

# DESIGN AND ANALYSIS OF AUTOMOBILE WHEEL RIM WITH RADIAL AND SPIRAL FLEXURES

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**Abstract**— Today's interest in metal alloys for automotive applications relies on the mixture of high strength properties and denseness. For this reason magnesium alloys are terribly enticing as structural materials wherever weight savings are of great concern. In automotive applications weight reduction will improve the performance of a vehicle by reducing the rolling resistance and energy of acceleration, therefore reducing the fuel consumption and furthermore a discount of the greenhouse gas and greenhouse emission is achieved. Wheel rim is an inseparable part of associate degree automobile. Its main functions are to help propulsion of a vehicle on the road similarly as withstand against the vehicle weight and sensible conditions like turning and braking, environmental conditions. In automobile, a wheel rotate unceasingly during propulsion thus total load on a vehicle induces alternating fatigue stress during a wheel rim. So as to sustain all masses and sensible conditions wheel materials should be of good quality. Magnesium alloy is that the lightest of all metals used as a basis for constructional alloys. It is this property that entices automobile makers to replace denser materials, not solely steels, solid irons and copper base alloys, however even Al alloys by magnesium primarily based alloys. The necessity to scale back the weight of automobile elements as an end in a part of the introduction of legislation limiting emission has triggered renewed interest in metal. The expansion rate over the next ten years has been forecast to be 7- percent once a year. A wider use of metal base alloys necessitates many parallel programs. These are classified as alloy development, method development: improvement and design issues. Metal encompasses a long history in automotive applications. The decrease of metal use in automotive applications within the seventies was greatly connected to its prize volatility and additionally to lack of data. Stricter legislative rules (CAFE) and voluntary commitments to reduce the typical fuel consumption have these days revived the interest in magnesium. The aim of this paper is to review the influence of magnesium in properties of existing wheel rim material

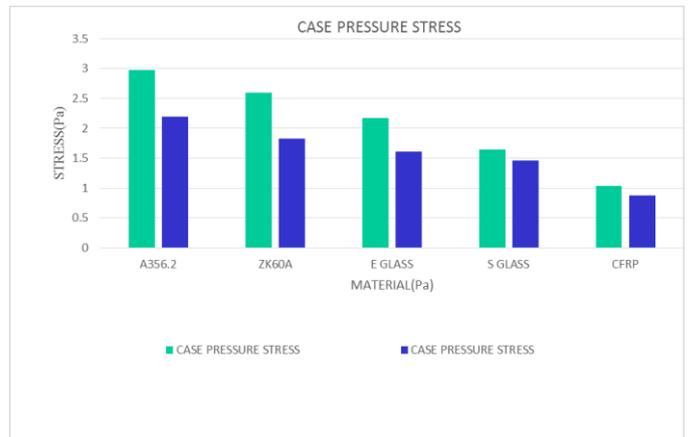
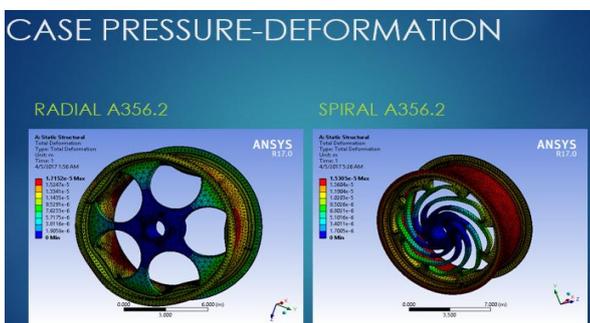
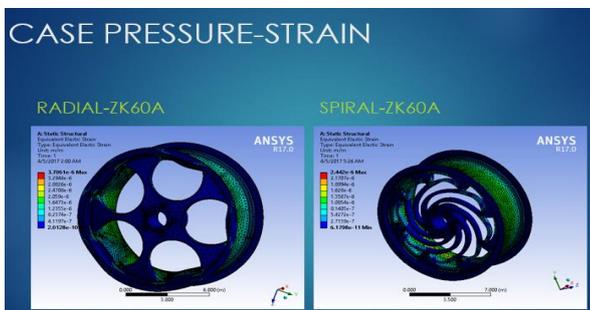
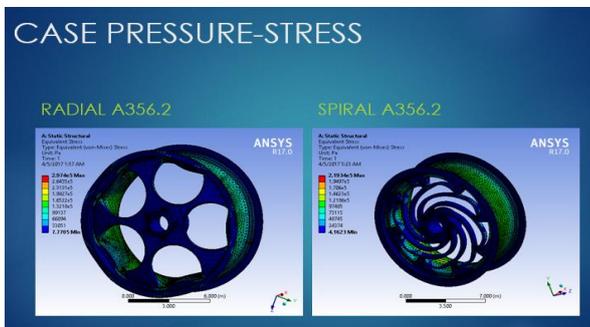
**Index Terms**—Wheel rim materials, Magnesium, Carbon Nano-Tubes.

## I.INTRODUCTION

There is increasing interest in light-weight weight construction since the car industry's commitment to realize a twenty fifth reduction in average fuel consumption for all new cars by the year 2005 (compared to levels in 1990). Magnesium with its sensible strength to weight quantitative relation is one of the candidate materials to understand light-weight weight construction, however it's to contend with varied alternativematerials. Therefore ,the totally different light-weight metals need to contend not solely with one another, however additionally with polymers and steels. Materials choice is thereby determined by economic problems the maximum amount as by materials and components characteristics or properties. However Mg shows high potential to substitute conventional materials. Mg alloys ought to be used in applications wherever Mass and high specific properties are needed. in keeping with the mix of specific Young's modulus and high specific strength magnesium alloys show similar or perhaps higher values than atomic number 13 and lots of business steels. With the increasing use of Mg the price per metric ton is coming down, that makes it additional competitive from the economic purpose of read too. The consumption of primary Mg shows a broad increase within the last 20 years whereas North America is that the main client followed by the western a part of Europe and Japan one. Most of the obtainable Mg (40%) continues to be used for alloying aluminum atomic number 13 and solely concerning thirty fourth is directly used for Mg components, which might be divided into casting applications (33.5%) and formed materials (0.5%). It was calculable that the marketplace for Mg die castings can grow from one zero five tons in 2000 to double this amount in 2006. Close to eighty exploit this market is expected to travel towards die casting automotive parts. The need for light-weight, high strength materials has been recognized since the invention of the plane. As the strength and stiffness of a fabric will increase the dimensions, and

consequently, the mass, of the fabric required for an exact load bearing application is reduced. This results in many blessings within the case of aircraft and vehicles like to increase in payload and improvement of the fuel potency. With international oil resources on a decline, increase within the fuel potency of engines has become extremely fascinating. The inadequacy of metals and alloys in providing each strength and stiffness to a structure has crystal rectifier to the event of metal matrix composites (MMCs), whereas the strength and malleability is provided by the metal matrix and the strength and/or stiffness is provided by the reinforcement that's either a ceramic or high stiffness metal primarily based particulate or fiber. Metal matrix composites is designed to possess qualities like low coefficient of thermal expansion and high thermal conductivity.

II.ANALYSIS



III.LITERATURE SURVEY

M. Sabari et.al (2015) has studied the comparative study of wheel rim materials for its deformation with the help of FEA. In his study he considered two materials particularly steel and aluminum alloy. CAD model of each material has designed using Solid works and analysis is performed by using CATIA package. During this analysis he changed the two parameters like load applied and speed of wheel rim. By ever-changing load and cruising speed rims has analyzed additionally graph of most displacement against speed aforethought and it is found that as speed will increase displacement of each material will increase. Displacement in alloy wheel rim is over the steel .

T. Shiva Prasad et.al (2014) has studied the properties of various sorts of wheel rims with advantageous and disadvantages of assorted materials like Al, Mg, carbon fiber, steel, etc. he studied relatively aluminium and solid steel for static displacement, von Mises stress and dynamic displacements. Researcher found that stress evoked furthermore as displacement of aluminium wheel rim is quite higher than the forged steel .

Sourav Das (2014) has studied the planning and weight optimization of car wheel rim by taking AlSi7Mg0.3 metallic element alloy wheel. in keeping with researcher and wheel rim material manuals metallic element alloys, metallic element alloys are lightweight , very good heat conductor similarly as wonderful aesthetic look. Ductility of metallic element alloys is extremely low as compared

S. Ganesh et.al (2014) has studied the Al 356.2 aluminium alloy wheel for spiral wheel rim used for four wheel vehicles and given the properties of assorted rim materials with some drawbacks. Paper aforementioned that magnesium rims are sturdy enough however not appropriate for off road vehicles however they're utilized in a Mercedes-G automotive

models. Just one massive disadvantage of metallic element is bent rim can't be repaired thus such rims square measure directly fall in scrap .

**N. Satyanarayana et.al (2012)** has studied the over casted metallic element alloy (Al.356.2) wheel rim for finding fatigue behaviour underneath constant loading. Researcher not thought-about the comparison of Al.356.2 with different styles of materials .

**Qiuyu Huang** studied the corrosion of CNTs/Mg in sodium chloride solution. Once CNTs was attached, compact web structure will be fashioned on the corrosion interface; it will forestall the invasion of Cl- and safeguards the alloy. The degree of corrosion is most slight and corrosion rate is lowest once the content of CNTs is 1.5%, the corrosion resistance inflated by 9.79 times. The main compositions of corrosion product are Mg(OH)<sub>2</sub>, MgO and CNTs, and this will be tested by the analysis of the surface and structure of mineral. CNTs have the capability to cut grain size and increase the corrosion resistance .

**Weixue Li** analyzed the strain of every part of CNTs strengthened Mg matrix composites once being loaded. The most strengthening mechanism is stress transfer-ring. The more the layer variety is, the more thin the dispersing is, and this go against the raise of yield strength. Solely at intervals the specially attached scope of CNTs length, will the yield strength rise .

**Zhao Ping** prepares the CNTs particulate strengthened magnesium matrix amorphous composite material. On observing through transmission microscope, he found that carbon nanotubes particles combined with matrix utterly, and XRD characterization is also additionally verified that the amorphous structure wasn't huge modified. Compression check proves that the maximum compression strength and fracture displacement were improved. The large space agglomeration of CNTs wasn't found. CNTs fashioned a lots of toughening nest structure within the matrix. However the amendment of macro plastic toughness material isn't obvious .

IV.CONCLUSION

From this technical and analysis note, we can conclude that mechanical properties of the automobile wheel rim can be enhanced with combination of Mg-CNT Nano composites. Due to light weight application of magnesium, the un sprung weight of the automobile is reduced there by with an increase

in fuel efficiency. The major drawback is the high cost of carbon nano tubes which is used for increasing the strength of magnesium

	RADIAL	SPIRAL
A356.2	100%	11%
CFRP	66%	23%

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