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"WEIGHT OPTIMIZATION WITH ALTERNATE MATERIAL OF AUTOMOBILE WHEEL RIM USING DYNAMIC ANALYSIS"

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ABSTRACT

The motivation behind the vehicle wheel edge gives a firm base on which to fit the tire. Its measurements, shape ought to be reasonable to satisfactorily suit the specific tire required for the vehicle. In this investigation a feel sick of vehicle wheel edge having a place with the plate wheel class is thought of. Structure in a significant modern movement which impacts the nature of the item. The wheel edge is planned by utilizing displaying programming Inventor. In demonstrating the time spent in delivering the unpredictable 3-D models and the hazard associated with structure and assembling procedure can be effectively limited. So the displaying of the wheel edge is made by utilizing SOLIDEDGE. Later this SOLIDEDGE model is imported to ANSYS for investigation work. ANSYS programming is the most recent utilized for mimicking the various powers, pressure following up on the part and furthermore for figuring and review the outcomes. A solver mode in ANSYS programming computes the anxieties, diversions, shear pressure and their relations without manual mediations, lessens the time contrasted and the strategy for scientific calculations by a human. ANSYS static examination work is done by considered two distinct materials to be specific Steel S-7, aluminum composite, magnesium compound, PEEK with 30% of Carbon Reinforced (PEEK CF 30) and their relative exhibitions have been watched separately. In this task by watching the consequences of static investigations acquired PEEK with 30% of Carbon Reinforced is recommended as best material.

Key Words: ANSYS, Solidedge, Stress Analsys, Wheel Rim, Steel S-7, Magnesium Alloy, Aluminium, PEEK with 30% of Carbon Reinforced (PEEK CF 30).

I. INTRODUCTION

Wheel rim is an inseparable part of an automobile mounted on the axle hub of a vehicle. Its main functions are to rotate over the axle of a automobile so as to use power from engine to propel automobile, provide support for braking system over its body, dissipate heat generated in the body of wheel rim to surrounding environment, support whole body weight as well as withstand against impact load due to pot holes and road irregularities with constant load of rider body as well as constant tyre pressure. Wheels have a vital importance for the safety of the vehicle and special care is needed in order to ensure their stability. The advancement of the wheel has strongly influenced the design, material selection and the manufacturing process. They are loaded in a complex manner and further improvement in the wheel design will be possible only if their loading will be better implicit. in order to achieve an optimum design of the wheel, the accurate knowledge of the loading, the mechanical properties and allowable stresses of the material is required.

Fig.1 Wheel Rim

II. OBJECTIVE

Our objective is to improve the performance of wheel rim by reducing the weight, deformation and stresses without affecting its performance through the static and dynamic analysis with the help of Solid edge and ANSYS software.

III. PROBLEM DEFINATION

In existing design of wheel rim of vehicle was very weighted so fuel consumption rate is higher. And its minimizing the weight of wheel rim through material selection. And we have applying all loads on the model of wheel rim with different materials and find results with the help of analysis software.

IV. METHODOLOGY

In my dissertation, alloy wheel three dimension model have been analyzed for additional research. The result obtained by experimentation of steel materials , aluminium alloy and Magnesium alloy and *PEEK with 30% of Carbon Reinforced (PEEK CF 30)* by using ANSYS.

4.1 Theory of wheel rim

The wheel of any vehicle is most important component. It provides the movement and also carries the loads. The tire of vehicle is assembled with rim, and these assemblies provide the function and performance of the automobile. The tire is design by manufacturer is suitable for rim, because various type of rim is available for different types of vehicles.
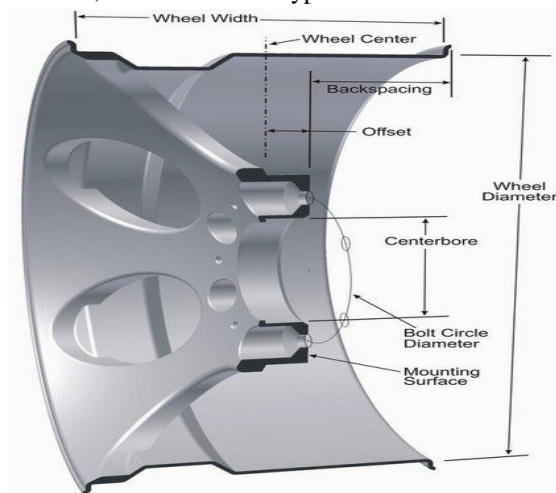

Fig. 4.1 Wheel rim nomenclature

4.2 DRAFTING OF WHEEL RIM MODEL

Drawing the 2D model of this final wheel rim model, which is show the all dimension of the model. This is also done with the help of SOLIDEDGE software which is called Drafting. It is essential part of every design.
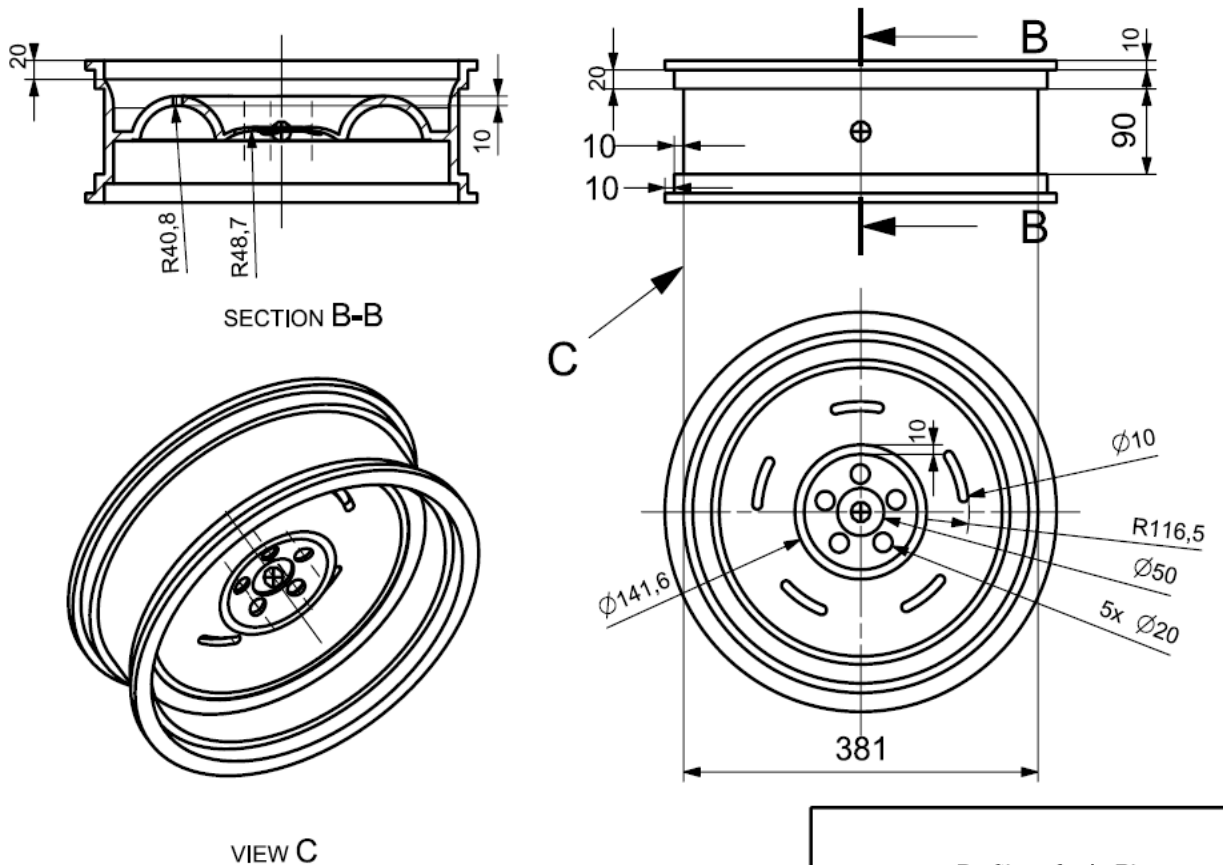

Fig. 4.2 Drafting View of the Wheel rim

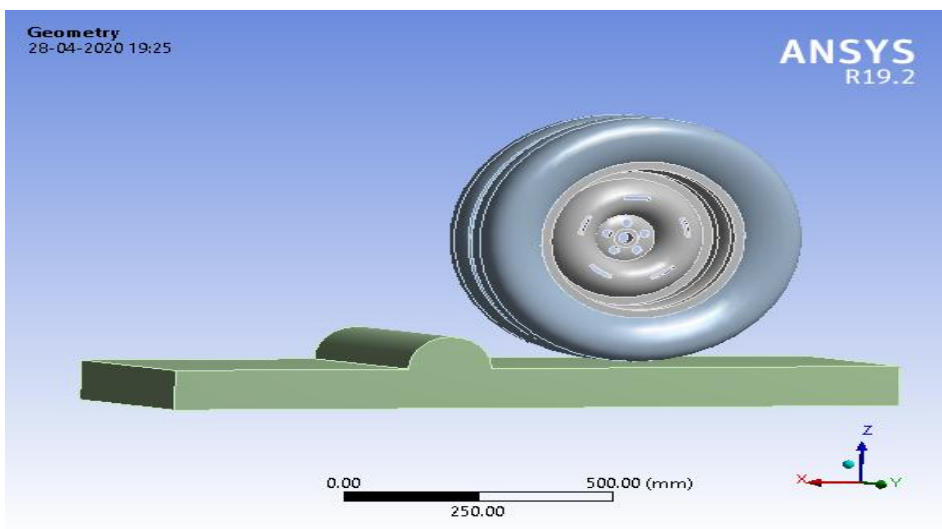### 4.3 EXPORT 3D MODEL OF WHEEL RIM IN ANSYS FOR ANALYSIS
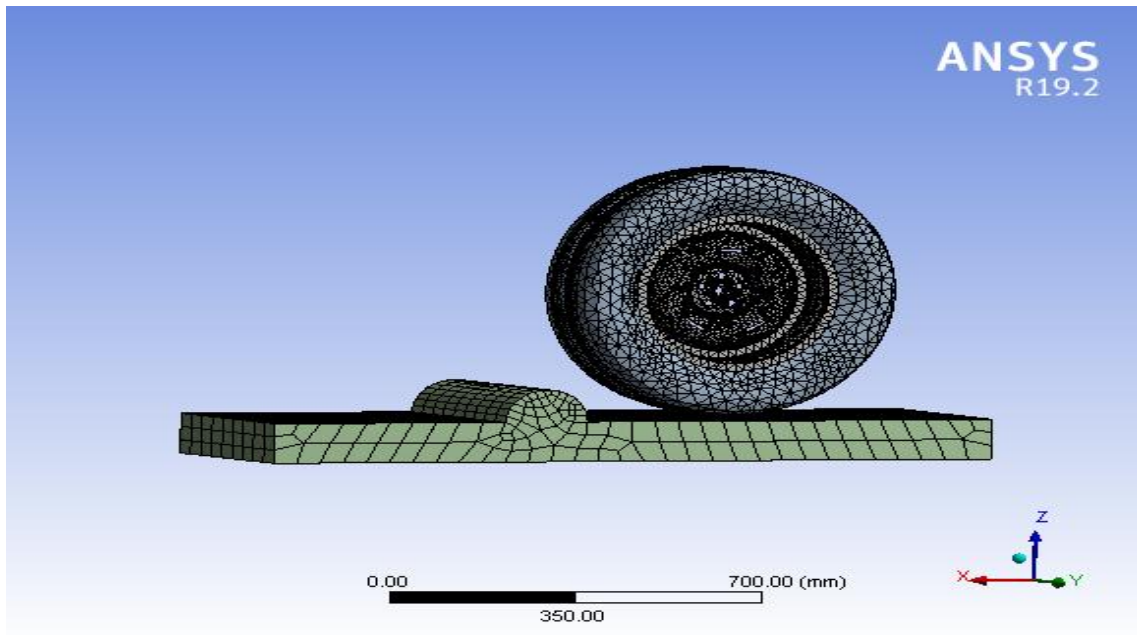

Fig. 4.3 Export in ANSYS Wheel rim

Fig.4.4 Meshing generate in Wheel rim

4.4 LOAD APPLIED

Here the load of 5790 N is applied throughout the half inner surface area of the hub, because all load always applied half area of hub surface in static condition.

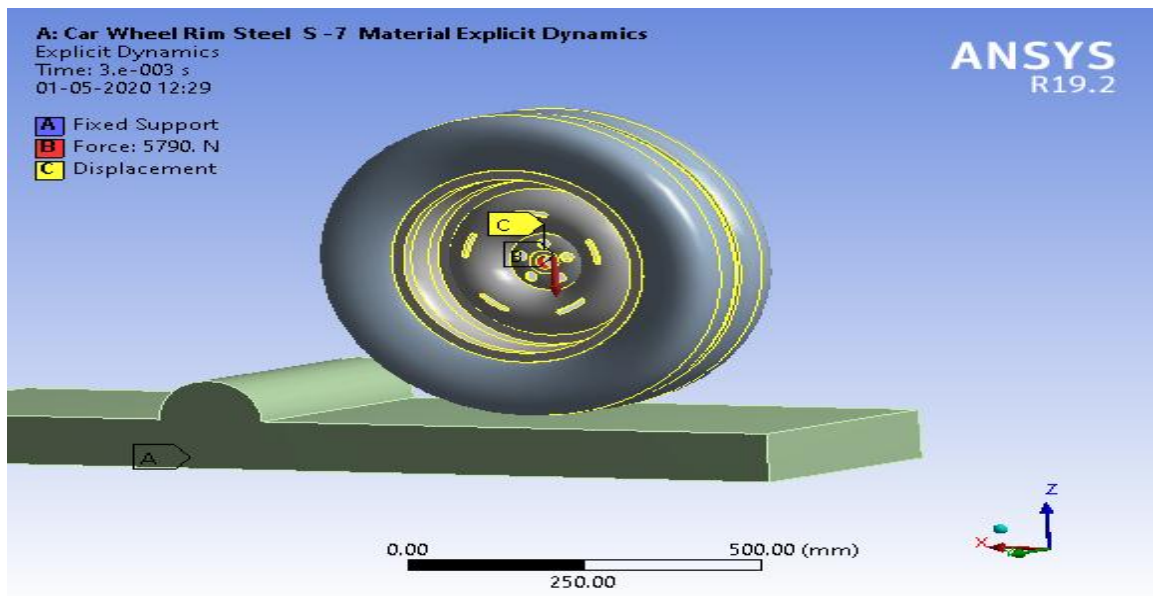#### 4.4.1 Car wheel rim steel S-7 material

Fig. 4.5 Car wheel rim steel S-7 (Exiting) material boundary conditions fixed support , force
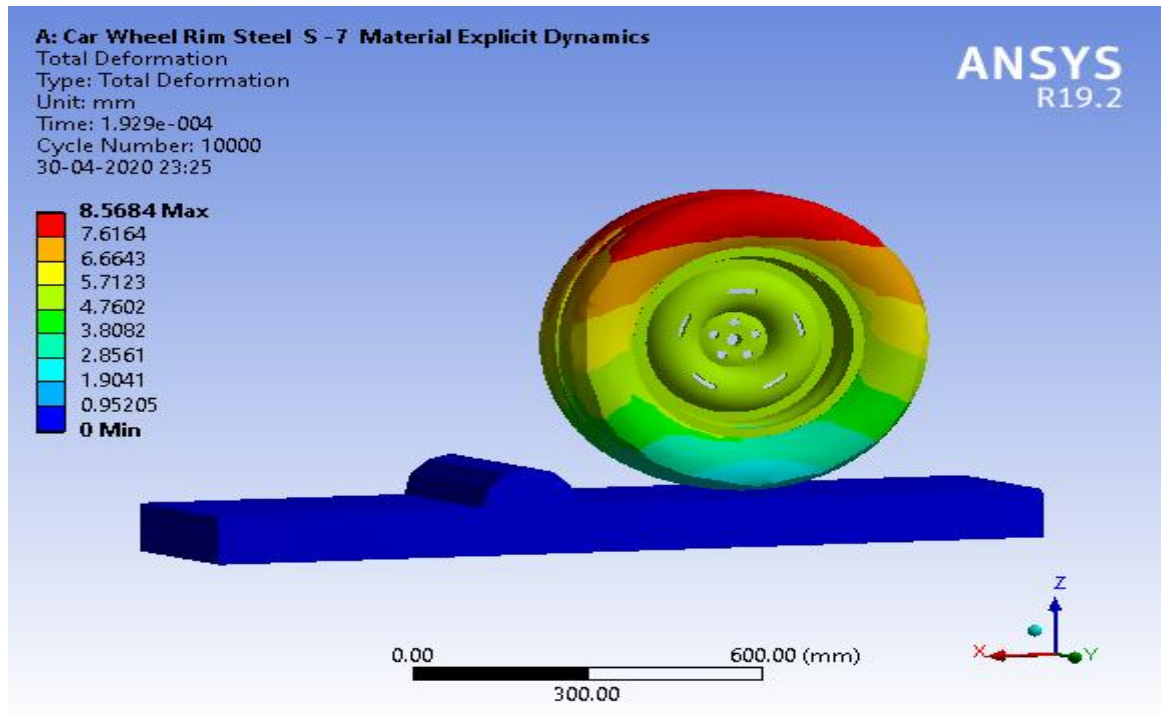
Fig. 4.6 Car wheel rim steel S-7 material at results total deformation

4.4.2   Magnesieun Alloy wheel rim

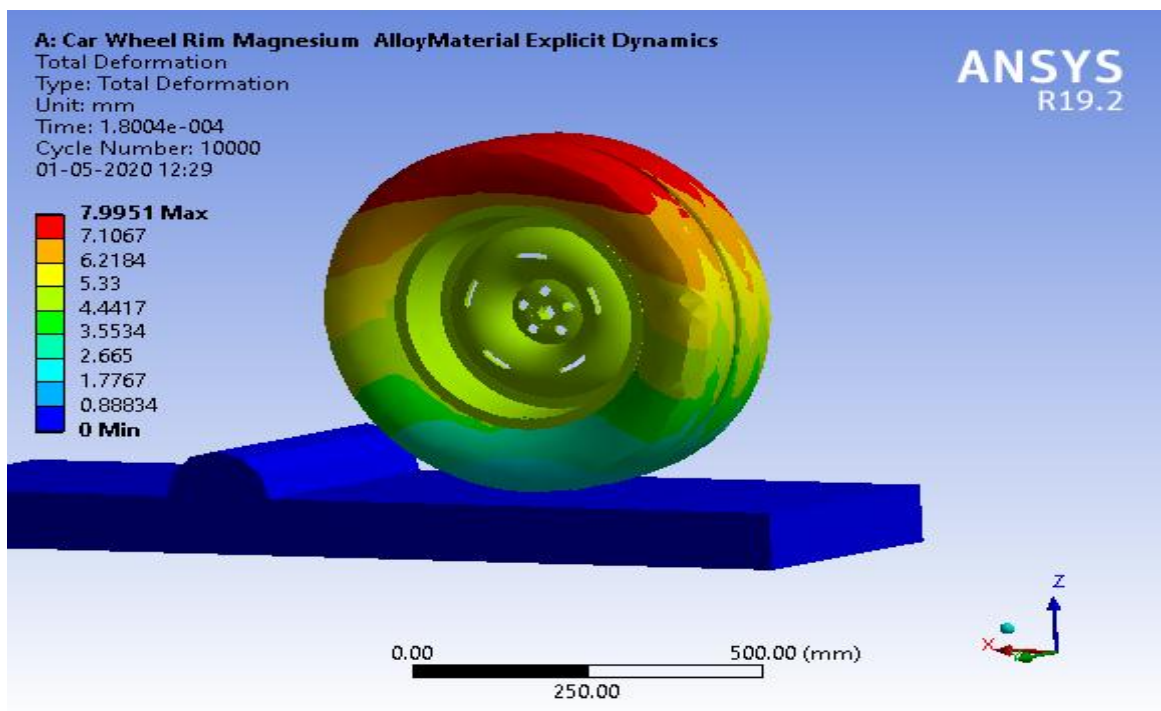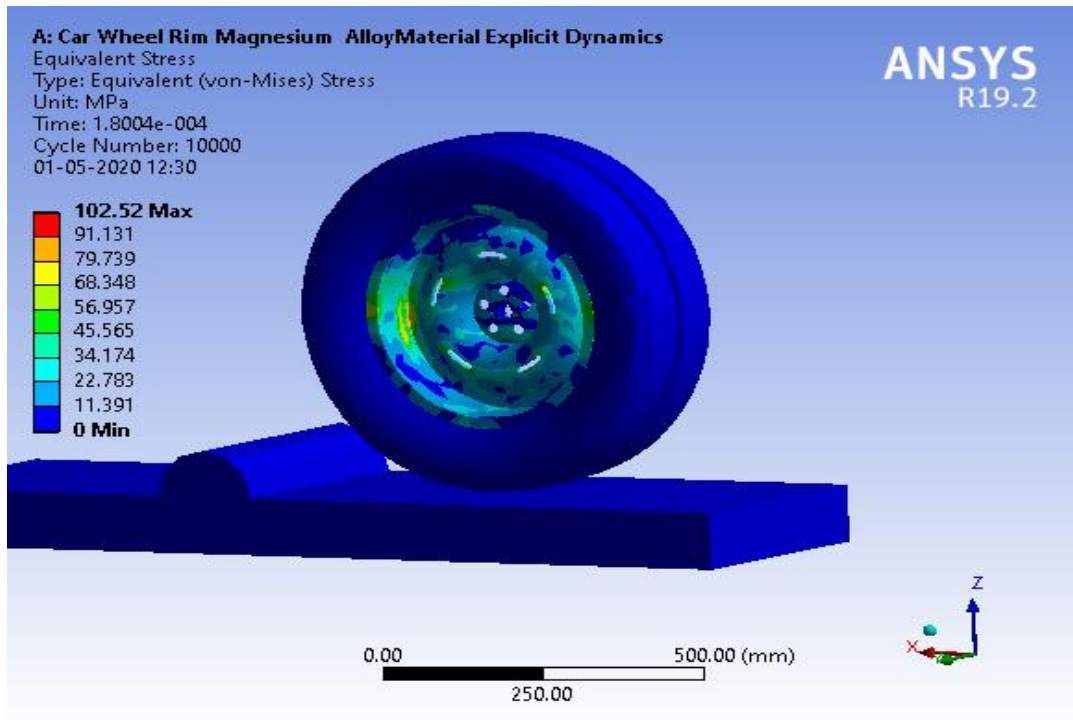**Fig. 4.7 Car wheel rim Magnesium Alloy at results total deformation**

Fig. 4.8 Car wheel rim Magnesium Alloy at results von misses stress
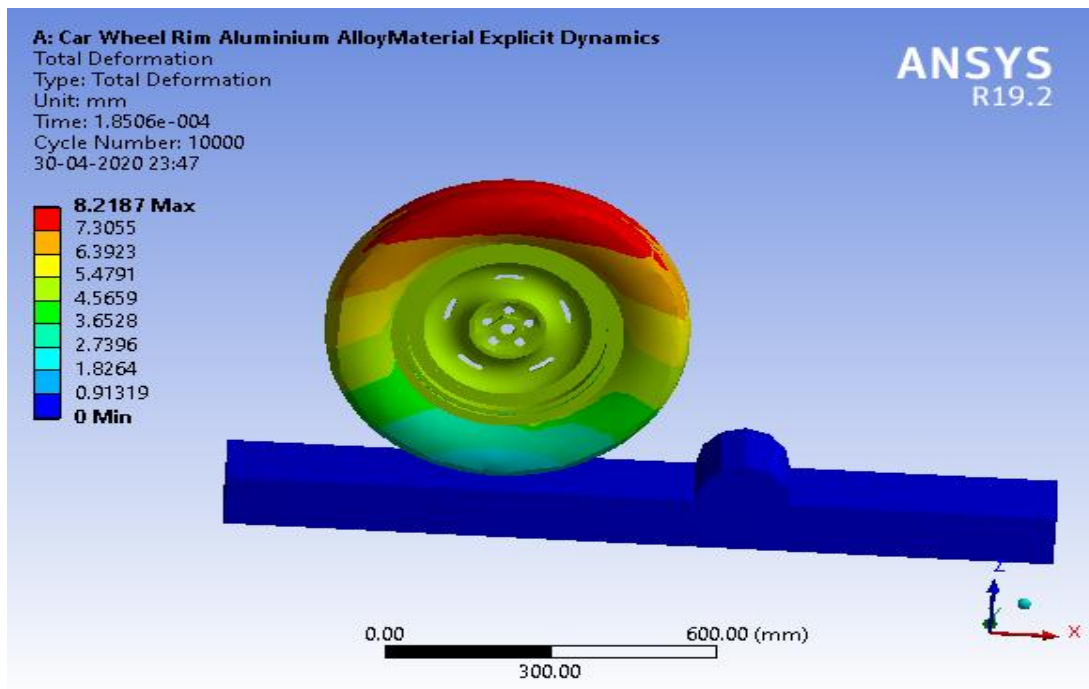
4.4.3 Aluminium Alloy

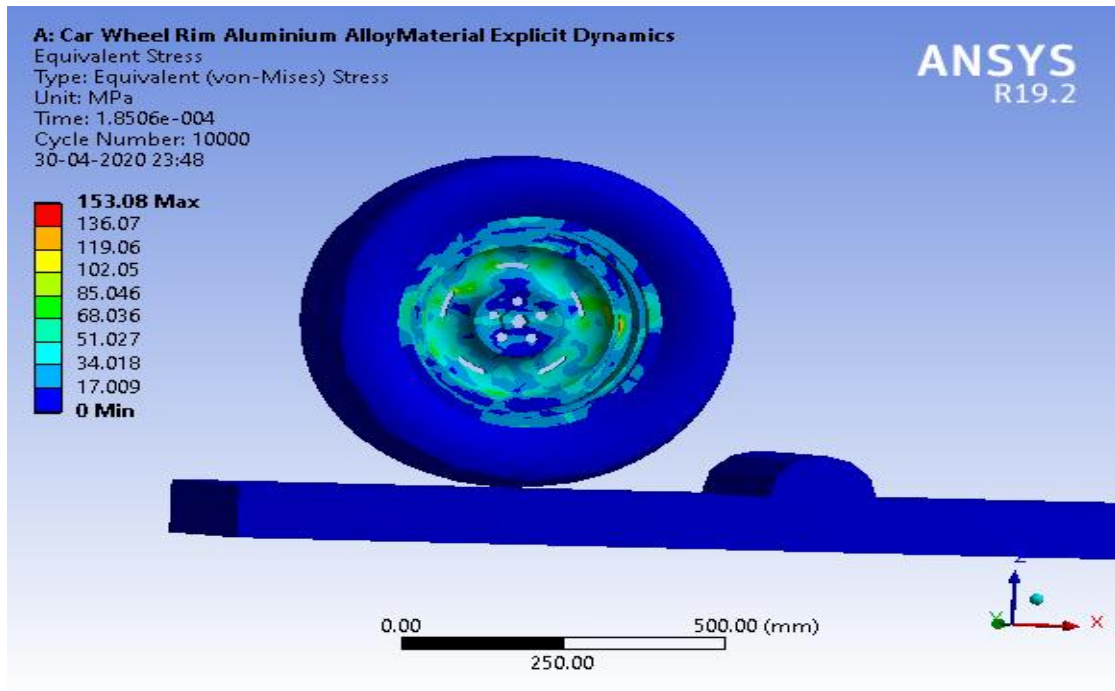**Fig. 4..9 Car wheel rim Aluminium Alloy results total deformation**

Fig. 4.10 Car wheel rim Aluminium Alloy results von misses stress
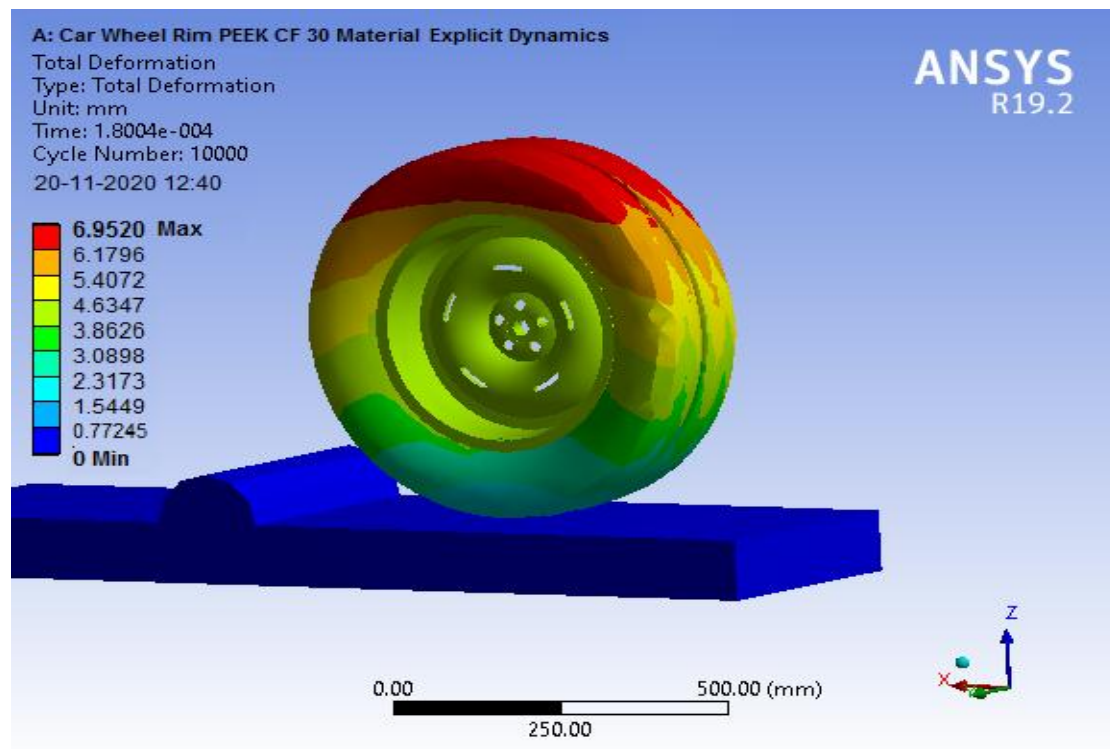
4.4.3   PEEK CF 30

Fig. 4.11 Car wheel rim PEEK CF 30 material at results total deformation
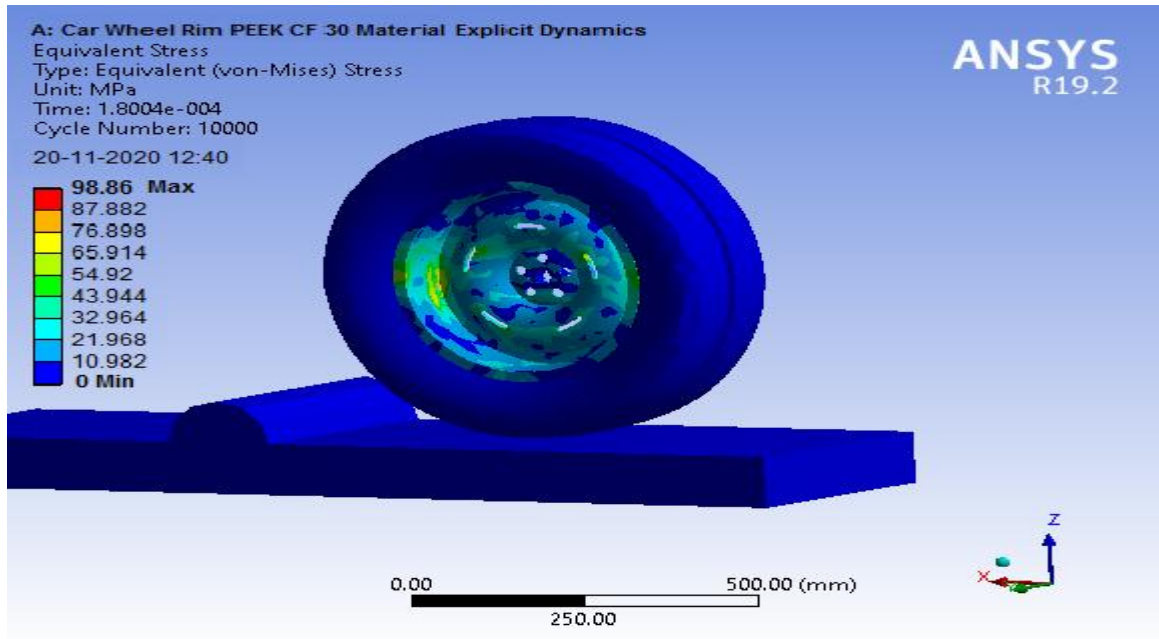
Fig. 4.12 Car wheel rim PEEK CF 30 Material at results von misses stress

V. RESULTS AND DISCUSSION

The scope of the present investigation is concerned for the development of wheel rim by performing reduce wear. By changing the materials with materials and the stress, deformation.

Here Car rim with concrete road model has made on Solid edge and simulate by ANSYS software. Through dynamic analysis find out three parameters results like deformation , Stress and Shaer stress.In this study car wheel is running 100 km/hr speed with fully loaded car.then find out variou results and compare results with exiting materials (Steel material).

Find out deformation values for PEEK with 30% of Carbon Reinforced Material, Magnesium Alloy, Aluminium Alloy and Steel S-7 results are respectively like 6.9520mm, 7.99mm, 8.218 mm, 8.56 mm. here cleared seen that PEEK with 30% of Carbon Reinforced (PEEK CF 30) has less deformation value compared to other then material deformation value so it is good for future design consideration.

Find out stress values for PEEK with 30% of Carbon Reinforced (PEEK CF 30), Magnesium Alloy, Aluminium Alloy and Steel S-7 results are respectively like 98.86MPa, 102.52 MPa and 153.08 Mpa, 390MPa. here cleared seen that PEEK with 30% of Carbon Reinforced (PEEK CF 30) has less deformation value compared to other then material stress value so it is good for future design consideration.

Find out shear stress values for PEEK with 30% of Carbon Reinforced (PEEK CF 30), Magnesium Alloy, Aluminium Alloy, Steel S-7 results are respectively like 49.378MPa, 59.12 MPa and 88.378 Mpa and 212.77 Mpa. here cleared seen that PEEK with 30% of Carbon Reinforced (PEEK CF 30) has less deformation value compared to other then material shear stress value so it is good for future design consideration.

Table 5.1 Car heel rim weight comparison

Materials	Waight (kg)
Steel S-7	25
Aluminium Alloy	9.5
Magnesium Alloy	6.5
PEEK CF 30	5.5

VI. CONCLUSION

We create 3D model of wheel rim in SOLIDEDGE software and after that it import to the ANSYS software. And we applied all forces with given boundary conditions and find the all results.

1. In all cases Von-mises stresses of PEEK with 30% of Carbon Reinforced (PEEK CF 30) is less compare to other materials. So it is safe for designing.
2. Weight of PEEK with 30% of Carbon Reinforced (PEEK CF 30) model is very low as compare to the other model. So it reduces the fuel consumption of vehicle.
3. Cost of PEEK with 30% of Carbon Reinforced (PEEK CF 30) model is very low as compare to the other model. Now we suggest after the analysis PEEK with 30% of Carbon Reinforced (PEEK CF 30) material is best for wheel rim.

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