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DESIGNING AND ANALYSIS OF CNG TANK FOR AUTOMOTIVE VEHICLE

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ABSTRACT

This paper describes of adoption of CNG fuel for vehicles for current use, it is required new innovative design of gas storage tank, especially for four wheeler. It also required investigating enough space and proper location of storage tank for conventional vehicle. In this research, work doing on designing gas tank for vehicle's with respect to safety aspects. And also protect the gas tank. So design & analysis under static consideration for a prospect CNG storage tank used to construct vehicle for its function to operate under various condition.

Till the date the CNG tanks used in automobiles where high in weight causing extra weight on frame and making unhandy. The designing and Analysis of CNG tank for Automotive Vehicle is a project based on making the CNG tanks lighter in weight and handy that can be used in automobile by using different metals and alloys.

1. INTRODUCTION

Air pollution refers to the contamination of the earth's environment with constituents that have considerable effects on human health. The quality of life or the natural environment gets affected when pollutants accumulate in the air at higher concentrations. Vehicles emissions have become the fore most source of air pollutants including carbon monoxide, lead, nitrogen dioxide, sulphur dioxide, ozone and particulate matters. Vehicles emission mainly from automobiles is responsible for about two third of air pollution in the urban area. Petrol engines exhaust contains high concentration of HC whereas the diesel vehicular exhaust has higher concentration of particulate matter, NO× and CO2. The concentration of CO and unburnt HC in the diesel exhaust are slightly lower as compared to petrol engine.

At this present situation CNG is most useful alternate in cars. It having no of advantages. Material used in CNG tank is steel is heavy in weight which causes the effect on suspension system of car. We decided to work on material of tank having the less weight and high strength and also in minimum cost. In today's world requirements of cars are increasing day by day to fulfill mass production of cars. Mass production is positive thing, as per increasing requirement of car fuel requirement is also increasing. In all over world mainly petrol or diesel is used as fuel and we all know that this is non-renewable energy sources which is limited and one day it is finished. So keeping this problem in mind we need to find some alternate sources. As per requirement CNG is best alternate source by according its price and performance is concerned compare to petrol and diesel.

2. CALCULATION

Materials used for CNG Tank:

1) Standard Material: 34CrMo4 Alloy steel

34CrMo4 main Alloy composition is Cr and Mo.

34CrMo4 Steel is a high quality Quenched and Tempered Alloy Structural steel, It belong to the high quality low carbon, Low alloy chromium, molybdenum, nickel case hardening steel. Oil Quenched & Tempered Hardness is 18-22 HRc. Annealing delivery hardness less than 250HB. With a lower carbon content range, So have good weldability.

Material Properties:

Physical Properties –

Modulus Of Elasticity = 210 GPa Density = 7.85 kg/m3

Thermal Conductivity = 42 W/m0C

Mechanical Properties –

Tensile strength = 1500 MPa Yield Tensile Strength = 800 MPa Elongation = 16 %

Working Pressure = 200 bar

Design Pressure = 1.05*200 = 210 bar Hydrostatics Pressure = 1.3*210 = 273 bar Allowable Stress (σall) = 1500/3.5 = 428.57 MPa

Dimensions Of Tank Diameter (D) = 267 mm Length (L) = 893 mm

6all> 6R. Hence Design is safe

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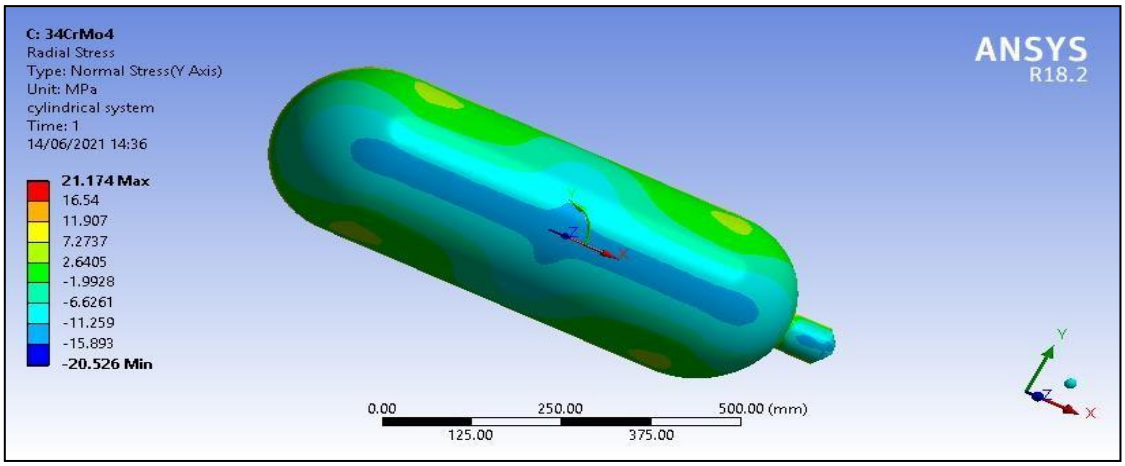

Fig no.4.6.1(Radial Stress)

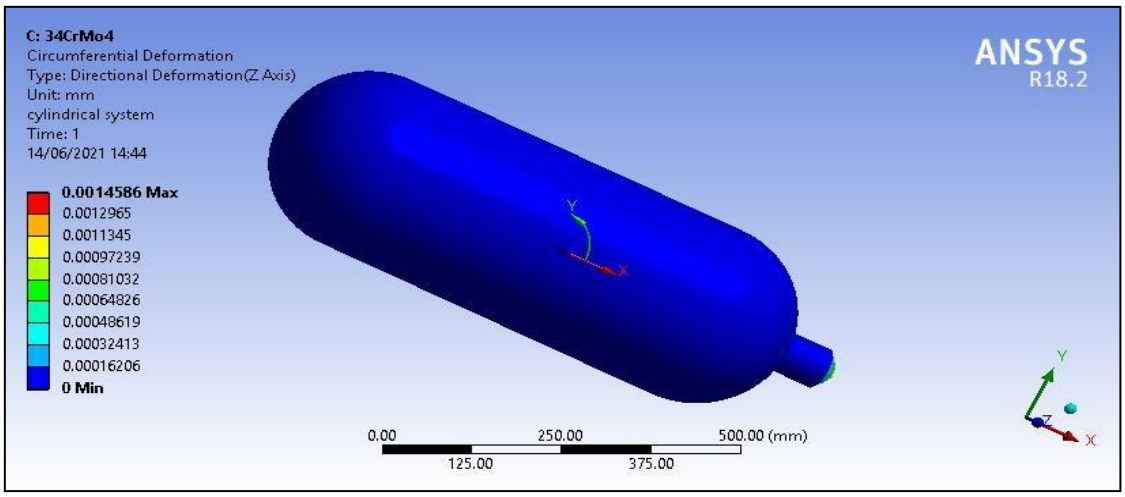

Fig no 4.6.4 (Radial Deformation)

2) Aluminum 7068 alloy T6511

7068 aluminum alloy is one of the strongest commercially available aluminum alloys, with a tensile strength comparable to that of some steels. This material, also known as an aircraft alloy, is heat treatable.

Material Properties -

Physical properties:

Density = 2.85 g/cm^3 Melting point = 476-6350 C

Mechanical Properties:

Tensile strength = 700 Mpa Yield strength = 590 MPa Elongation = 8%

Poisson's ratio = 0.23

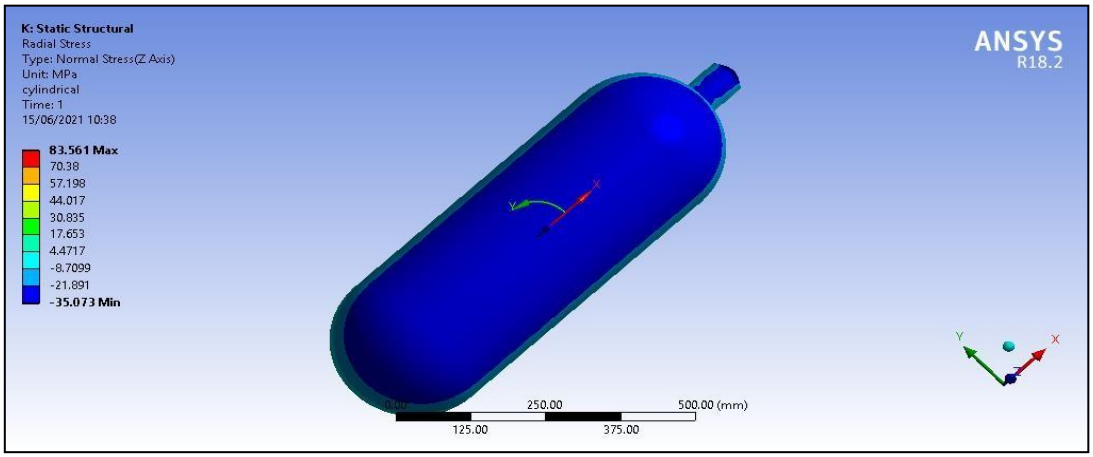

Fig no.4.6.5(Radial Stress)

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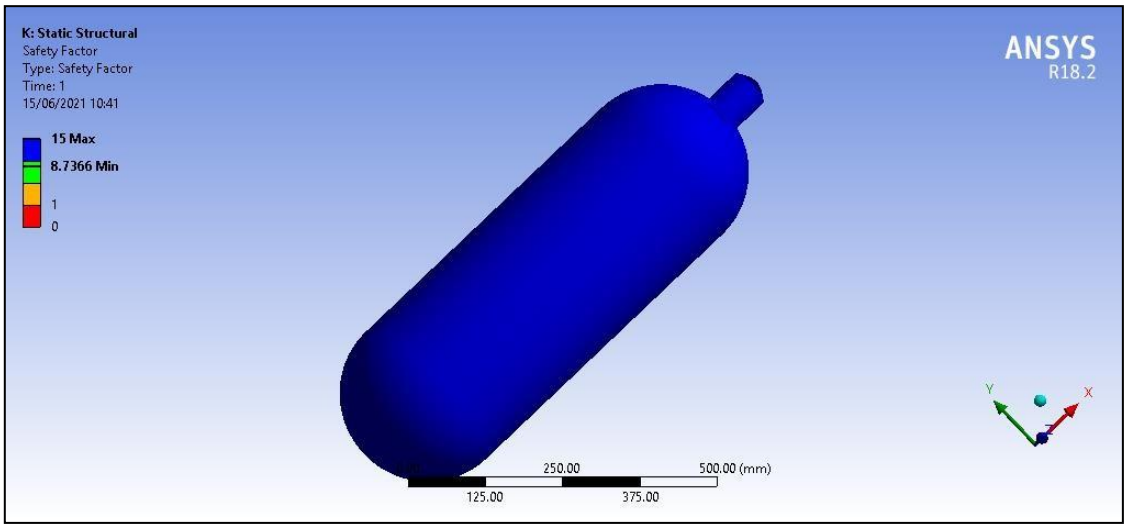

Fig no.4.6.9 (Factor of safety)

3. COMPARISION OF MATERIALS

Materials	Max circumferential Deformation	Radial Stress (MPa)	Axial stress (MPa)	Equivalent- t stress(Mpa)	Weight (KG)	Cost	F.S (Max – Mini)
30CrMO4	1.4586	-20.526 To 21.174	- 15.076 To 81.275	3.1383 To 80.311	65	19500	9.96120 T0 15
Aluminum	0 TO 0.095786	-35.073 To83.561	34.245 To - 10.693	6.3436 To 78.177	60	38000	8.7 T0 15
Titanium	0.0058083	-34.83 To 82.538	- 9.0756 To 35.232	6.96 To 77.47	42.82	50000	15
Carbon fiber	0.002940	-35.38 To 64.20	-11.85 To 33.51	6.017 To78.626	32	41000	15
Glass fiber	0.0092131	-35.073 To 83.56	-10.69 To 34.24	6.3436 To 78.177	28	45000	4.53 To 15

4. FUTURE SCOPE

Use either SI (MKS) or CGS as primary units. (SI units are strongly encouraged.) English units may be used as secondary units (in parentheses). This applies to papers in data storage. For example, write “15 Gb/cm2 (100 Gb/in2).” An exception is when English units are used as identifiers in trade, such as “3½-in disk drive.” Avoid combining SI and CGS units, such as current in amperes and magnetic field in oersteds. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity in an equation.

The SI unit for magnetic field strength H is A/m. However, if you wish to use units of T, either refer to magnetic flux density B or magnetic field strength symbolized as µ0H. Use the center dot to separate compound units, e.g., “A·m2.”

5. CONCLUSION

1) On the basis of the study, the analysis of. 34crmo4, aluminum, titanium, carbon fiber and glass fiber are analyzed for the application of CNG tank which is used in automobile vehicles.
2) From the analysis we got the stress values for the selected material which is less as compared to the standard material which is available in the market (34crmo4).

3) So from these analysis results, we conclude that, the stress induced, deformation and weight of the selected materials is less as compared to the 34crmo4.
4) The weight of the tank which is manufactured by selected materials is less, hence it will be helpful for increasing mileage of vehicle.
5) So the materials like aluminum, titanium, carbon fiber and glass fiber are capable of using in the manufacturing of CNG tank.

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