International Journal of Research
Available at https://edupediapublications.org/journals

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017

Experimental Analysis of Cylindrical Pressure Vessel by Using Different Frp Composite Materials

Mr. P.Ramakrishna Reddy, Mr. A.Prashanth, Mr.D.Suresh Reddy

[1] PG Scholar, Department of MECH,Mallareddy Engineering College ,Autonomous, maisammaguda, Hyderabad, Telangana, INDIA, PIN-500100
E-Mail Id: rkreddy1992@yahoo.com

[2] Assistant Professor, Department of MECH,Mallareddy Engineering College, Autonomous, maisammaguda, Hyderabad, Telangana, INDIA, PIN-500100
E-Mail Id: adunuri327@gmail.com

[3] Assistant Professor, Department of MECH,Mallareddy Engineering College, Autonomous,maisammaguda, Hyderabad, Telangana, INDIA, PIN-500100
E-Mail Id: dumpasureshreddy@gmail.com

Abstract:

A pressure vessel is a holder intended to hold gasses or fluids at a pressure considerably not quite the same as the ambient pressure. The uses of pressure vessel are in wide range, pressure vessels are used as a piece of a collection of employments in both industry and the private section. They appear in these fragments as mechanical pressed air recipients and nearby bubbling water accumulating tanks. Distinctive instances of pressure vessels are diving barrels, recompression chambers, refining towers, pressure reactors, autoclaves, and various diverse vessels in mining operations. The pressure differential is perilous, and deadly accidents have occurred in the authentic background of pressure vessel progression and operation. Pressure vessels can theoretically be any shape, yet shapes made of regions of circles, barrels, and cones are normally used. A commonplace arrangement is a barrel with end tops called heads. Head shapes are routinely either hemispherical or dished. More befuddled shapes have by and large been altogether harder to separate for safe operation and are when in doubt substantially more difficult to create.

This project will present the development, application and results of this new composite material which shows better performance results than the existing.in this dissertation work ANSYS software is used to carry out the structural analysis of steel and FRP composite pressure vessels. On the basis of analysis it is found that steel pressure vessel has less strength than FRP pressure vessel and it is also concluded that the pressure inside the vessel can be reduced up to 75% by replacing steel with FRP material. For the same geometrical parameters of the steel pressure vessel the stress state of FRP composite pressure vessel is calculated under different interval pressures experimentally. Finally pressure and structural efficiency of composite pressure vessel is compared with steel pressure vessel. In this project pressure vessel is modeled used catia V5 design software and static analysis is carried out by applyingaluminium metal matrix, inconel, s2 glass,saffil and stainless steel in ANSYS 14.5 software.

INTRODUCTION:

A pressure vessel is a holder planned to hold gasses or liquids at a pressure impressively not exactly the same as the enveloping pressure.

The pressure differential is unsafe, and deadly setbacks have occurred in the historical backdrop of pressure vessel change and operation. Along these lines, pressure vessel setup, deliver, and operation are overseen by planning pros maintained by institution. Subsequently, the importance of a pressure vessel shifts from country to country, yet incorporates parameters, for instance, most outrageous safe working pressure and temperature, and are worked with a security factor, disintegration stipend, minimum diagram temperature (for frail break), and incorporate nondestructive testing, for instance, ultrasonic testing, radiography, and pressure tests, by and large including water, generally called a hydrotest, however could be pneumatically taken a stab at including air or another gas.

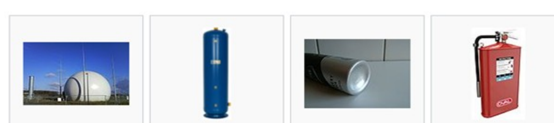
The favored test is hydrostatic attempting in light of the fact that it's a significantly more secure system for testing as it releases extensively less essentialness if break some way or another happened to happen (water does not rapidly construct its volume while quick depressurization happens, not under any condition like gasses like air, i.e. gasses bomb brutally). In the United States, as with various distinctive countries, the law vessels over a particular size and weight (15 PSI) be attempted to Code, in the United States that Code is the ASME Boiler and Pressure Vessel Code (BPVC), these vessels in like manner require an Authorized Inspector to support each new vessel created and each vessel has a nameplate with fitting information about the vessel, for instance, most outrageous sensible working weight, most prominent temperature, minimum blueprint metal temperature, what association delivered it, the date, its enlistment number (through the National Board), and ASME's genuine stamp for weight vessels (U-stamp), making the vessel traceable and formally an ASME Code vessel.

MAIN FEATURES OF PRESSURE VESSEL

Shape of a Pressure Vessel

Pressure vessels can theoretically be any shape, however shapes made of regions of circles, barrels, and cones are regularly used. A run of the mill design is a barrel with end tops called heads. Head shapes are a great part of the time either hemispherical or dished (torispherical). More snared shapes have undeniably been impressively harder to separate for safe operation and are generally considerably more difficult to create.

Theoretically, a round pressure vessel has around twofold the nature of a barrel molded pressure vessel with a comparable divider thickness, and is the ideal shape to hold internal pressure. In any case, a roundabout shape is difficult to manufacture, and thusly more exorbitant, so most pressure vessels are round and empty with 2:1 semi-bended heads or end best on each end. little pressure vessels are gathered from a pipe and two spreads. For barrel molded vessels with a width up to 600 mm (NPS of 24 in), it is possible to use predictable pipe for the shell, subsequently avoiding various audit and testing issues, mainly the nondestructive examination of radiography for the long wrinkle if required. A deterrent of these vessels is that more conspicuous estimations are all the more expensive, so that for example the most money related condition of a 1,000 liters (35 cu ft), 250 bars (3,600 psi) pressure vessel might be a separation crosswise over of 91.44 centimeters (36 in) and a length of 1.7018 meters (67 in) including the 2:1 semi-roundabout domed end. Tops.



Spherical gas container. Cylindrical pressure vessel. Picture of the bottom of an aerosol spray can. Fire Extinguisher with rounded rectangle pressure vessel

Fig1: Types of Pressure Vessels

Materials for the Pressure Vessel

Many pressure vessels are made of steel. To make a barrel formed or round pressure vessel, rolled and possibly fabricated parts would should be welded together. Some mechanical properties of steel achieved by rolling or creating could be negatively affected by welding, unless one of kind protections are taken. Despite attractive mechanical quality, current models coordinate the use of steel with a high impact protection, especially for vessels used as a piece of low temperatures. In applications where carbon steel would persevere through disintegration, one of a kind utilization safe material should in like manner be used.

Some pressure vessels are made of composite materials, for instance, fiber wound composite using carbon fiber held set up with a polymer. In view of the high versatility of carbon fiber these vessels can be light, yet are generously more difficult to make. The composite material may be bent around a metal liner, forming a composite overwrapped pressure vessel.

Other particularly normal materials consolidate polymers, for instance, PET in carbonated refreshment holders and copper in channels.

Pressure vessels may be settled with various metals, ceramics, or polymers to balance spilling and shield the structure of the vessel from the contained medium. This liner may in like manner pass on a critical piece of the pressure stack.

Pressure Vessels may in like manner be created from concrete (PCV) or distinctive materials which are weak in strain. Cabling, wrapped around the vessel or inside the divider or the vessel itself, gives the indispensable strain to restrict the inside pressure. A "watertight steel thin layer" lines the internal mass of the vessel. Such vessels can be assembled from measured pieces therefore have "no inborn size limitations". There is in like manner a high demand of redundancy as a result of the sweeping number of individual connections restricting the internal pressure.

COMPOSITE MATERIALS:

This chapter describes the materials used for the processing of the composites under this investigation. It presents the details of the characterization and tests which the composite samples are subjected to.

ALUMINIUM METAL MATRIX

Aluminum matrix composites (AMCs) are potential materials for different applications because of their great physical and mechanical properties. The expansion of fortifications into the metallic lattice enhances the firmness, particular quality, wear, crawl and weariness properties com-pared to the customary designing materials. This paper shows the diagram of the impact of expansion on various fortifications in aluminum compound featuring their benefits and negative marks. Significant issues like agglomerating wonder, fiber-matrix holding and the issues identified with conveyance of particles are talked about in this paper. Impact of various support on AMCs on the mechanical properties like rigidity, strain, hardness, wear and weariness is likewise dis-cussed in detail. Real uses of various AMCs are likewise featured in this work.

MMC (Metal matrix composites) are metals fortified with other metal, clay or natural com-pounds. They are made by scattering the strengthen ments in the metal network. Fortifications are usu-allydone to enhance the properties of the base metal like quality, solidness, conductivity, etc.Aluminium and its compounds have pulled in most consideration as base metal in metal lattice composites. Aluminum MMCs are generally utilized as a part of flying machine, aviation, auto-mobiles and different fields. The fortify ments ought to be steady in the given working tem-perature and non-receptive as well. The most ordinarily utilized fortifications are

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017

Silicon Carbide (SiC) and Aluminum Oxide (Al2O3). SiC fortification in-wrinkles the rigidity, hardness, thickness and wear protection ofAl and its combinations. The molecule conveyance assumes an extremely essential part in the properties of theAl MMC and is enhanced by concentrated shearing. Al2O3 fortificationhas great compressive quality and wears protection.

STAINLESS STEEL

Stainless steels contain typically 10-30 % chromium besides other elements like C, Mn, Si, S etc. Chromium imparts corrosion resistance to steel. Varying amounts of other alloying elements like Ni, Mo, V, Ti, Ni, etc may be added to obtain certain specific property. There are different types of stainless steels like

Austenitic stainless steels

Ferrite stainless steels

Martensitic stainless steel

Duplex stainless steels

Precipitation hard enable stainless steel

INCONEL

Inconel is a group of austenitic nickel-chromium-based super composites. Inconel composites are oxidation-consumption safe materials appropriate for benefit in outrageous situations subjected to weight and heat..

S GLASS

Glass strands are among the most versatileIndustrial materials known today. They are readilyproduced from crude materials, which areAvailable in for all intents and purposes boundless supply. All glass strands portrayed in this article are derivedfrom creations containing silica. They Exhibit valuable mass properties, for example, hardness,Transparency, protection from substance assault, stability and latency, and in addition attractive fiberProperties, for example, quality, adaptability, and solidness.. A few high-quality glass strands are known, including S-glass, Te-glass, and R-glass. All offer 10 to 15% higher quality than E-glass at room temperature, yet their genuine esteem is their capacity to withstand higher being used temperatures than E-glass. These strands are utilized as a part of military applications. Stringent quality-control methods are important to meet military details. S-glass and Te-glass are subordinates of the ternary SiO2-Al2O3-CaO framework. R-glass is a subordinate of the quaternary SiO2-Al2O3-CaOMgO framework. S-glass and S-2 glass strands, an item variation, have a similar glass arrangement yet extraordinary coatings.

S-2 GLASS FEATURES

S-2 glass fiber offers significantly more strength then conventional glass fiber. 85% more tensile strength in resin-impregnated strands. Better fiber toughness, modules of resistance and impact deformation than conventional glass fiber. Excellent tolerance to damage accumulation.

BENEFITS

Steady, superior for solid and sturdy completed parts. Enhanced effect abilities to completed parts and higher composite durability and harm tolerance. The capacity of composite parts to withstand elevated amounts of pressure and flexural fatigue without calamitous disappointment.

SAFFIL

Saffil Alumina Fibers are high-immaculateness polycrystalline fibers intended for use in applications up to 1600°C. Since their improvement in the mid 1970s, Saffil Fibers have been utilized effectively to take care of issues in requesting high-temperature protection and numerous other strength applications. Saffil Fibers are delivered by a one of a kind arrangement expulsion process which guarantees the most elevated amounts of concoction virtue and least conceivable levels of shot substance (non-stringy particles). The exceptional technique for make enables the fiber distance across to be entirely controlled with a middle of around 3 microns with low levels of fiber under 1 micron in width.

COMPOSITE MATERIALS

Introduction

Composite materials have been comprehensively used to upgrade the execution of various sorts of structures. Appeared differently in relation to conventional materials, the central purposes of enthusiasm of composites are their preferred strength over mass extent and likewise high caliber to weight extent. Because of these central focuses, composites have been logically participated in helper parts in various present day fields. A couple of representations are helicopter rotor bleeding edges, plane wings in cutting edge plane outline, and platform structures in basic building applications. **Fibers**

Fibers are the critical constituent in a fiber-invigorated composite material. They have the greatest volume part in a composite cover and offer the genuine fragment of the load following up on a composite structure. True blue decision of the sort, aggregate and presentation ofstrands is imperative, in light of the fact that it impacts the going with qualities of a composite bay

- Tensile strength and modulus
- Compressive strength and modulus
- Fatigue strength and fatigue failure mechanisms
- Electric and thermal conductivities

The various types of fibers currently in use are:

- Glass Fibers
- Carbon Fibers
- Aramid Fibers
- Boron Fibers
- Silicon Carbide Fibers

Matrix

In a composite material the strands are enveloped by a thin layer of cross section material that holds the fibers always in the pined for presentation and spreads an associated stack among each one of the fibers. The network in like manner expects a strong part in choosing the natural consistent quality of the composite article and moreover mechanical components, for instance, toughness and shear quality.

The matrix entwines the strands, holding them balanced in the fundamental concentrated on heading. The network ought to in like manner isolate the fibers from each other so they can go about as discrete components. The system should shield the reinforcing filaments from mechanical mischief (e.g. scratched spot) and from normal ambush. A flexible system will give a techniques for support off or stopping parts that may have begun at broken strands; then again, a delicate structure may depend on the fibers to go about as grid break plugs. Through the idea of its "hold" on the fibers (the interfacial bond quality), the cross section can in like manner be an essential strategies for growing the toughness of the composite.

Applications of Composite Materials

The normal utilizations of composites are expanding step by step. These days they are utilized as a part of therapeutic applications as well. Some different fields of uses are:

• Automotive: Drive shafts, grasp plates, fiber Glass/Epoxy leaf springs for substantial trucks and trailers, rocker arm covers, suspension arms and direction for guiding framework, guards, body boards and entryways.

• Aerospace: Drive shafts, rudders, lifts, heading, landing gear entryways, boards and floor materials of planes,

• Payload inlet entryways, remote controller arm, high pick up receiving wire, reception apparatus ribs and struts and so forth.

• Marine: Propeller vanes, fans and blowers, outfit cases, valves &strainers, condenser shells.

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017

• Chemical Industries: Composite vessels for fluid petroleum gas for elective fuel vehicle, racked bottles for flame benefit mountain climbing, underground stockpiling tanks, channels and stacks and so forth.

•Electrical and Electronics: Structures for overhead transmission lines for railroads, Power line covers, Lighting shafts, Fiber optics malleable individuals and so forth.

PRESURE VESSEL USES

Pressure vessels are used as a piece of a collection of usages in both industry and the private division. They appear in these divisions as present day stuffed air beneficiaries and private bubbling water amassing tanks. Distinctive instances of pressure vessels are diving barrels, recompression loads, refining towers, pressure reactors, autoclaves, and various diverse vessels in mining operations, oil refineries and petrochemical plants, nuclearreactors vessels, submarine and spaceship common environment, pneumatic supplies, water driven archives under pressure, rail vehicle airbrake stores, road vehicle airbrake supplies, and limit vessels for softened gasses, for instance, noticing salts, chlorine, and LPG (propane, butane). A surprising utilization of a pressure vessel is the explorer cabin of a bearer; the outside skin passes on both the flying machine moving pressures and the hotel pressurization loads.

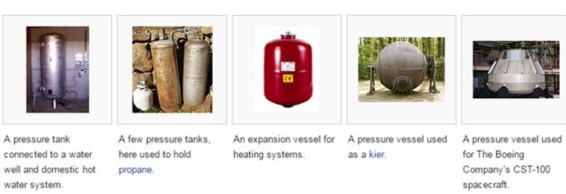


Fig2: various pressure vessels and their use

DESIGN AND SCALING

Scaling

Regardless of what shape it takes, the base mass of a pressure vessel scales with the pressure and volume it contains and is conversely corresponding to the quality to pressure ratioof the development material (least mass declines as quality increments).

Scaling of stress in walls of vessel

Pressure vessels are held together against the gas pressure due to pliant powers inside the dividers of the holder. The normal (malleable) stress in the dividers of the compartment is in respect to the pressure and range of the vessel and conversely relating to the thickness of the dividers. As needs be, pressure vessels are proposed to have a thickness with respect to the compass of tank and the pressure of the tank and oppositely relating to the best allowed run of the mill stress of the particular material used as a piece of the dividers of the holder.

Since (for a given weight) the thickness of the dividers scales with the compass of the tank, the mass of a tank (which scales as the length times traverse times thickness of the divider for a round and empty tank) scales with the volume of the gas held (which scales as length times run squared). The right condition vacillates with the tank shape however depends upon the thickness, ρ, and most prominent acceptable nervousness σ of the material despite the weight P and volume V of the vessel. (See underneath for the right conditions for the stress in the dividers.)

Spherical vessel

For a sphere, the minimum mass of a pressure vessel is

$$M = \frac{3}{2} P V \frac{\rho}{\sigma},$$

Where

M= mass

P= pressure difference between ambient (gauge pressure)

V= volume

ρ= density of the pressure vessel material

σ= maximum working stress that material can tolerate

Different shapes other than a circle have constants bigger than 3/2 (unending chambers take 2), albeit a few tanks, for example, non-round injury composite tanks can approach this.

Cylindrical vessel with hemispherical ends

This is in some cases called a "bullet" for its shape, in spite of the fact that in geometric terms it is a case. For a chamber with hemispherical finishes,

$$M = 2\pi R^2 (R + W) P \frac{\rho}{\sigma},$$

Where

- R = radius
- W = middle cylinder width , and the overall width is W + 2R

Cylindrical vessel with semi-elliptical ends

In a vessel with an aspect ratio of middle cylinder width to radius of 2:1,

$$M = 6\pi R^3 P \frac{\rho}{\sigma}.$$

Alternate components are consistent for a given vessel shape and material. So we can see that there is no hypothetical "effectiveness of scale", as far as the proportion of pressure vessel mass to pressurization vitality or of pressure vessel mass to put away gas mass. For putting away gasses, "tankage productivity" is autonomous of pressure, at any rate for a similar temperature.

In this way, for instance, a regular outline for a base mass tank to hold helium (as a pressurant gas) on a rocket would utilize a round load for a base shape steady, carbon fiber for most ideal M/pV, and exceptionally cool helium for most ideal

Stress in thin-walled pressure vessels

Stress in a shallow-walled pressure vessel in the shape of a sphere is

$$\sigma_\theta = \sigma_{\rm long} = \frac{pr}{2t},$$

Where σ_Θ is hoop stress, or stress in the circumferential direction, $\sigma_{\rm long}$ is stress in the longitudinal

Direction, p is inner gauge strain; r is the internal radius of the field, and tis thickness of the sector wall. A vessel may be taken into consideration "shallow-walled" if the diameter is at the least 10 times (from time to time referred to as 20 times) greater than the wall depth.

Stress in a shallow-walled stress vessel in the shape of a cylinder is

$$\sigma_\theta = \frac{pr}{t},$$
$$\sigma_{\rm long} = \frac{pr}{2t},$$

where:

- σ_θ is hoop stress, or stress in the circumferential direction
- σ_{long} is stress in the longitudinal direction
- p is internal gauge pressure
- r is the inner radius of the cylinder
- t is thickness of the cylinder wall.

All weight vessel layout benchmarks contain assortments of these two formulas with additional test terms to speak to divider thickness resistances, quality control of welds and in-advantage utilization rewards.

For instance, the ASME Boiler and Pressure Vessel Code (BPVC) (UG-27) recipes are

Spherical shells:

$$\sigma_\theta = \sigma_{\rm long} = \frac{p(r + 0.2t)}{2tE}$$

Cylindrical shells:

$$\sigma_\theta = \frac{p(r + 0.6t)}{tE}$$
$$\sigma_{\rm long} = \frac{p(r - 0.4t)}{2tE}$$

where E is the joint efficient, and all others variables as stated above.

The factor of safety is often included in these formulas as well, in the case of the ASME BPVC this term is

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017

included in the material stress value when solving for pressure or thickness.

Winding angle of carbon fiber vessels

Wound boundless round and hollow shapes ideally take a twisting point of 54.7 degrees, as this gives the fundamental double the quality the circumferential way to the longitudinal.

Operation standards

Pressure vessels are proposed to depictions safely at a chose strain and temperature, really suggested on the grounds that the "Layout Pressure" and "Plan Temperature". A vessel this is insufficiently proposed to adapt to a high anxiety constitutes a truly important wellbeing shot. In this manner, the characterize and accreditation of pressure vessels is spoken to by method for setup codes, for instance, the ASME Boiler and Pressure Vessel Code in North America, the Pressure Equipment Directive of the EU (PED), Japanese Industrial Standard (JIS), CSAB51 in Canada, Australian Standards in Australia and diverse overall models like Lloyd's, GermanischerLloyd, Det Norske Veritas, SociétéGénérale de Surveillance (SGS S.A.), Lloyd's Register Energy Nederland (prior called Stoomwezen) et cetera.

Note that in which the pressure volume thing is a lump of a security stylish, any incompressible liquid inside the vessel can be rejected on the grounds that it doesn't add to the capacity control set away inside the vessel, so simply the degree of the compressible component, as a case, gas is connected.

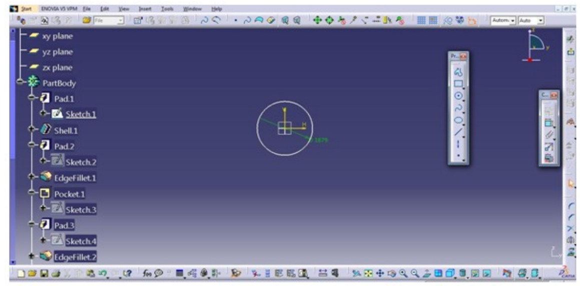
CATIA

(computer aided three-dimensional interactive application) is a multi-platform CAD/CAM/CAE commercial software suite developed by the French company **DASSAULT SYSTEMS.**

MODELING OF PRESSURE VESSEL

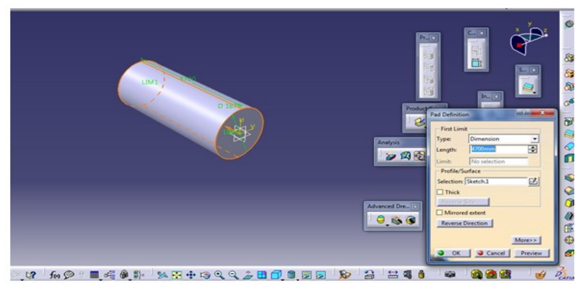
Draw a circle

Diameter of circle: 1879 mm



Extrude

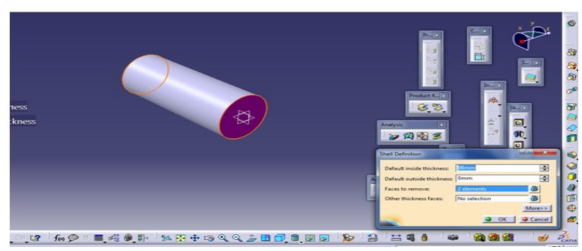
Extrude length: 4700 mm



Shell

Inside thickness: 98 mm

Outside thickness: 0 mm



Holes

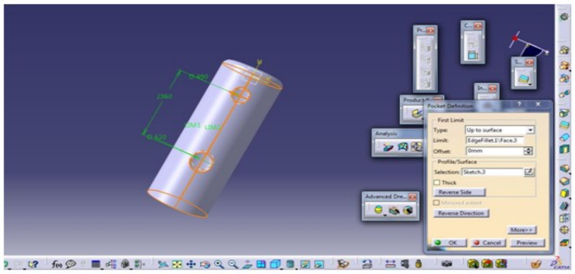
First Hole Diameter: 620 mm

Second Hole diameter: 490 mm

Distance of two holes: 2360 mm

Pocket distance: up to surface

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017



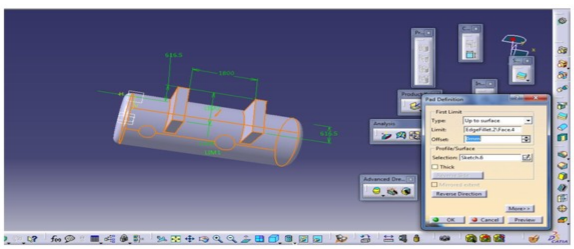
Supports

Supporting pad length: 1233 mm

Supporting pad width: 200 mm

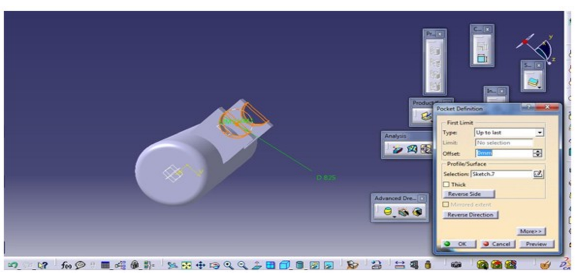
Distance of two supports: 1800 mm

Surface to Height of supporting pad: 615.5 mm



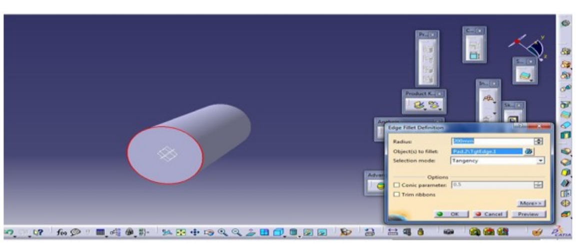
Holes on supports

Hole diameter: 825 mm

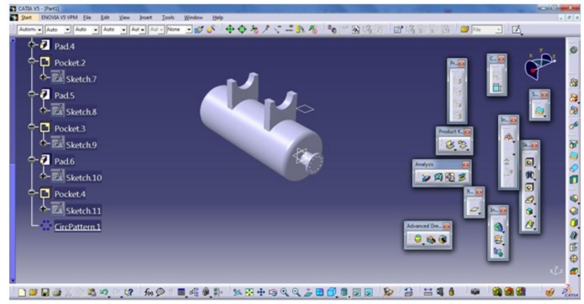


Fillets

Radius of Edge fillet: 200 mm



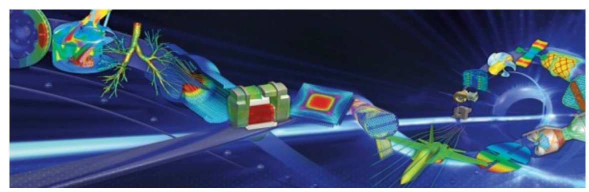
Pressure vessel model



ANSYS

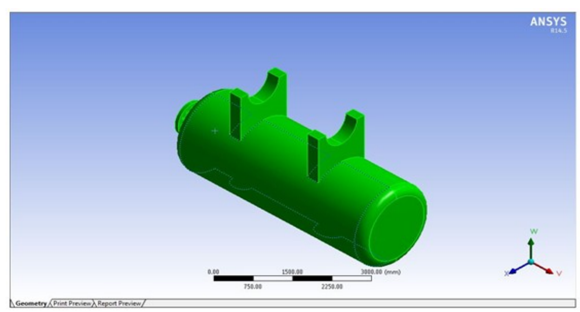
Introduction

ANSYS delivers innovative, dramatic simulation technology advances in every major Physics discipline, along with improvements in computing speed and enhancements to enabling technologies such as geometry handling, meshing and post-processing.

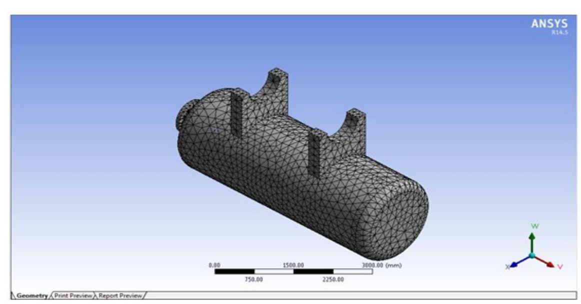


STRUCTURAL ANALYSIS ON PRESURE VESSEL

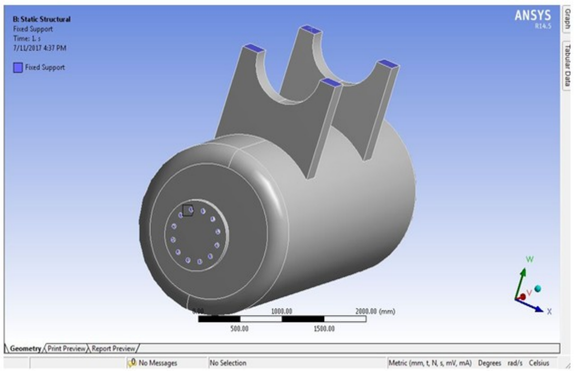
Model



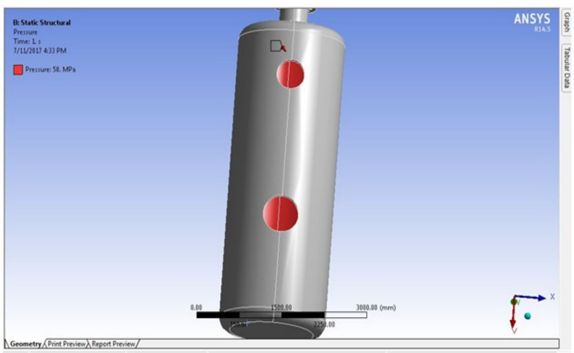
Mesh



Fixed support



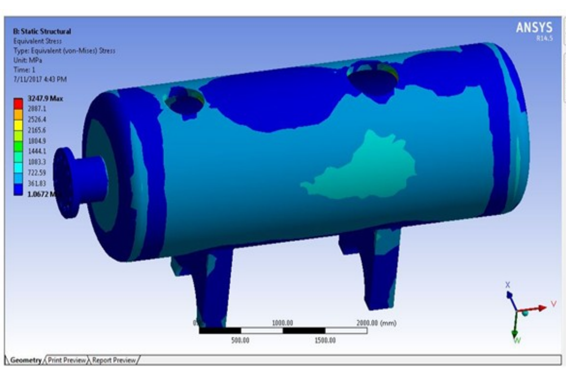
Pressure load



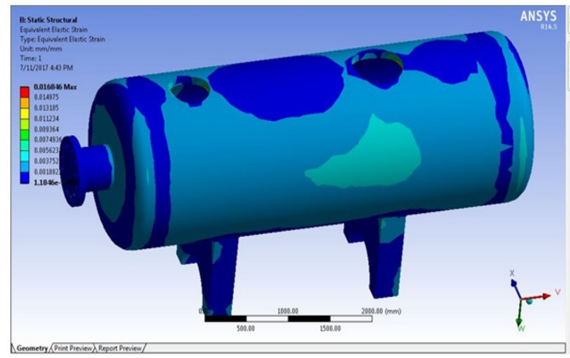
Material	Density(kg/m^3)	Young's modulus(MPa)	Poison's ratio	Bulk modulus (Mpa)	Shear modulus (Mpa)
stainless steel	7750	1.93e+005	0.31	1.693e+005	73664
aluminium metal matrix	2800	98000	0.33	96078	36842
inconel	8440	2.08e+005	0.28	1.5758e+005	81250
s2 glass	2460	86900	0.23	53642	35325
saffil	3300	3.0e+005	0.2	1.667e+005	1.25e+005

STAINLESS STEEL

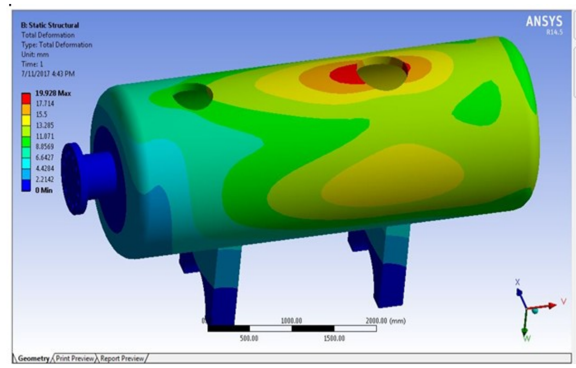
Max stress



Max strain

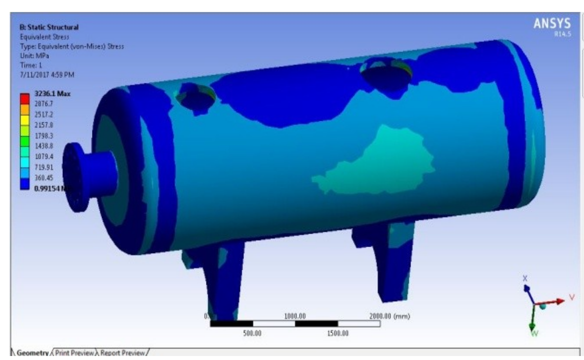


Total Deformation



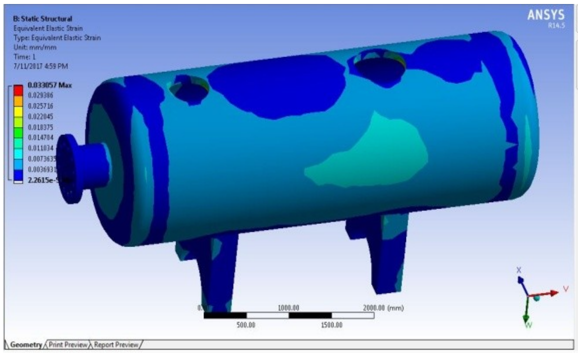
ALUMINIUM METAL MATRIX

Max stress

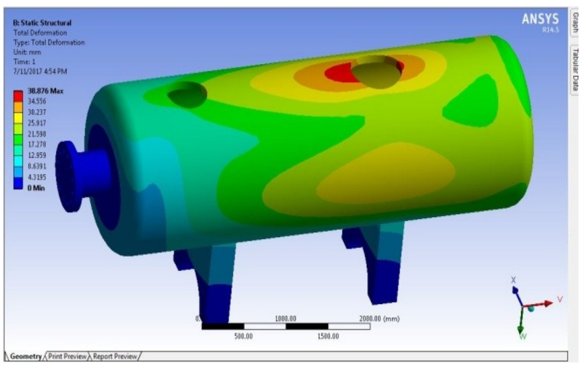


Max strain

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017

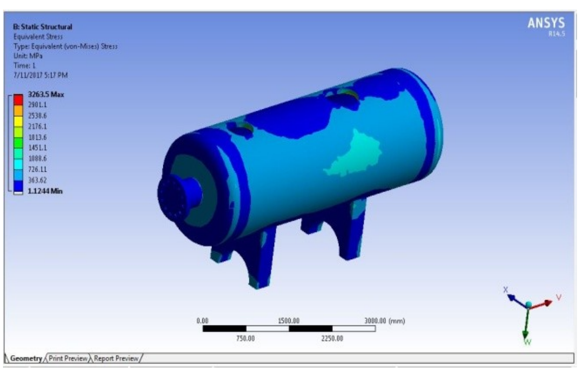


Total Deformation

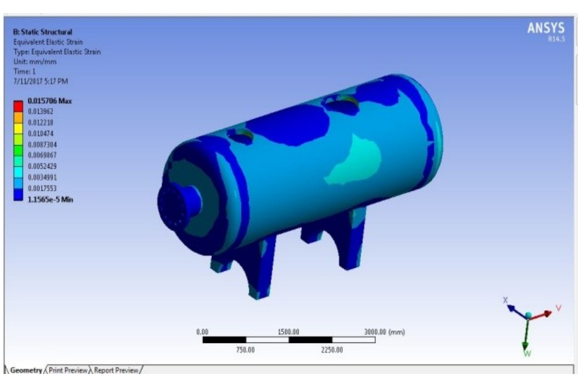


INCONEL

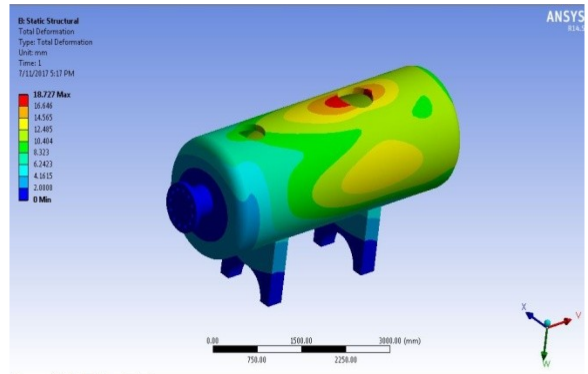
Max stress



Max strain

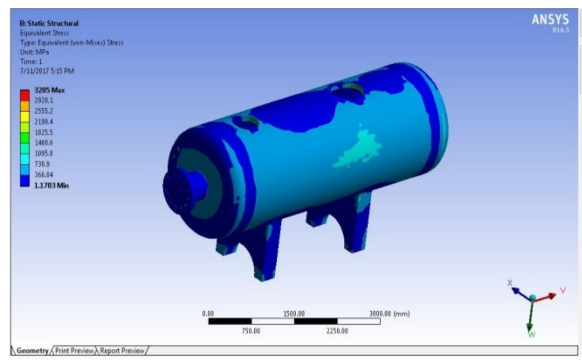


Total Deformation

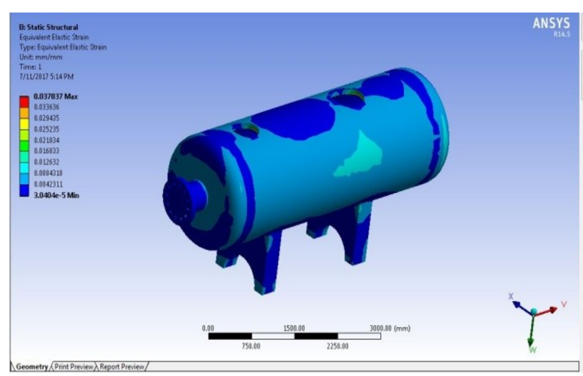


S2 GLASS

Max stress

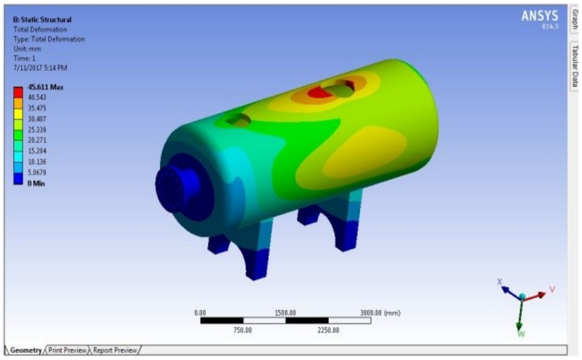


Max strain



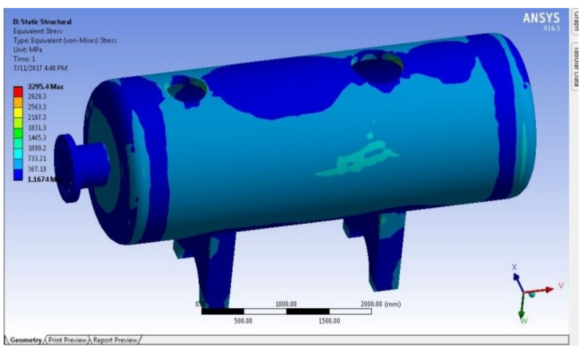
Total Deformation

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017

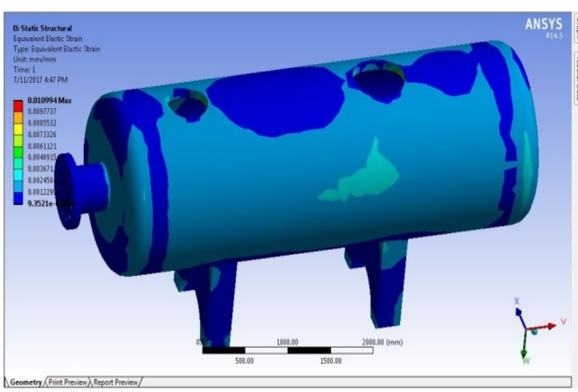


SAFFIL

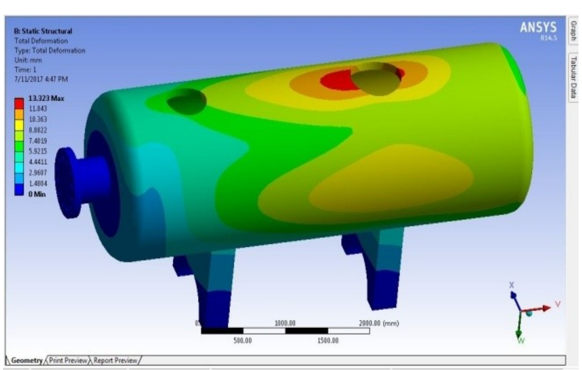
Max stress



Max strain



Total Deformation



Results table

Material	Max Stress (Mpa)	Max Strain	Total deformation (MM)
stainless steel	3247.9	0.016846	19.928
aluminium metal matrix	3236.1	0.033057	38.876
inconel	3263.5	0.015706	18.727
s2 glass	3285	0.037837	45.611
saffil	3295.4	0.010994	13.323

MATERIAL TESTING

Mechanical testing

Mechanical testing reveals the properties of a material when propel is associated logically or statically. A mechanical test demonstrates whether a material or part is sensible for its normal application by measuring properties, for instance,versatility, elasticity, prolongation, hardness, crack strength, affect protection, stretch burst and beyond what many would consider possible.

Tensile Test

This test is carried out with accordance of IS 1608:2005. This testing processinvolves the test specimen to be placed in a testing machine and applies tension to it till it get fractured. The tensile force recorded as function of increase in the gauge length. A point load was applied along the center of the span of the corrugation. The maximum load at the point was noted, which gives the splitting load for the corrugated specimen.

Fig: Test Piece 1(Aluminium Metal Matrix)

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017

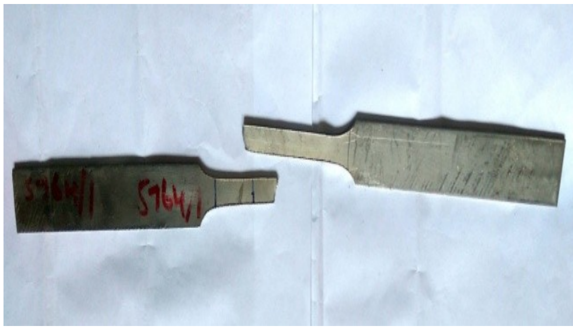


Fig: Test Piece 2(stainless steel)

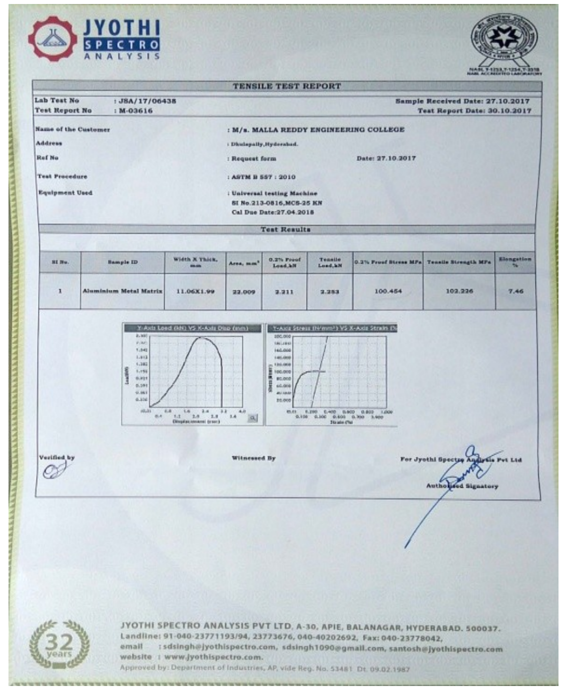
Force is applied perpendicular to the cross sectional area of the test item. Two of the essential material properties that tractable tests decide are:

- Yield Strength, which is the anxiety required to for all time extend, or twist, a material a particular sum, normally 0.2% of aggregate extension.

- Ultimate Tensile Strength, which is the most extreme anxiety a material can withstand only.

MECHANICAL TEST REPORTS

Aluminium Metal Matrix



JYOTHI SPECTRO ANALYSIS

TENSILE TEST REPORT

Lab Test No : JSA/17/06438 Sample Received Date: 27.10.2017
Test Report No : M-03616 Test Report Date: 30.10.2017

Name of the Customer : M/s. MALLA REDDY ENGINEERING COLLEGE
Address : Dhulapally,Hyderabad.
Ref No : Request form Date: 27.10.2017
Test Procedure : ASTM B 557 : 2010
Equipment Used : Universal testing Machine
SI No.213-0816,MCS-25 KN
Cal Due Date:27.04.2018

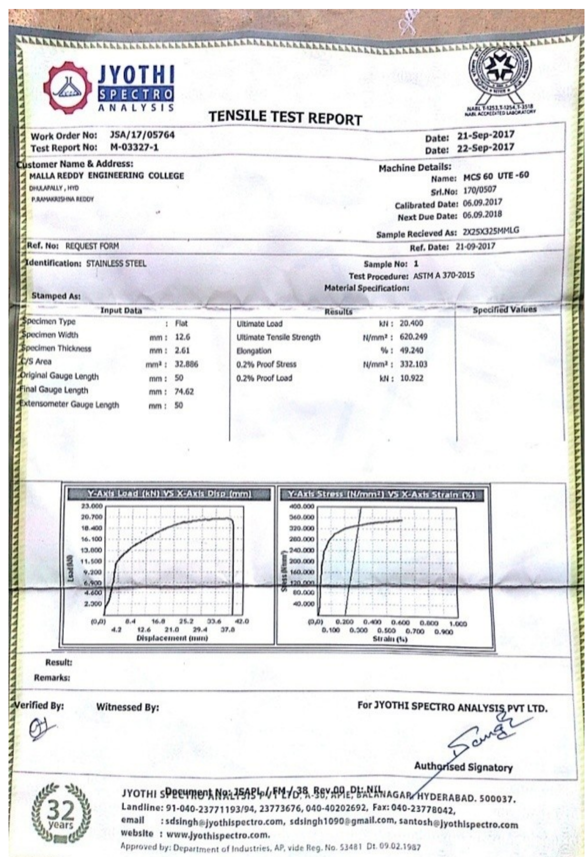
Test Results

Sl No.	Sample ID	Width X Thick. mm	Area, mm²	0.2% Proof Load,kN	Tensile Load,kN	0.2% Proof Stress MPa	Tensile Strength MPa	Elongation %
1	Aluminium Metal Matrix	11.06X1.99	22.009	2.211	2.253	100.454	102.236	7.46

Verified by Witnessed By For Jyothi Spectro Analysis Pvt Ltd
Authorised Signatory

JYOTHI SPECTRO ANALYSIS PVT LTD, A-30, APIE, BALANAGAR, HYDERABAD. 500037.

Stainless Steel



JYOTHI SPECTRO ANALYSIS

TENSILE TEST REPORT

Work Order No: JSA/17/05764 Date: 21-Sep-2017
Test Report No: M-03327-1 Date: 22-Sep-2017

Customer Name & Address:
MALLA REDDY ENGINEERING COLLEGE
DHULAPALLY , HYD
P.RAMAKRISHNA REDDY

Machine Details:
Name: MCS 60 UTE -60
Srl.No: 170/0507
Calibrated Date: 06.09.2017
Next Due Date: 06.09.2018
Sample Recieved As: 2X25X325MMLG

Ref. No: REQUEST FORM Ref. Date: 21-09-2017
Identification: STAINLESS STEEL
Sample No: 1
Test Procedure: ASTM A 370-2015
Material Specification:
Stamped As:

Input Data			Results			Specified Values
Specimen Type	:	Flat	Ultimate Load	kN :	20.400	
Specimen Width	mm :	12.6	Ultimate Tensile Strength	N/mm² :	620.249	
Specimen Thickness	mm :	2.61	Elongation	% :	49.240	
C/S Area	mm² :	32.886	0.2% Proof Stress	N/mm² :	332.103	
Original Gauge Length	mm :	50	0.2% Proof Load	kN :	10.922	
Final Gauge Length	mm :	74.62				
Extensometer Gauge Length	mm :	50				

Result:
Remarks:

Verified By: Witnessed By: For JYOTHI SPECTRO ANALYSIS PVT LTD.
Authorised Signatory

JYOTHI SPECTRO ANALYSIS PVT LTD, A-30, APIE, BALANAGAR, HYDERABAD. 500037.

CONCLUSION

- Design and analysis of pressure vessel is done.
- Brief study about pressure vessel, its features design is done in this project.
- Modeling of pressure vessel is done in Catia V5 design software
- The model is saved as igse files to import in ansys
- Pressure vessel is assigned with five different materials such as stainless steel, aluminum metal matrix, Inconel, S2Glass, Saffil.
- Model is meshed, fixed, and applied pressure load of 6MPA.
- Stress, strain, total deformation as the result of analysis is noted and tabulated.
- From result table we can conclude that aluminum metal matrix showing least stress value compare to other materials, meanwhile aluminum metal matrix also has 2nd less weight ratio after S2glass.
- Hence we can conclude that aluminum metal matrix (KS12750)is best suitable material for pressure vessel because of its less stress value on load conditions and its weight ratio
- Here we have applied new composite material as Aluminum metal matrix (KS12750) which gives better result than conventional stainless material.

REFERENCES

[1] Vasiliev V, Krinakov AA, Razin AF. New generation of filament–wound composite pressure vessels for commercial applications. Composite Structure 2003; 62:449–59.

[2] AzamTafreshi, Delamination buckling and post buckling in composite cylindrical shells under combined axial compression and external pressure. Composite Structures 2006; 72: PP 401– 418.

[3] Verijenko EV, Adali S, Tabakov PY. Stress distribution in continuously heterogeneous thick laminated pressure vessels.Composite Structures 2001; 54:371–7.

[4] E. Frulloni, J.M. Kenny. Experimental study and finite element analysis of the elastic instability of composite lattice structures for aeronautic applications. Composite Structures 2007; 78:519–528

[5] AzamTafreshi, Colin G. Bailey. Instability of imperfect composite cylindrical shells under combined loading. Composite Structures 2007; 80:49–64.

[6] Myung-Gon Kim, Sang-Guk Kang. Thermally induced stress analysis of composite/aluminum ring specimens at cryogenic temperature. Composites Science and Technology 2008; 68 :1080–1087.

[7] Varga L, Nagy A, Kovacs A. Design of CNG tank made of aluminium and reinforced plastic. Composites 1995; 26:457–63.

[8] P.B. Gning, M. Tarfaoui, Damage development in thick composite tubes under impact loading and influence on implosion pressure. Composites: Part -B 362005; 36:306–318.

[9] Zheng JY, Liu PF. Elasto-plastic stress analysis and burst strength evaluation of Al-carbon fiber/epoxy composite cylindrical laminates. Computational Materials Science 2008; 42(3):453–61.

[10] Parnas L, Katrice N. Design of fiber-reinforced composite pressure vessels under various loading conditions. Composite Structures 2002; 58:83–95. [11] Katırcı N., "Design of fiber reinforced composite pressure vessels", M. S. Thesis, Middle East Technical University, Turkey, 1998.

[12] M. Walker and P.Y. Tabakov, "Design optimization of anisotropic pressure vessels with manufacturing

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017

uncertainties accounted for", International Journal of Pressure Vessels and Piping 104 (2013) 96-104-19.

AUTHORS:

Mr.P.RAMAKRISHNA REDDY

Pg Scholar, Dept of MECH, Mallareddy Engineering College, Autonomous,maisammaguda, Hyderabad, Telangana, INDIA
Email:rkreddy1992@yahoo.com
Phone No: 9177957067

Mr.A.PRASHANTH

Assistant Professor, Dept of MECH,Mallareddy Engineering College, Autonomous, maisammaguda, Hyderabad Telangana, INDIA
Email:adunuri327@gmail.com
Phone No: 8790833371

Mr.D.SURESH REDDY

Assistant Professor, Dept of MECH,Mallareddy Engineering College, Autonomous, maisammaguda, Hyderabad Telangana, INDIA
Email:dumpasureshreddy@gmail.com
Phone No: 9642220220