Modelling And Analysis Of Chassis Using Different Materials

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Abstract - **This project deals with design and analysis of chassis of a chassis of a commercial vehicle. The model of the chassis is designed using the software called solid works, and the systematic analysis of the designed model is done using ANSYS software.In this model chassis is analyzed with existing material steel. And further is analyzed with alternative material. Then the model is analyzed for the deflection, max stress induced for all the above materials under same load.**

keywords - **Frame chasis,S-glass,E-glass,Aramid fibre,Carbon fibre, SOLIDWORKS &ANSYS Software.**

I . INTRODUCTION

A chassis consists of an internal vehicle frame that supports an artificial object in its construction and use, can also provide protection for some internal parts. An example of a chassis is the under part of a motor vehicle, consisting of the frame.If the running gear such as wheels and transmission, and sometimes even the driver's seat, are included, then the assembly is described as a rolling chassis .In the case of vehicles, the term rolling chassis means the frame plus the "running gear" like engine, transmission, drive shaft, differential, and suspension. An under body which is usually not necessary for integrity of the structure, is built on the chassis to complete the vehicle.

For commercial vehicles, a rolling chassis consists of an assembly of all the essential parts of a truck (without the body) to be ready for operation on the road. The design of a pleasure car chassis will be different than one for commercial vehicles because of the heavier loads and constant work use. Commercial vehicle manufacturers sell "chassis only", "cowl and chassis", as well as "chassis cab" versions that can be outfitted with specialized bodies. These include motor homes, fire engines, ambulances, box trucks, etc.

II .LITERATURE SURVEY

Alireza Arab Solghar, Zeinab Arsalanloo (2013) studied and analyzed the chassis of Hyundai Cruz Minibus. ABAQUS Software was used for modeling and simulation. Self weight of the chassis is considered for static analysis and Acceleration, Braking and Road Roughness were considered for dynamic analysis. It's observed that the stresses on chassis caused by braking were more compared with acceleration. we studied and analyzed Carbon/Epoxy, E- glass/Epoxy and S-glass/Epoxy as chassis material in various cross sections like C, I and Box Section. TATA 2518 EX chassis was taken for study. Solid works and Ansys software were used for this work. Study reveals that the Carbon/Epoxy box section chassis has superior strength, stiffness and lesser weight compared to other materials and cross section.

Roslan Abd Rahman, Mohd Nasir Tamin, Ojo Kurdi (2008) used FEM stress analysis as a preliminary data for fatigue life prediction. They used ABAQUS software for simulation and analysis and also taken ASTM Low Alloy steel A710 (C) for study. Primary objective was to find the high stressed area where the Fatigue Failure will start. It's found that the chassis opening area having contact with bolt experiences high stress.

N.V.Dhandapani, G Mohan kumar, K.K.Debnath (2012) have used Finite element methods to study the effect of various stress distribution using Ansys software. To investigate the field failure of 100Ton dumper they introduced gussets in failure area. After modification the chassis structure was validated by linear static analysis and found that the modified chassis was safe.

Teo Han Fui, Roslan Abd. Rahman (2007) have studied the 4.5 Ton truck chassis against road roughness and excitations. Vibration induced by Road Roughness and excitation by the vibrating components mounted on chassis were studied. Chassis responses were examined by stress distribution and displacements. Mode shape results determine the suitable mounting locations of components like engine and suspension systems.

III. THEORY OF CHASIS

Automotive chassis is a skeletal frame on which various mechanical parts like engine, tires, axle assemblies, brakes, steering etc. are bolted. The chassis is considered to be the most significant component of an automobile. It is the most crucial element that gives strength and stability to the vehicle under different conditions. Automobile frames provide strength and flexibility to the automobile. The backbone of any automobile, it is the supporting frame to which the body of an engine, axle assemblies are affixed. Tie bars, that are essential parts of automotive frames, are fasteners that bind Different auto parts together. Automotive chassis is considered to be one of the significant structures of an automobile. It is usually made of a steel frame, which holds the body and motor of an automotive vehicle. More precisely Automotive chassis or automobile chassis is a skeletal frame on which various mechanical parts like engine, tires, axle assemblies; brakes, steering etc are bolted.

At the time of manufacturing, the body of a vehicle is flexibly molded according to the structure of chassis. Automobile chassis is usually made of light sheet metal or composite plastics. It provides strength needed for supporting vehicular components and payload placed upon it. Automotive chassis or automobile chassis helps keep an automobile rigid, stiff and unbending. Auto chassis ensures low levels of noise, vibrations and harshness throughout the automobile.

IV. MATERIAL SELECTION AND USED

The ladder frame chassis construction can comprise an unlimited variety of materials and panel configurations. The composite structure provides great versatility as a wide range of core and facing material combinations can be selected.

Structural Considerations

Strength: Honeycomb cores and some facing materials are directional with regard to mechanical properties and care must be taken to ensure that the materials are orientated in the panel to take the best advantage of this attribute.

Stiffness: ladder frame chassis structures are frequently used to maximize stiffness at very low weights. Because of the relatively low shear modulus of most core materials, however, the deflection calculations must allow for shear deflection of the structure in addition to the bending deflections usually considered.

4.1 MATERIAL PROPERIES:

4.1.1. PROPERTIES OF STEEL:

Density	7.85e-006 kg mm^-3
Young's mod	2.e+005 MPa
Poisson's ratio	0.3

4.1.2. PROPERTIES OF S- GLASS EPOXY:

Density	2.5e-006 kg mm^-3
Young's mod	93000 MPa
Poisson's ratio	0.22

4.1.3. PROPERTIES OF E- GLASS EPOXY:

Density	2.55e-006 kg mm^-3
Young's mod	72000 MPa
Poisson's ratio	0.22

4.1.4. PROPERTIES OF CARBON EPOXY:

Density	1.6e-006 kg mm^-3
Young's mod	1.7e+005 MPa
Poisson's ratio	0.3

4.1.5. PROPERTIES OF ARAMID FIBRE:

Density	1.47 E-6 kg mm^-3
Young's mod	1 E5 MPa
Poisson's ratio	0.36

V.Modelling of ladder type box Frame chassis

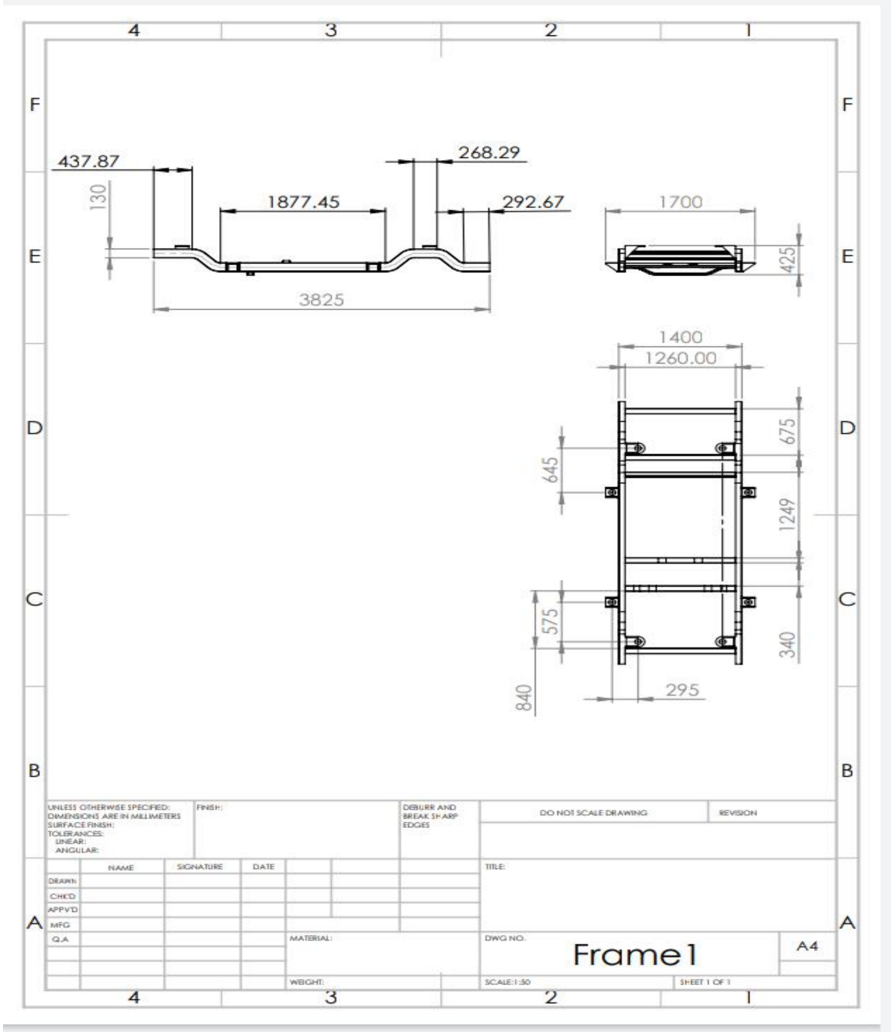

Figure 1. Modeling Sketch of frame chassis

VI. RESULTS AND DISCUSSION.

Analysis of Frame chassis on ANSYS Software.

6.**1 Geometry view in ansys**

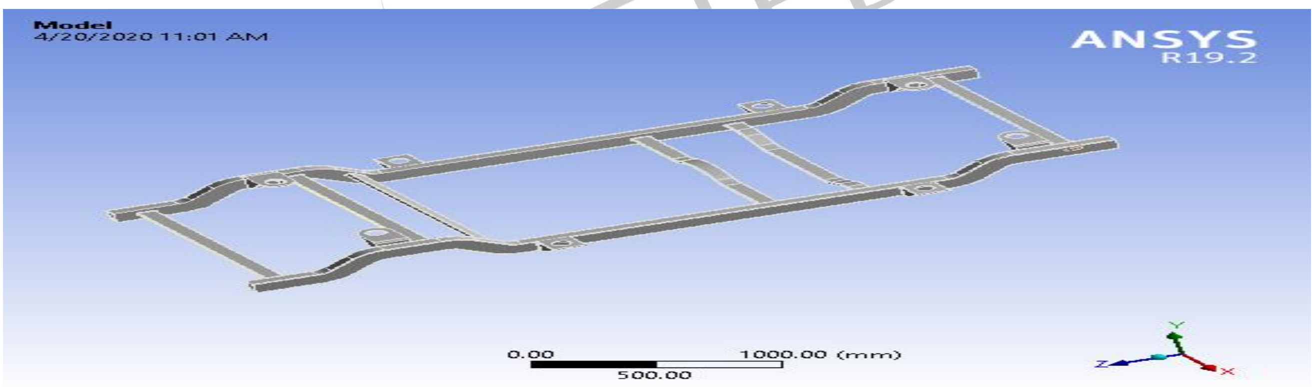

Figure 2.Geometry view in ansys

6.2. Steel Frame chassis

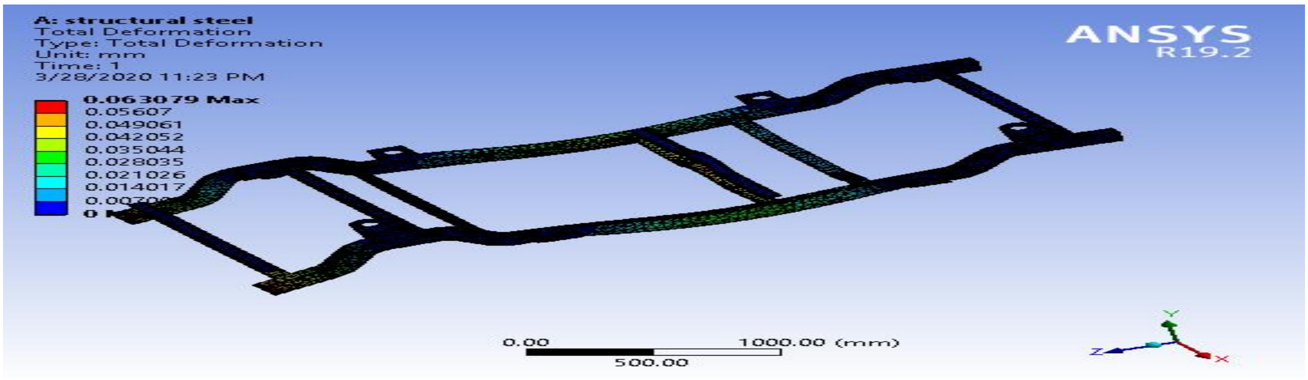

Figure 3. Total deformation of steel

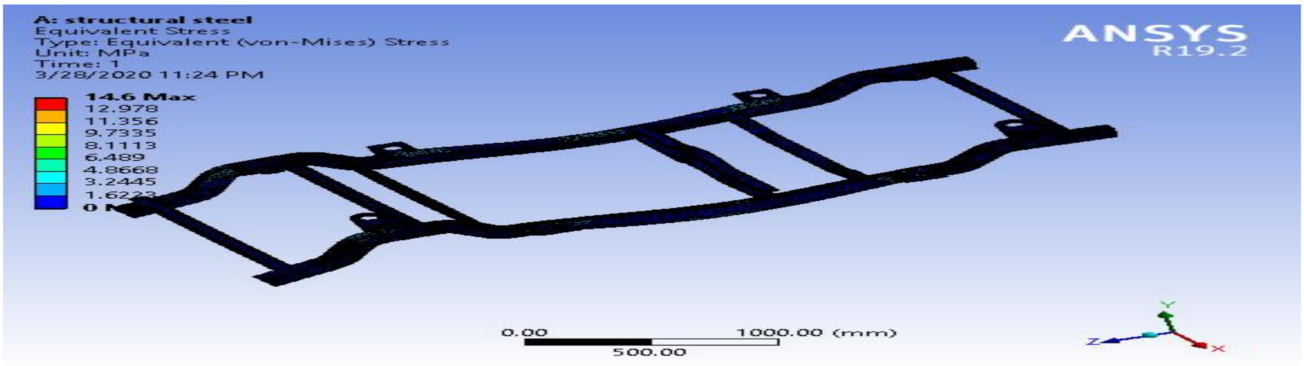

Figure 4. Total Equivalent stress of steel

6.3. S-glass Frame chassis

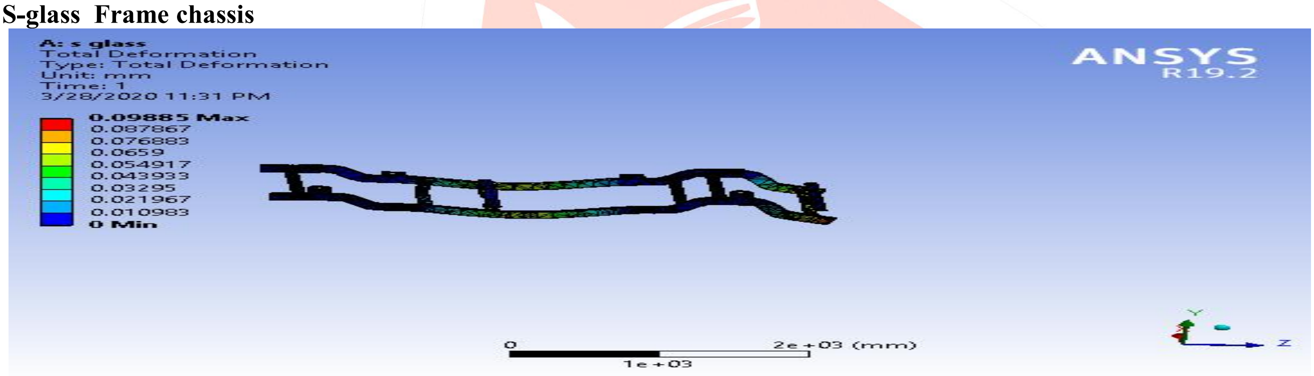

Figure 5. Total deformation of S-glass

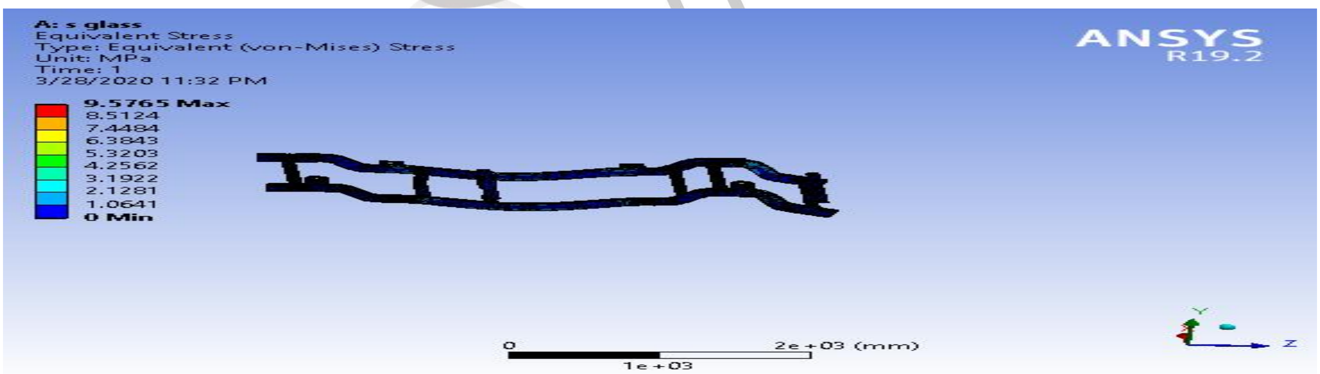

Figure 6. Total equivalent stress of S-glass

6.4. Carbon fiber Frame chassis

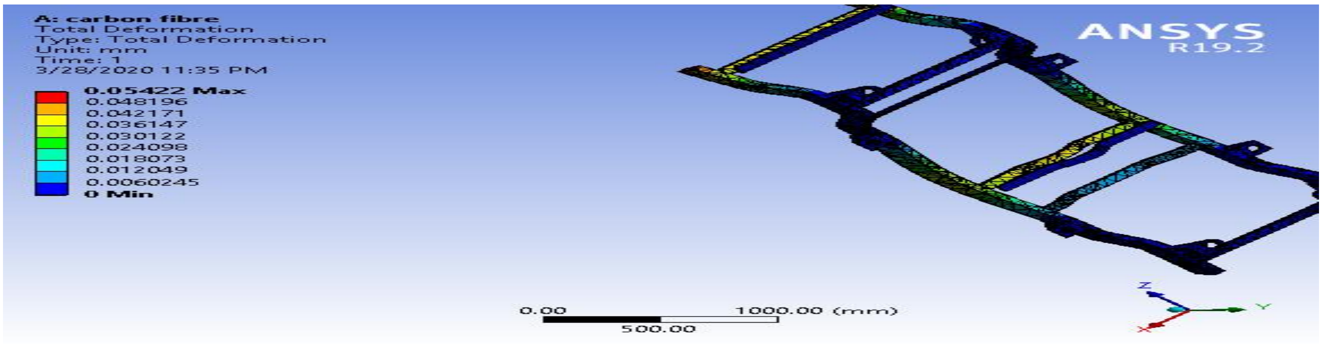

Figure 7. Total deformation of carbon fiber

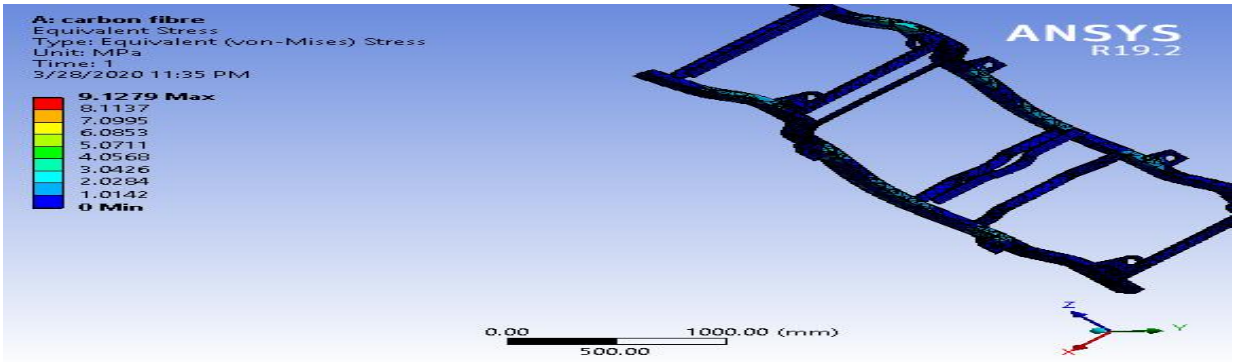

Figure 8. Total equivalent stress of carbon fiber

6.5.Aramid fiber Frame chassis

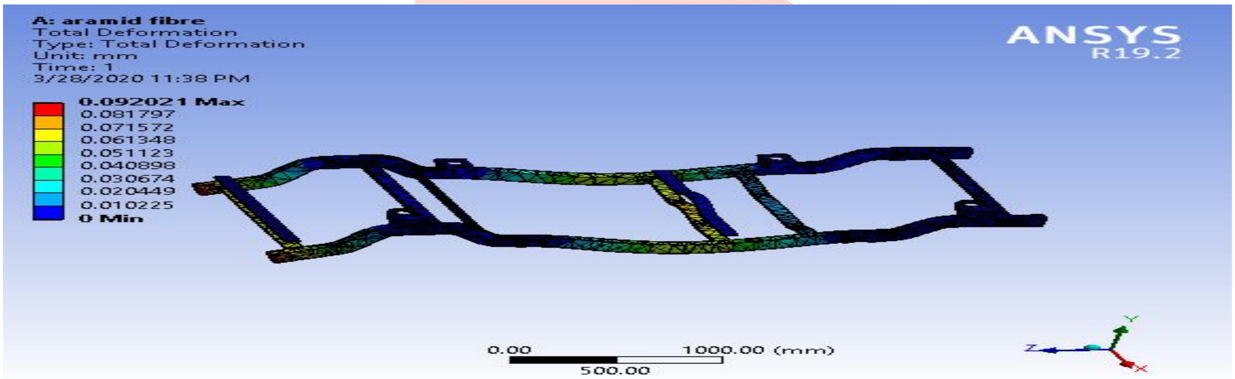

Figure 9. Total of deformation of aramid fiber

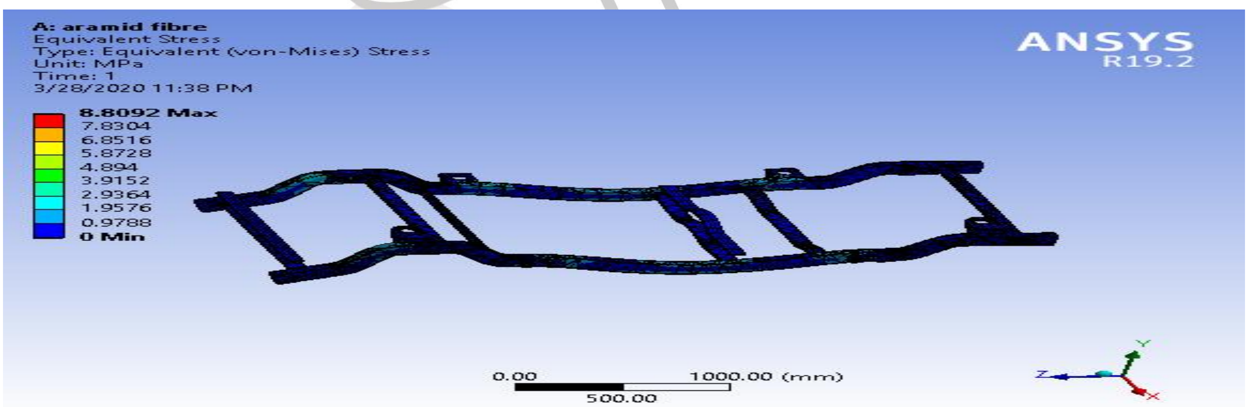

Figure 10. Total of equivalent stress of aramid fiber

6.6. E-glass Frame chassis

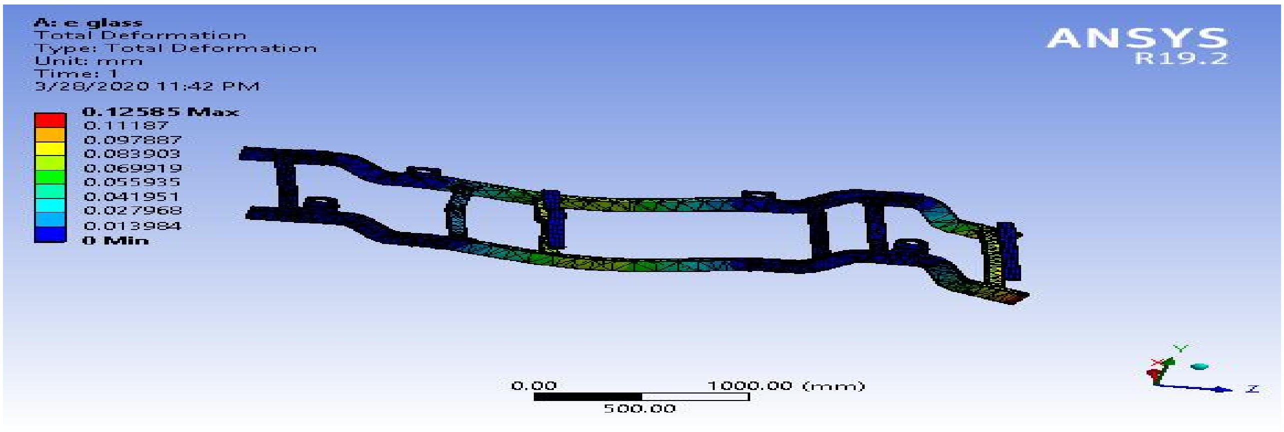

Figure 11. Total deformation of E-glass

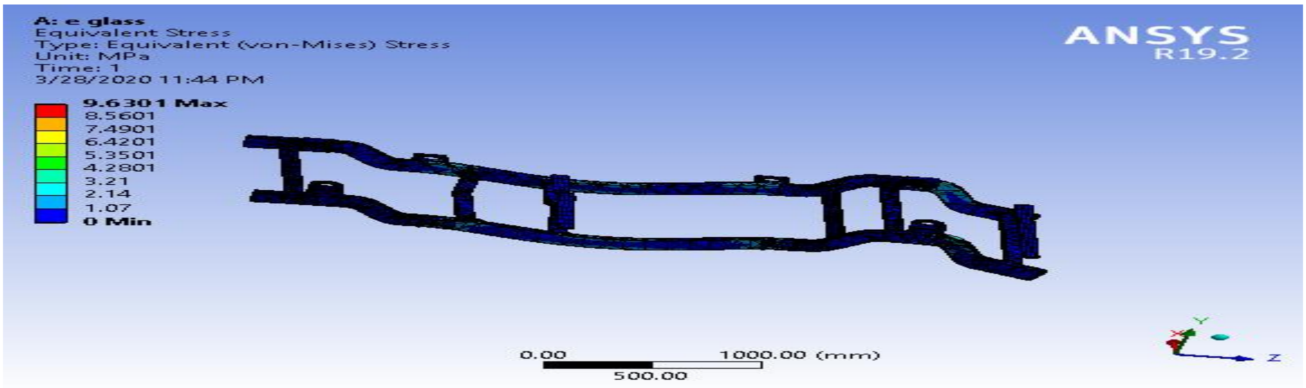

Figure 12. Total equivalent stress of E-glass

VII. Result Tables:

S.NO	MATERIAL / RESULTS	MASS (KG)	EQUIVALENT STRESS (MPa)	DEFORMATION (mm)
1.	**STEEL**	405.5	14.6	0.063
2.	**E-GLASS**	131.71	9.630	0.125
3.	**S-GLASS**	129.13	9.576	0.098
4.	**ARAMID FIBER**	75.92	8.802	0.092
5.	**CARBON FIBER**	82.64	9.127	0.054

VIII.CONCLUSION:

From the above analysis, the commercial vehicle chassis is subjected to working load of 1 tone and the analysis is carried out. Initially, the chassis is analyzed with existing steel material and the results are compared with optimized material. The materials used are s- glass, e-glass, carbon fibre and aramid fiber. The results are generated and compared to existing steel. From the above results the carbon fiber has low values of stress and deformation when compared to steel and s glass epoxy. Thus the carbon fibre can be chosen for chassis material.

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