07-2021 Revised: 13-07-2021 Accepted: 16-07-2021

ABSTRACT: Nowadays the safety and fuel efficiency are the major problem faced by passenger cars. The solution for this problem is to apply a fiber reinforced composite and thereby increases the fuel efficiency and safety. In this work the design and analysis of composite bumper is carried out a analysis with the existing steel bumper. Fusion 360 software is used to create the model of bumper. Charpy impact test is carried out by fabricating the specimen with hand layup process. Compared to steel bumper, the composite bumper has high factor of safety than steel bumper. Also the analysis explains the weight of composite bumper is less as compared with steel bumper.

KEY WORDS: E glass fiber, Poly vinyl alcohol, Hand layup process

I. INTRODUCTION

Bumper is a safety system or vehicles and is used to determine low speed collisions. It is manufactured or designed to reduce the damage in the front and rear side of motor vehicles at low speed collisions. Bumper is designed to protect the parts of vehicle such as headlight, hood, trunk, and taillights in low speed collisions.

In recent days, composite material makes a major role in automobile applications. Due to the less weight, composite material is suitable than steel bumper. It absorbs more collision energy.

II. METHODOLOGY

Material selection is the first process to determine the strength of composite material and E glass fiber is suitable for the manufacturing of composite fiber because the fibers are thickly arranged and confined. Purchasing of raw materials is the next process for manufacturing the specimen. During manufacturing a layer by layer fiber resin process is carried out to make the specimen and until the require thickness is to be build up. Resin is mixed with catalyst MEKP and cobalt. Testing is the next step to be taken by Charpy impact testing to determine the impact strength of both composite and steel and thereby find out the impact energy. The bumper is designed in fusion 360 software by providing accurate length, breadth and thickness. After the design to be completed the design is subjected to ansys finite element programming to analysis with the steel bumper.

Figure 1: Model of bumper

III. RAW MATERIALS

3.1 E-GLASS FIBER

E glass fiber is a high quality glass fiber which is used as a standard reinforcement for all the resin systems and has good mechanical properties.

Figure 2: E- glass fiber

3.2 GP RESIN

GP Resin or general purpose resin is a quick curing unsaturated polyester resin for lamination purpose. It has excellent mechanical properties, impact and water resistance.

3.3 MEKP Catalyst

MEKP or Methyl Ethyl Ketone peroxide is an

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 1899-1901 www.ijaem.net ISSN: 2395-5252

organic peroxide and highly explosive similar to acetone peroxide. It is a colorless and oil liquid. It is slightly less sensitive to shock and temperature.

3.4 COBALT

Cobalt is used as an accelerator. Basically these are promoters used to curing polyester and vinyl ester with MEKP catalyst.

3.5 RELEASING AGENT

The releasing agents which is used for the manufacturing is wax and poly vinyl alcohol and it is applied on the mould.

IV. CHARPY IMPACT TESTING

Charpy impact test find the amount of energy absorbed by a material during fracture and is the measure of toughness of the material.

Charpy impact specimen has a dimension of 55*10*6mm with a U notch of 2 mm deep.

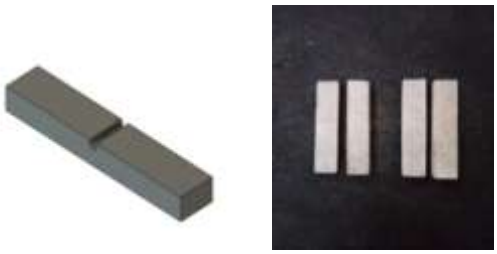

Figure 3: Specimen

4.1 RESULT

Explanation	Composite	Mild Steel
Cross sectional area, A (mm^2)	40	40
Impact value (J)	162	63
Impact energy (J/mm^2)	4.05	1.57

Table 1: Experiment result

V. ANALYSIS

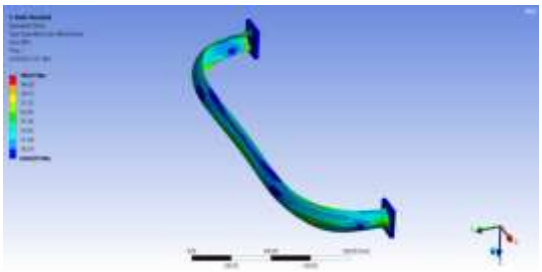

Figure 4: Stress analysis of composite bumper

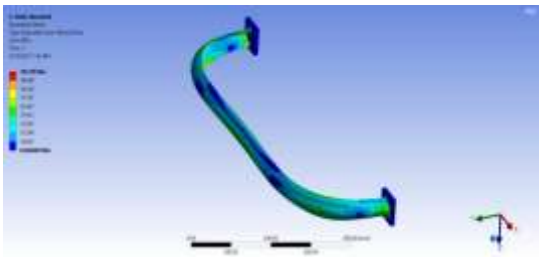

Figure 5: Stress analysis of steel bumper

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 1899-1901 www.ijaem.net ISSN: 2395-5252

VI. COMPARISON

Explanation	Composite	Mild Steel
Impact energy	4.05	1.57
Maximum stress (N/mm²)	166.28	169.37
Factor of safety	2.9	2.4

Table 2: Comparison

VII. CONCLUSION

Testing, design and analysis of composite and steel bumper are completed and got the results. Impact strength of composite is 4.05 J/mm² and steel is 1.57J/mm². The composite and steel bumper is analysed in ANSYS 16.2 and maximum stress induced in steel bumper is 169.37 N/mm² and composite is 166.28 N/mm². From the study it is concluded that the E-glass fiber is suitable for the fabrication of bumper and it has less weight as compared to steel bumper.

REFERENCE

[1]. Sun C.T, Chen, J.K, Impact response analysis of buckled composite laminates 1985.
[2]. Mallick P.K, fiber reinforced composites, Marcel Dekker, 1988, pp. 248-56
[3]. Williams, J.G, Calculation of energy release rates for cracked laminates (1988) 101-19
[4]. Autar K, Kaw, Mechanics of composite materials, CRC press, New York, 1997