

# Modelling and Structural Analysis of Disc plate with Different Materials by Using ANSYS Software

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**ABSTRACT:** The disc brake is a wheel brake by which rotation of the wheel slows by the friction caused by compressing brake pads against a disc brake with a set of calipers. Usually cast iron disc brake is used, but the disc brake may in some cases be made of composites such as reinforced carbon– carbon or ceramic matrix composites. The present paper deals with the analysis of Disc rotor of a Bajaj pulsar150 DTSi bike. In general the Disc brake is made of Cast iron, for investigating the effect of strength variations on the predicted stress distributions,it has been selected. For the same disc rotor instead of Cast iron, Aluminum alloy material is selected and analyses. The model of Disc brake is developed by using Solid modeling software solid works. Further Static Analysis is done by using ANSYS Workbench. The results obtained from the static structural analysis of disc plate like Von-Mises stress, Von-Mises strain, total deformation, the grey cast iron gives better results when compared to aluminum alloy.

**KEYWORDS:** ANSYS Work Bench , Disc Plate, Finite Element Analysis, Solid Works.

## 1.INTRODUCTION

A Brake is a device by means of which artificial frictional resistance is applied to moving machine member, in order to stop the motion of a machine. To stop the wheel, friction material in the form of brake pads, mounted on a device called a brake caliper, is forced mechanically, hydraulically, pneumatically or electromagnetically against both sides of the disc. Friction causes the disc and attached wheel to slow or stop. Brakes convert motion to heat, and if the brakes get too hot, causes less efficient (brake fade). The disc brake is a wheel brake which slows rotation of the wheel by the friction caused by pushing brake pads against a brake disc with a set of calipers. Disc brake consists of a disc bolted to the wheel hub and a stationary housing called caliper. The caliper is connected to a stationary part of the vehicle like the axle casing or the stub axle as is cast in two parts each part containing a piston. To improve the braking efficiency usage of other materials instead of cast iron is investigating. The brake disc (or rotor in American English) is usually made of cast iron. This is connected to the wheel and/or the axle.

In this paper materials used for analysis of disc brake are Grey cast iron and Aluminium alloy 6061 and their properties are tabulated in table 1.

Table 1:Materials Used For Disc Brake

MATERIALS	Young's modulus GPa	Poisson's ratio	Density g/cc	Thermal expansion /°c
GREY CAST IRON	110	0.28	7.2	11 x10 <sup>-6</sup>
ALUMINIUM ALLOY 6061	71	0.33	2.7	23.5x10 <sup>-6</sup>

### II.MODELLING PULSUR150 DTSi DISC BRAKE

The photographic view of pulsor150 disc brake is as shown in the figure.



Fig. 1 Photographic view of Pulsur150 DTSi disc brake

Modelling of pulsor150 disc brake is done using solidworks software. SOLIDWORKS is solid modeling software that runs on Microsoft Windows and has been produced by assault system, SOLIDWORKS Corp., since 1997. It is the world's leading CAD/CAM /CAE software, gives a broad range of integrated solutions to cover all aspects of product design and manufacturing. Much of its success can be attributed to its technology which spurs its customer's to more quickly and consistently innovate a new robust, parametric, feature based model. SOLIDWORKS is the perfect solution for the manufacturing enterprise, with associative applications, robust responsiveness and web connectivity that make it the ideal flexible engineering solution to accelerate innovations. It provides easy to use solution tailored to the needs of small medium sized enterprises as well as large industrial corporations in all industries, consumer goods, fabrications and assembly.

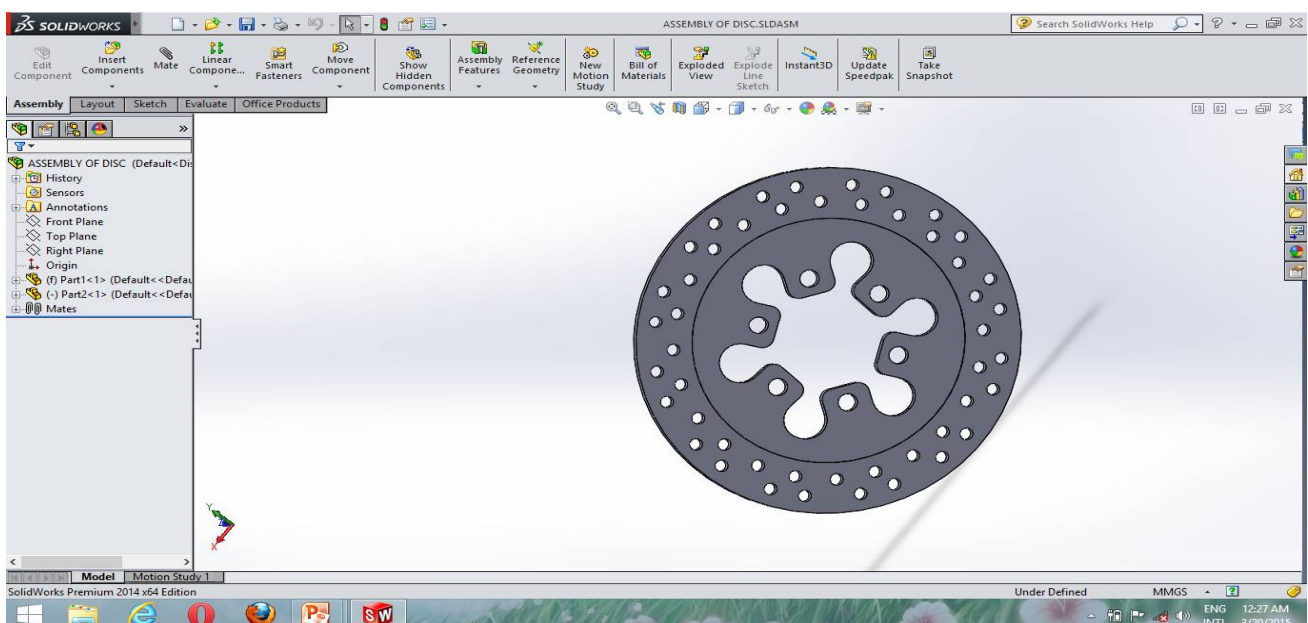


Fig.2 Geometric Model In Solidworks

The different views of disc brake in the solidworks modeling is shown in the figure below.

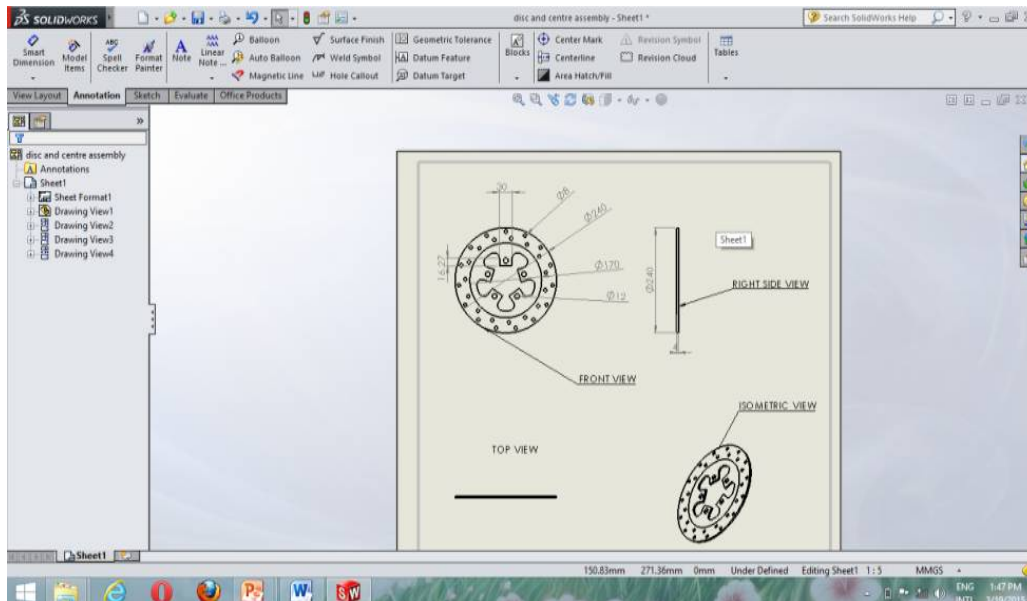


Fig.3 Different views of disc brake

### III.ANALYSIS OF PULSUR150 DISC BRAKE

ANSYS provides a cost-effective way to explore the performance of products or processes in a virtual environment. This type of product development is termed virtual prototyping. With virtual prototyping techniques, users can iterate various scenarios to optimize the product long before the manufacturing is started. This enables a reduction in the level of risk, and in the cost of ineffective designs. The multifaceted nature of ANSYS also provides a means to ensure that users are able to see the effect of a design on the whole behavior of the product, be it electromagnetic, thermal, mechanical etc.

ANSYS is general-purpose finite element analysis (FEA) software package. Finite Element Analysis is a numerical method of deconstructing a complex system into very small pieces (of user-designated size) called elements. The software implements equations that govern the behaviour of these elements and solves them all; creating a comprehensive explanation of how the system acts as a whole. These results then can be presented in tabulated, or graphical forms. This type of analysis is typically used for the design and optimization of a system far too complex to analyze by hand. Systems that may fit into this category are too complex due to their geometry, scale, or governing equations.

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FEA procedure flow chart is shown below:

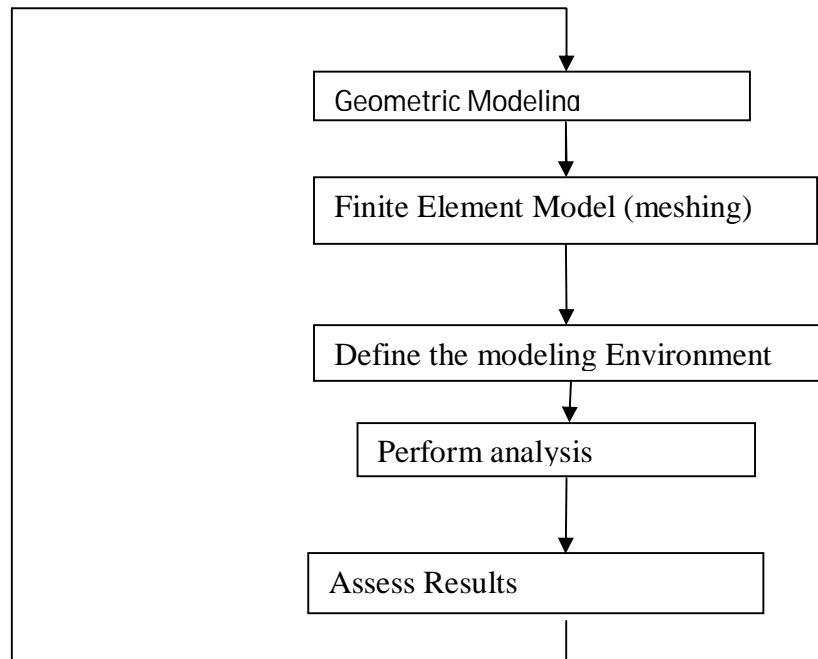


Fig.4 Flowchart for FEA analysis

## IV. RESULT AND ANALYSIS

### Static Structural Analysis Of Disc Plate For Cast Iron And Alumium Alloy 6061

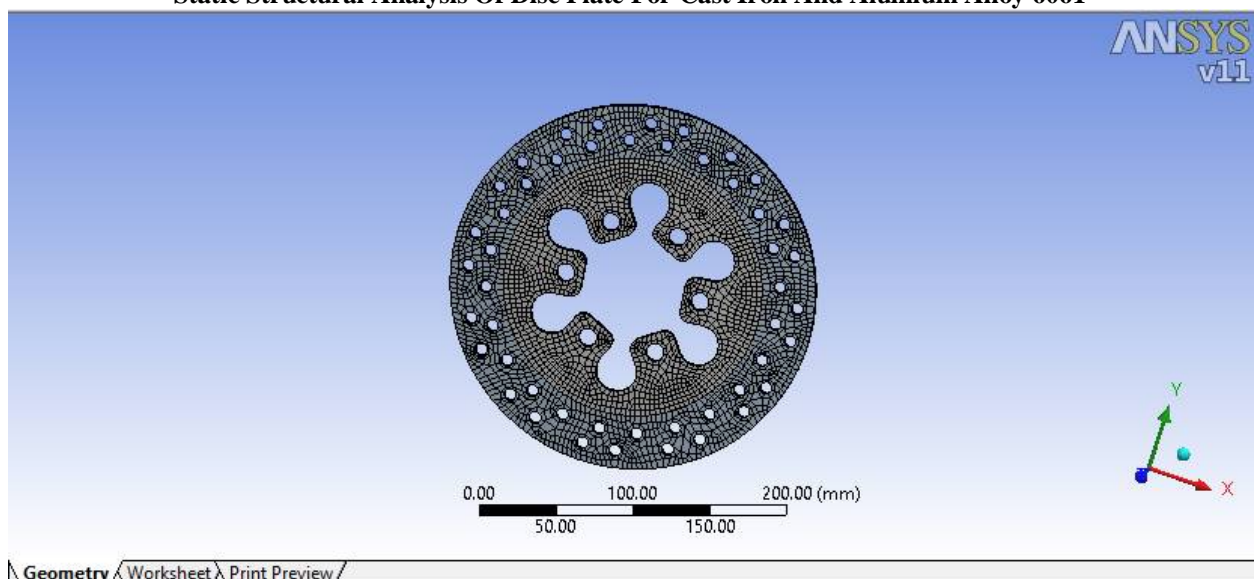


Fig .5 Disc brake mesh generated model



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## I. For Cast Iron:

### A. Von-Mises stress

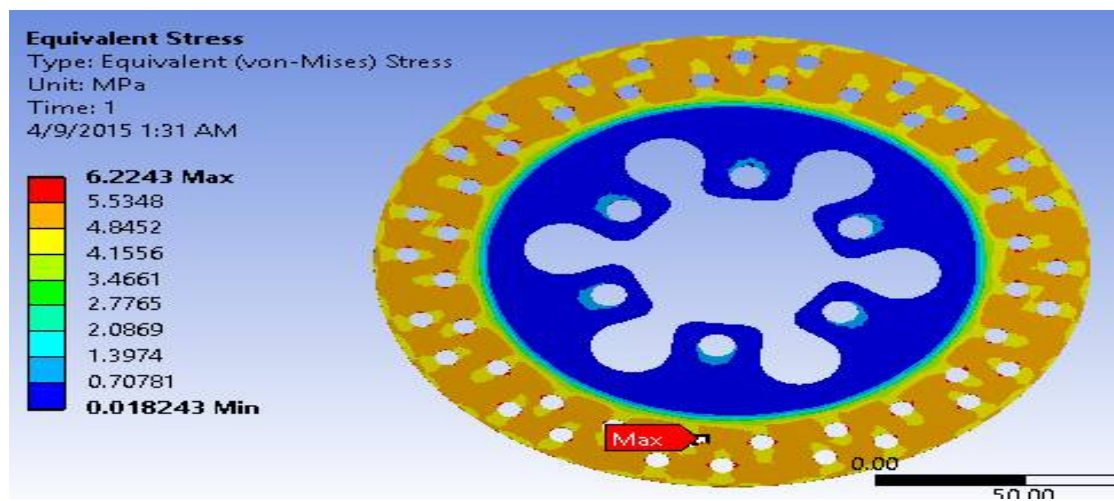


Fig.6 Von-Mises stress for grey cast iron

### B. Von-Mises strain

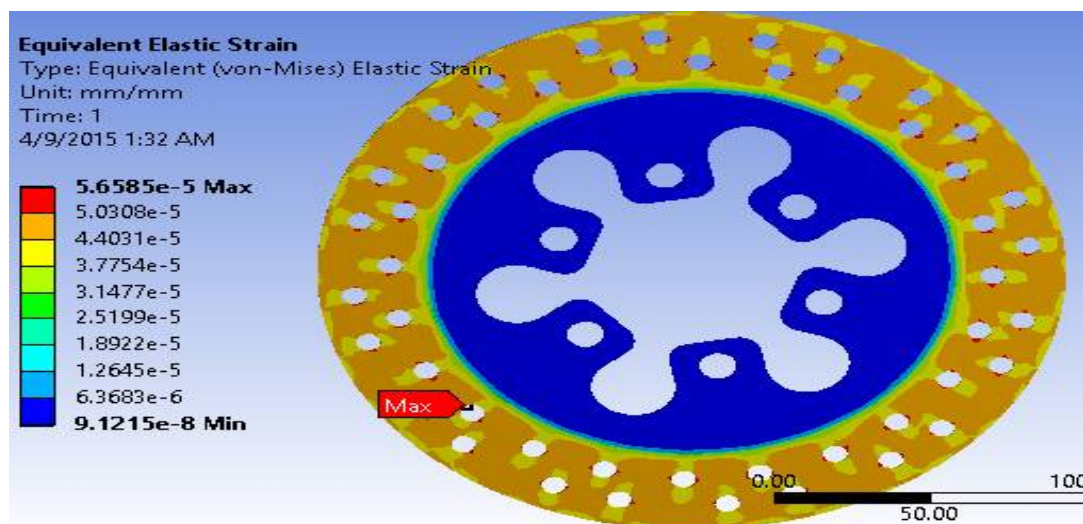


Fig.7 Von-Mises strain for grey cast iron

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## C.Total Deformation

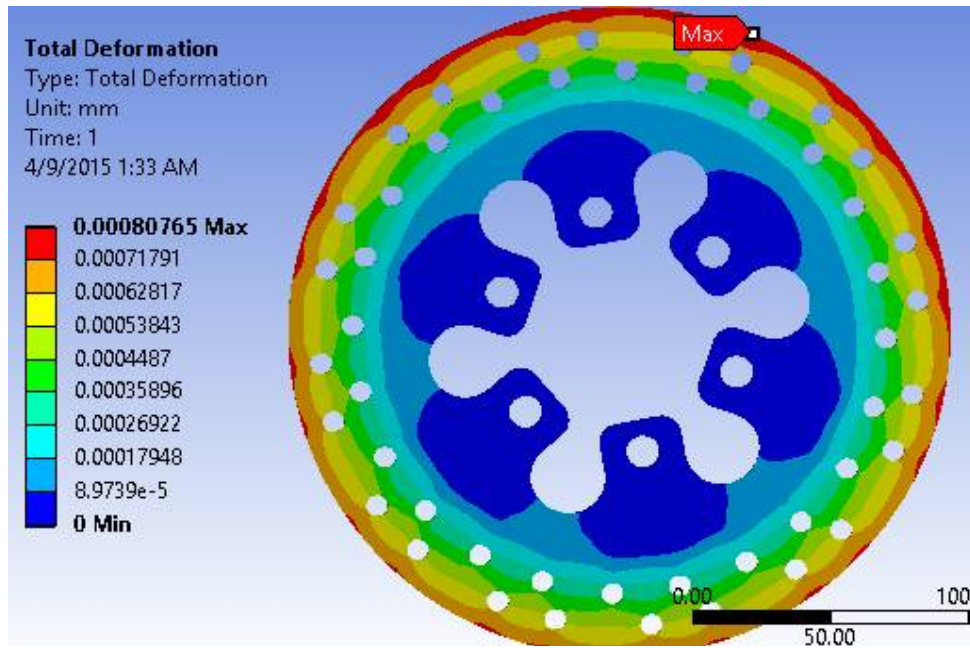


Fig.8 Total deformation for grey cast iron

## II. For Aluminium alloy 6061:

### A.Von-Mises stress

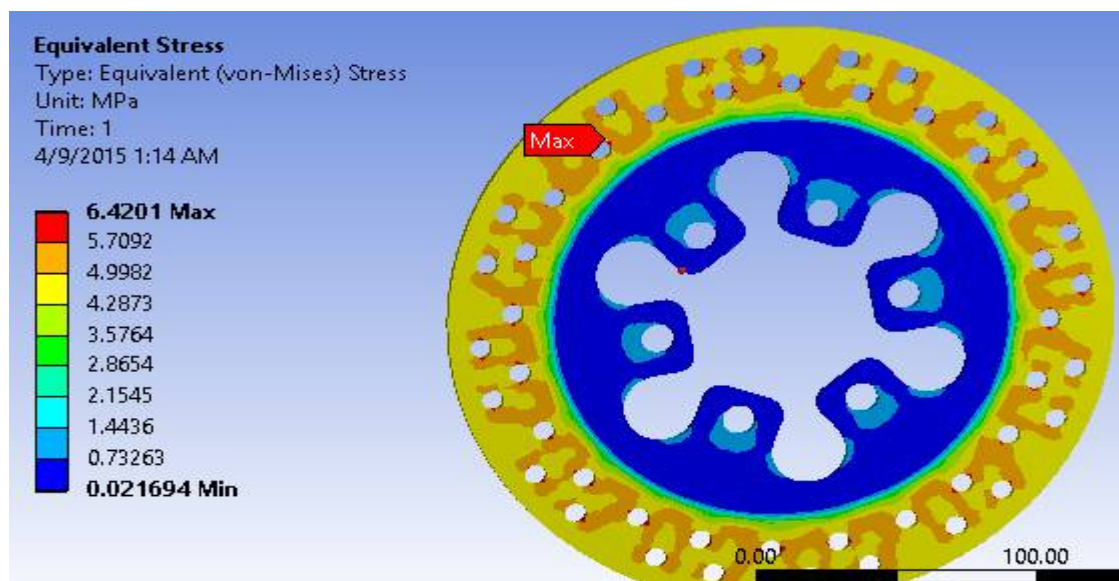


Fig.8 Von-Mises stress for Aluminium alloy

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## B. Von-Mises strain

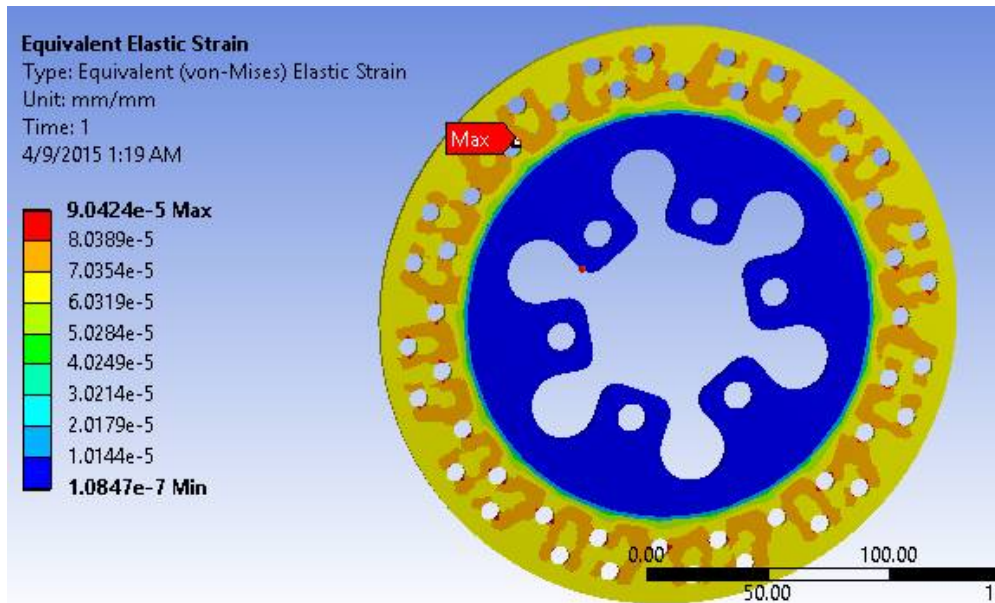


Fig.9 Von-Mises strain for Aluminium alloy

## C. Total Deformation

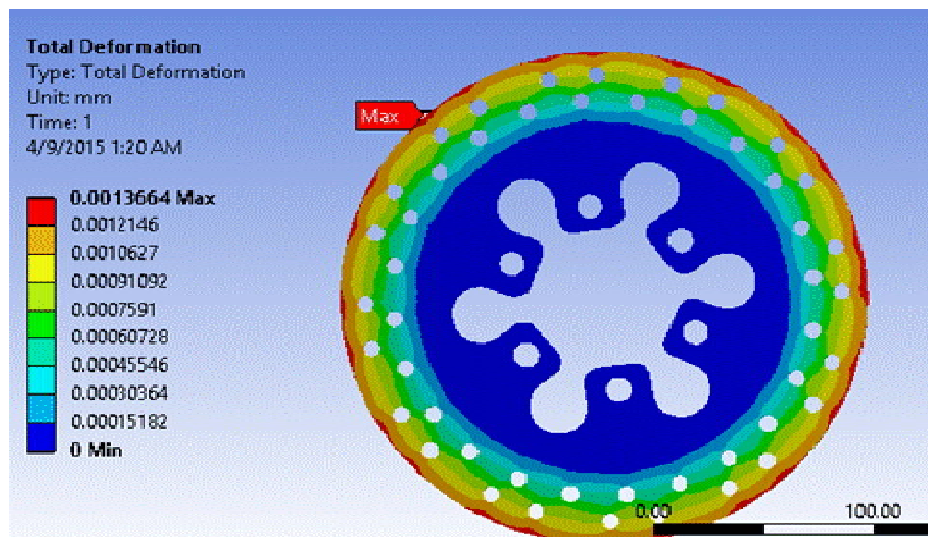


Fig.10 Total deformation for Aluminium alloy

The values obtained are tabulated as follows:



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Table 2:Results tabulated:

Material	Von-Mises Stress (MPa)	Von-Mises Strain (mm/mm)	Total Deformation (mm)
Grey CastIron	6.2243	$5.6585 \times 10^{-5}$	0.00080765
AluminiumAlloy 6061	6.4201	$9.0424 \times 10^{-5}$	0.00013664

## V.CONCLUSION

By the comparison of various results obtained from the static structural analysis of disc plate like Von-Mises stress, Von-Mises strain, total deformation and mass, the Grey cast iron gives better results when compared to Aluminium alloy. For further scope, analysis for different materials can be made to give better performance.

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