



e-ISSN: 2319-8753 | p-ISSN: 2320-6710

# IJIRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 4, April 2021

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

**Impact Factor: 7.512**



9940 572 462



6381 907 438



ijirset@gmail.com



www.ijirset.com

# Design and Analysis of Disc Brake in Metal Matrix Composites

Mareesram<sup>1</sup>, Mariappan<sup>2</sup>, Muthugopalakrishnan<sup>3</sup>, Poneswaran<sup>4</sup>, Mr.M.Ayyanar Raja<sup>5</sup>

UG Students, Department of Mechanical Engineering, Francis Xavier Engineering College, Vannarpattai, Tirunelveli,  
Tamil Nadu, India.<sup>1,2,3,4</sup>

Professor, Department of Mechanical Engineering, Francis Xavier Engineering College, Vannarpattai, Tirunelveli,  
Tamil Nadu, India<sup>5</sup>

**ABSTRACT:** In this project analysis the behaviour of the brake disc made of cast iron compared with aluminium metal matrix composite material in software ANSYS20.0. Modelling of the disc brake rotor is done using SOLIDWORKS 2010. Finally a comparison is made between cast iron and aluminium metal matrix composite materials and the best material for making disc brake have been suggested based on the magnitude of Von misses stresses, temperature distribution and deformation from the analysis result. We have taken case study on Hyundai car i20 front disc brake.

**KEYWORDS :**Hyundai i20,soild works , Ansys

## I. INTRODUCTION

Aluminium Silicon carbide metal matrix composites are widely used in engineering structures, industry electronic applications, sporting goods and aerospace etc. It's properties mostly depend on the processing method and the different compositions which is capable of producing desired properties to meet the industry need. Al-SiC composites can be more easily produced by the stir casting technique due to its good casting ability and relatively inexpensive. Analyzing the wear properties of Al-SiC composite is found that wear rate decreases linearly with increasing SiC content. Mechanical characterization of Al-SiC composite like density, hardness, elongation%, toughness, bending, poisson ratio, modulus of elasticity, young's modulus and tensile strength were evaluated. The improved value of tensile strength is one of the key reason they are widely used in industry. It has been found that particle reinforced Aluminium matrix composites can improve considerably the strength and hardness of Aluminium and its alloys. But at the same time, the plasticity and ductility is substantially reduced and thus it severely affects the safety and reliability of components fabricated from Aluminium matrix composites (AMCs).

## II. METHODOLOGY

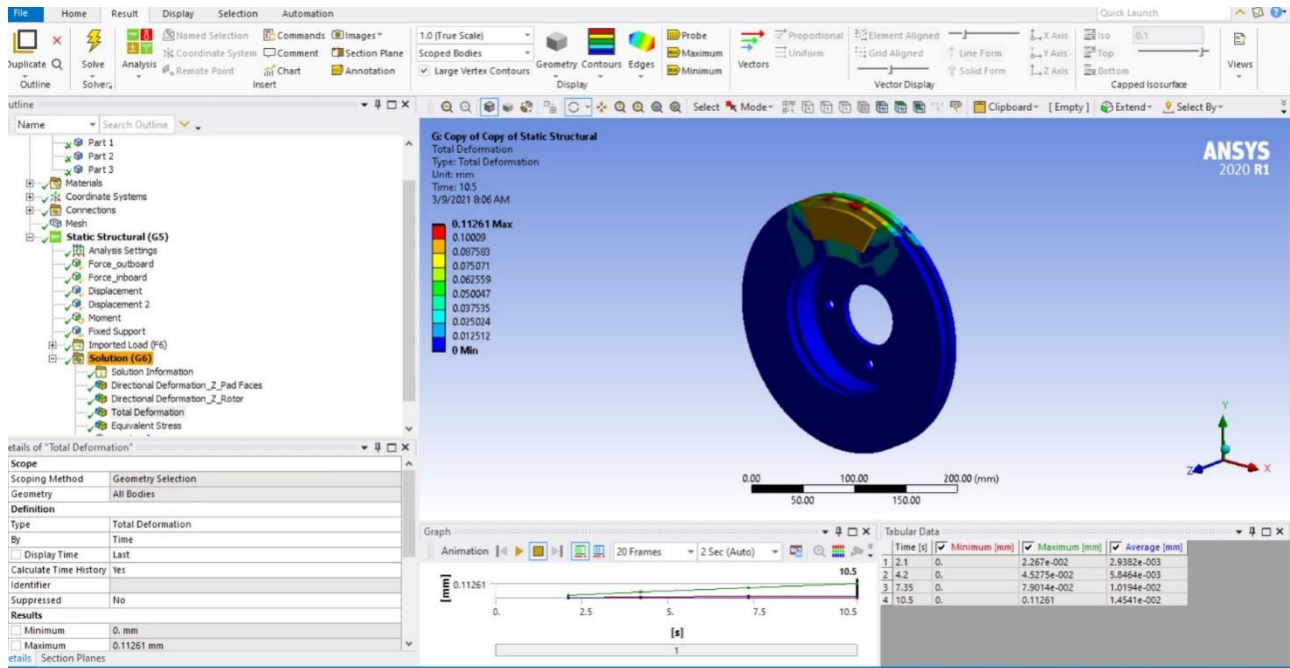
Material properties required for selection: The properties that need to be considered by designers when specifying steel construction products are: Strength, Toughness, Ductility, Durability. Aluminium (Al) metal matrix composites (MMCs) with ceramic particulate reinforcement such as silicon carbide (SiC) have long been considered as significantly lighter weight, potentially longer lasting and more environmentally favorable automobile brake discs

In this project analysis the behaviour of the brake disc with aluminium metal matrix composite material and conventional grey cast iron material in software ANSYS 2020. Modelling of the disc brake rotor is done using SOLIDWORKS 2010. Finally a comparison is made between cast iron and aluminium metal matrix composite materials and the best material for making disc brake have been suggested based on the magnitude of Von misses stresses, temperature distribution and deformation from the analysis result.

## 1 ANSYS ANALYSIS RESULT DIAGRAMS:

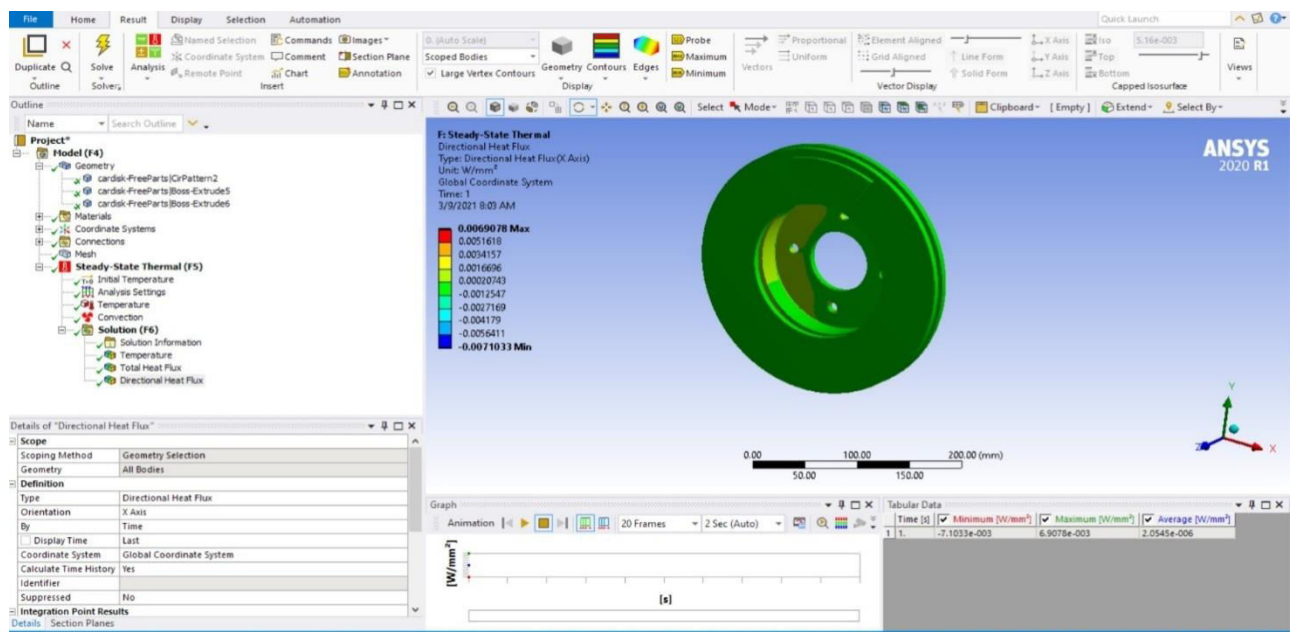
### 10.1.1 AI 95%, Sic 5%

#### Deformation:



(Fig-11)

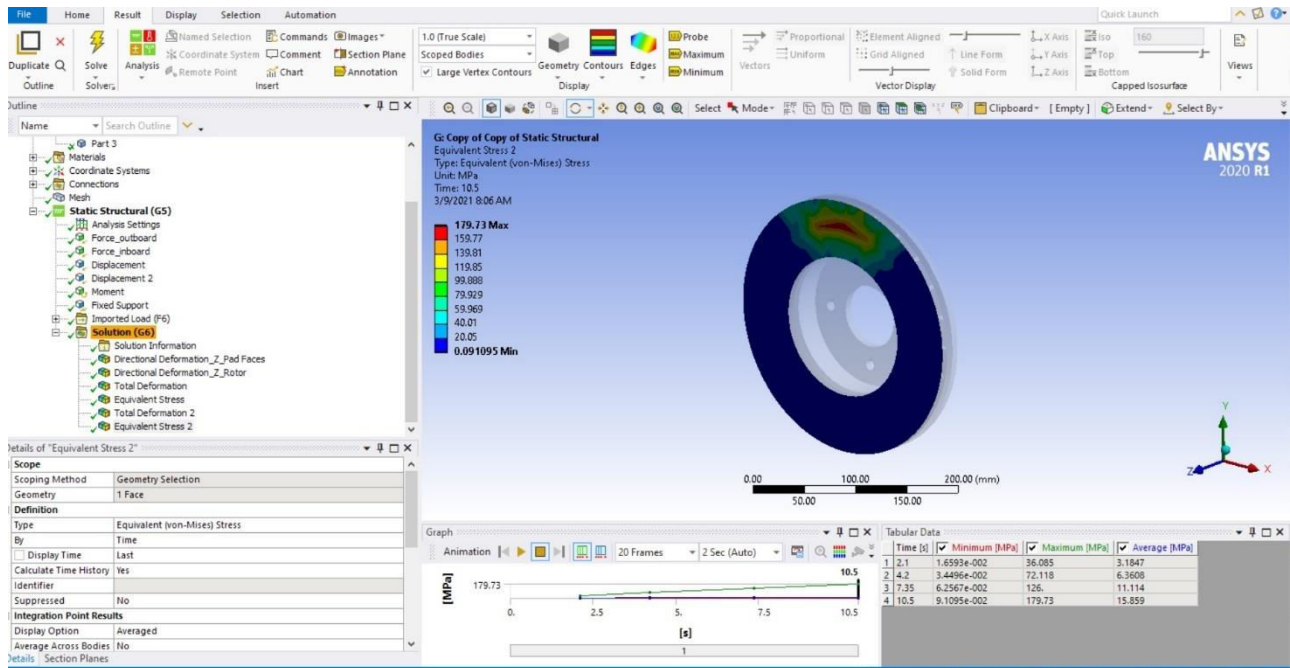
#### Directional heat flux:



(Fig-12)

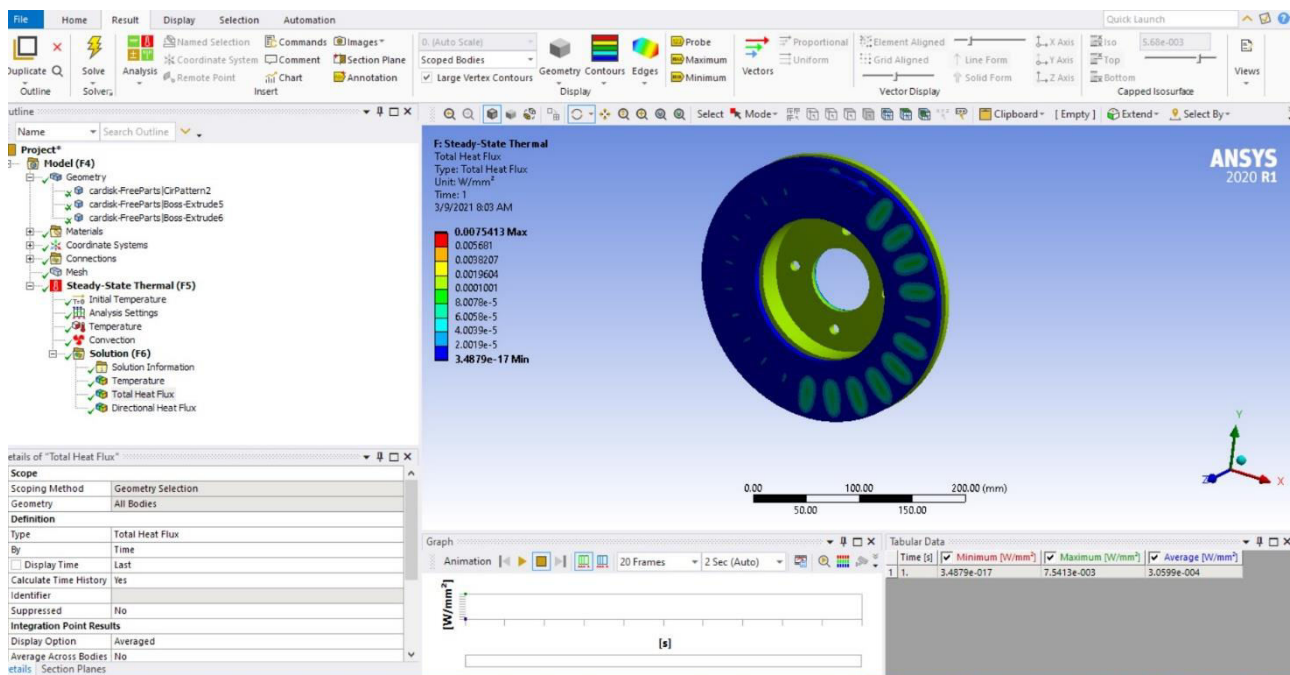


Face stress:



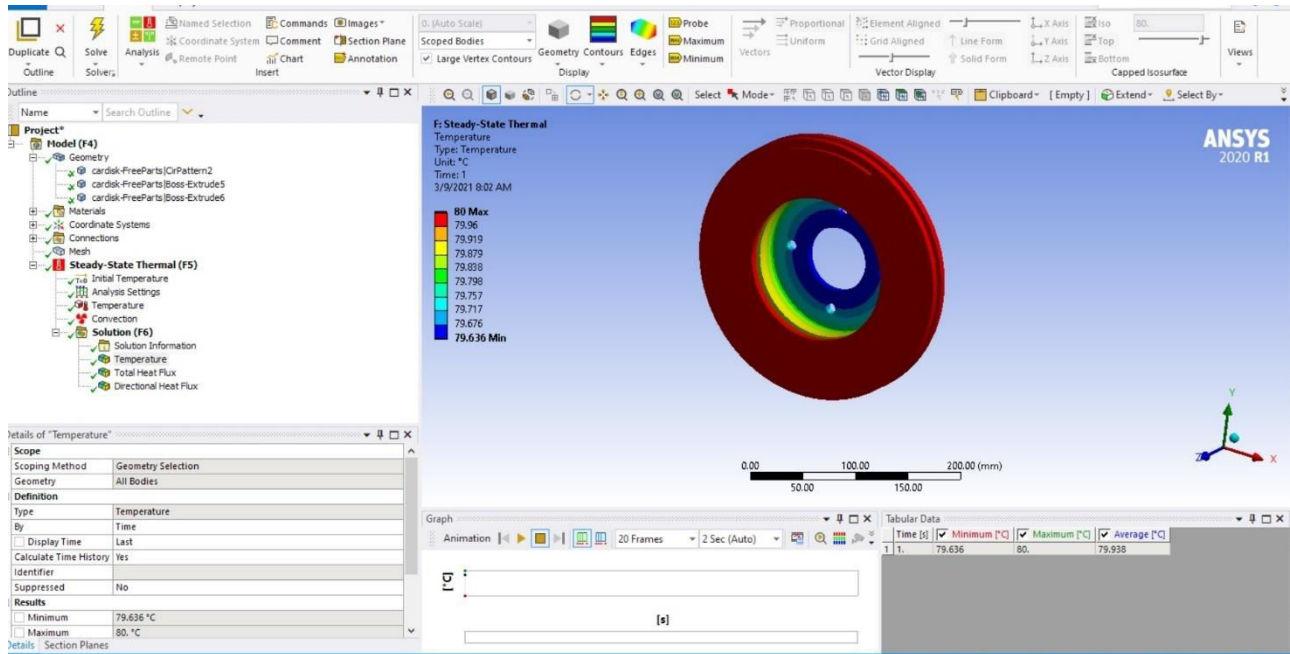
(Fig-13)

Heat flux:



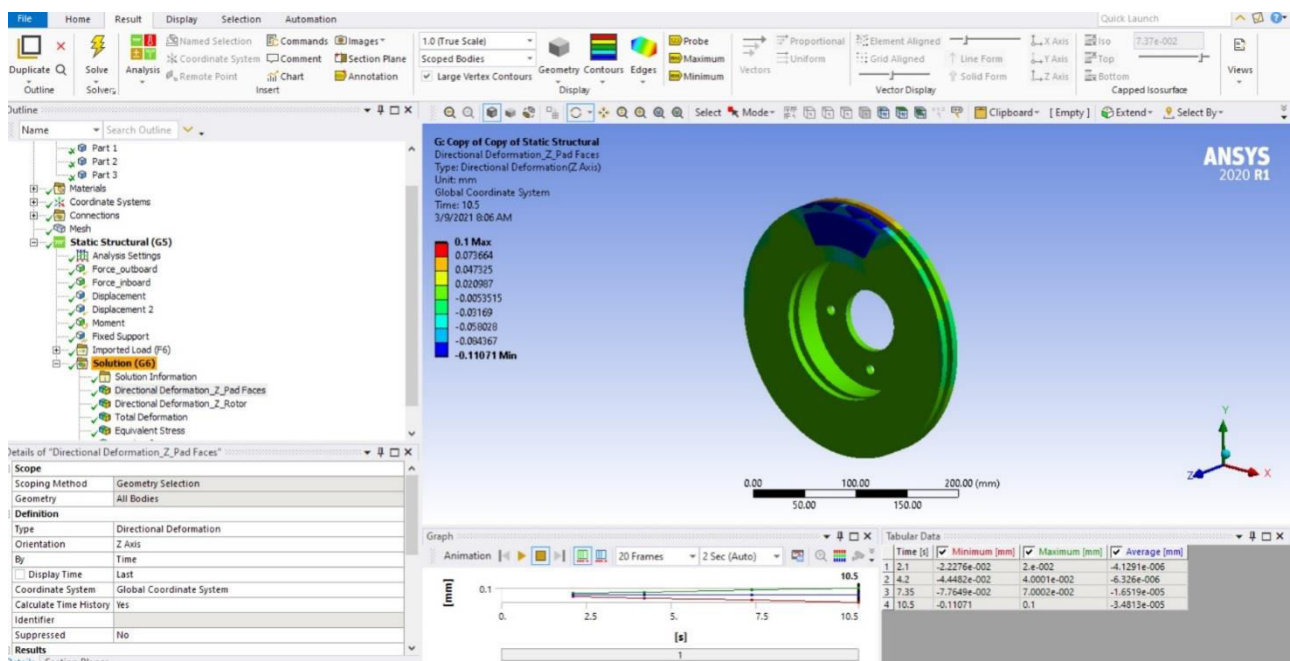
(Fig-14)

Thermal distribution:



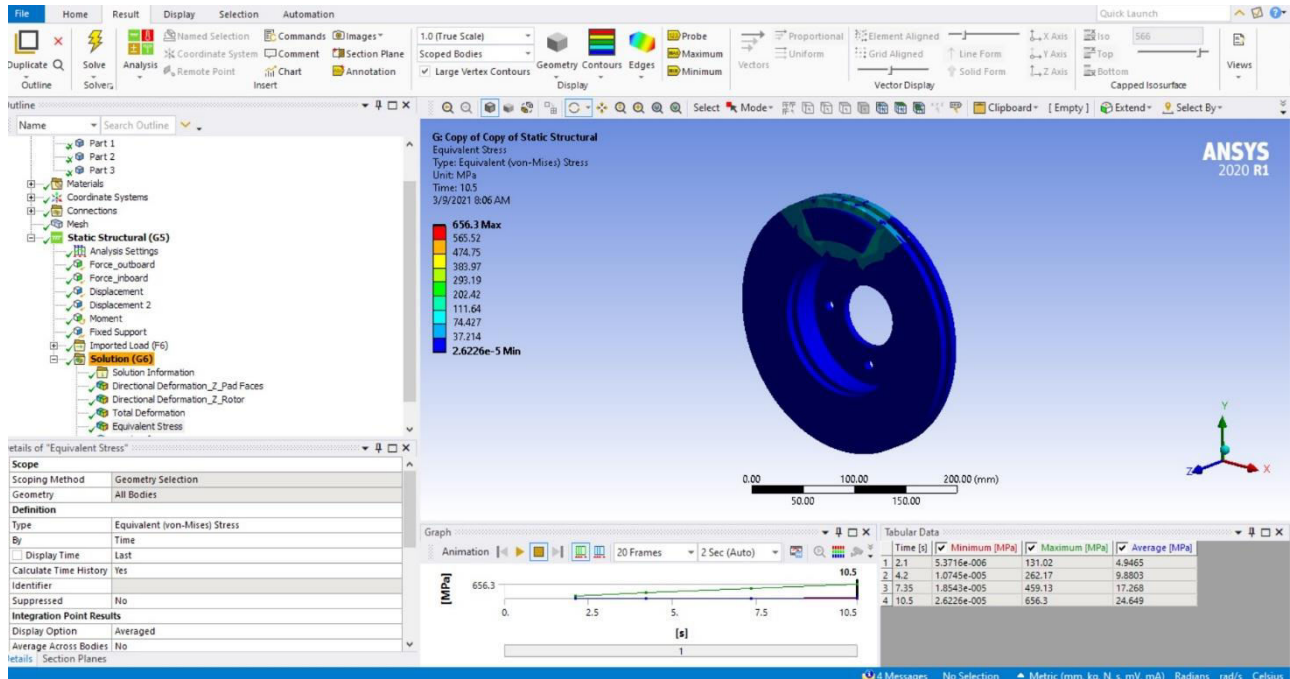
(Fig-15)

Directional deformation pad force:



(Fig-16)

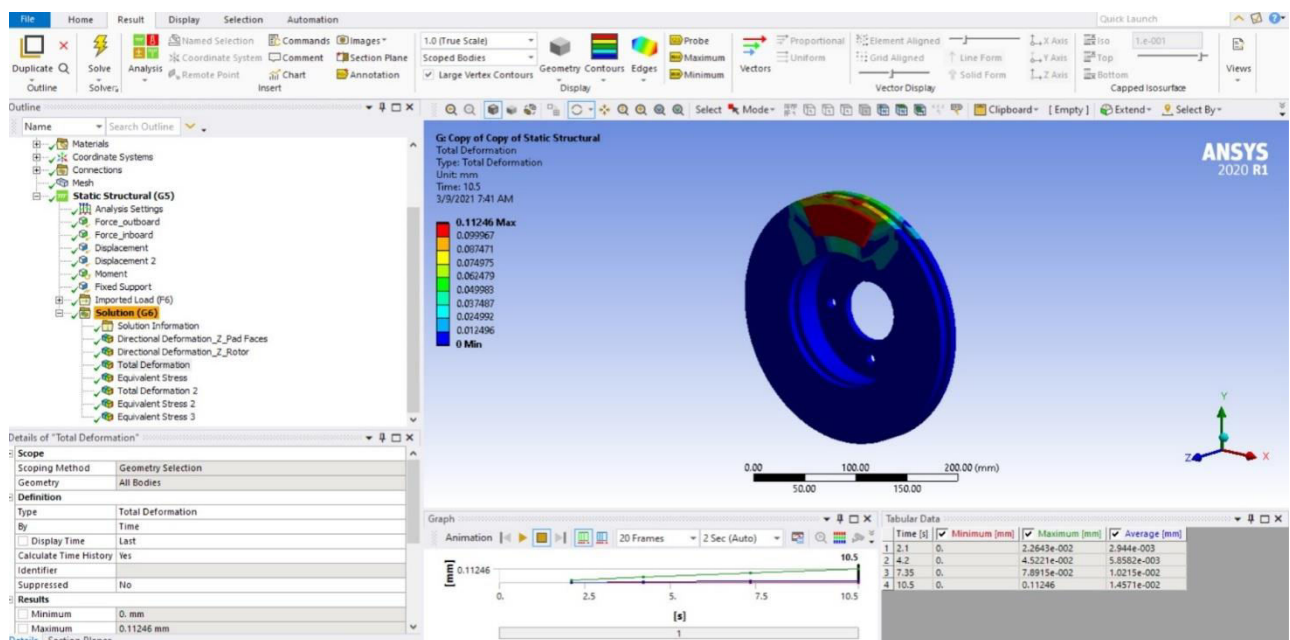
Von misses stress:



(Fig-17)

10.2.Al 90% Sic 10% composition :

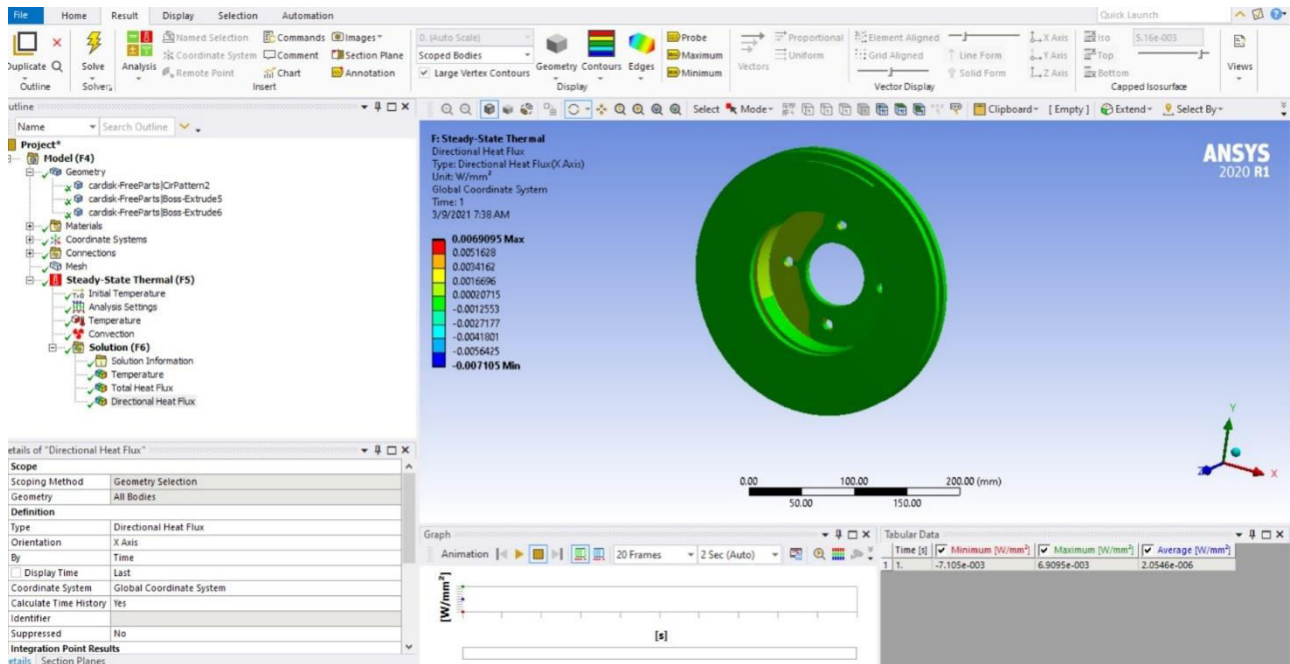
Deformation :



(Fig-18)

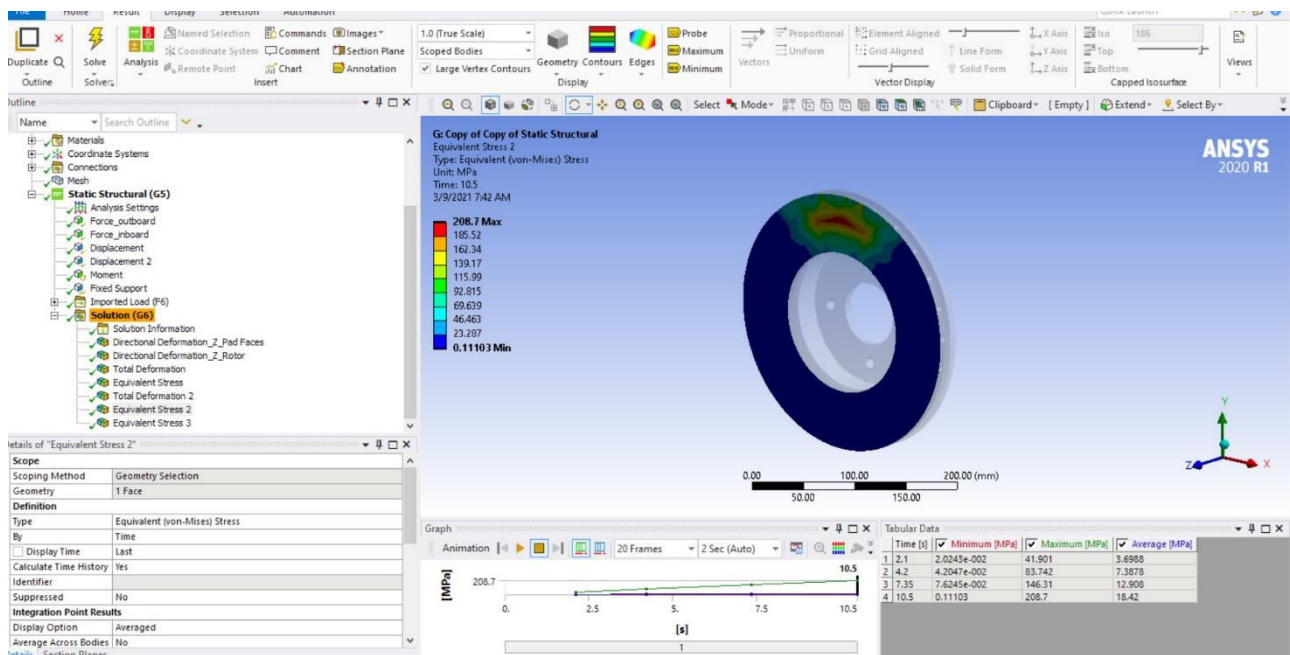


Directional heat flux:



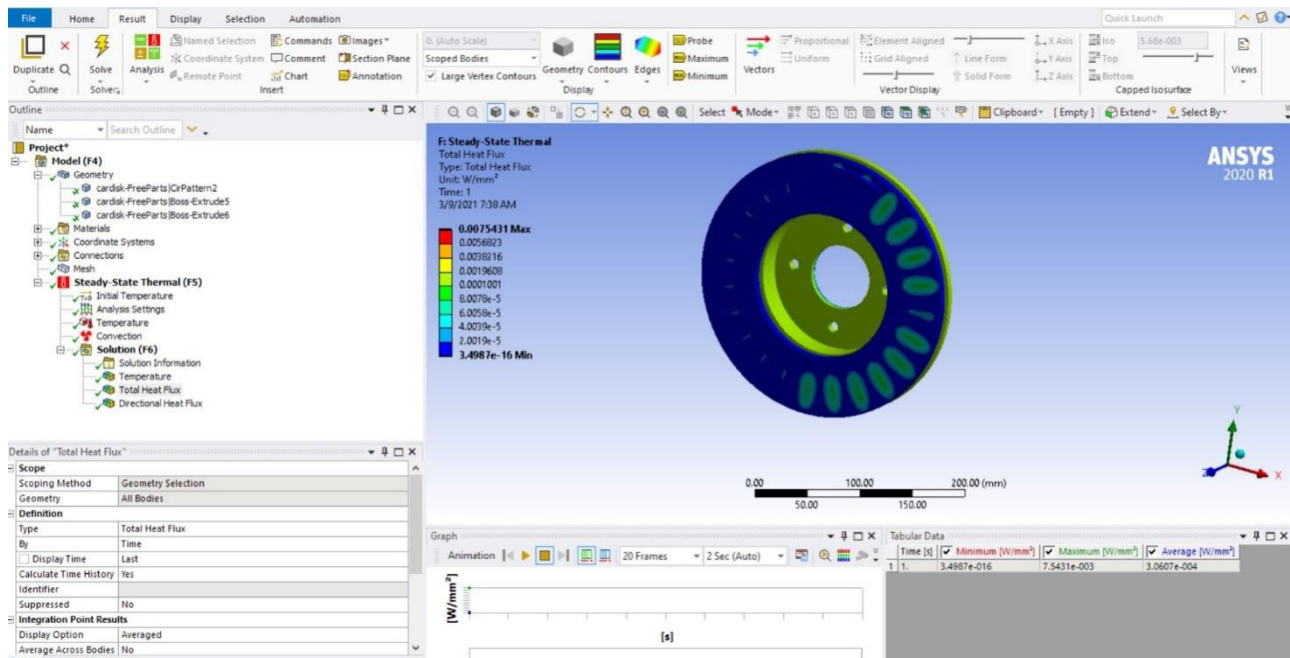
(Fig-19)

Face stress:



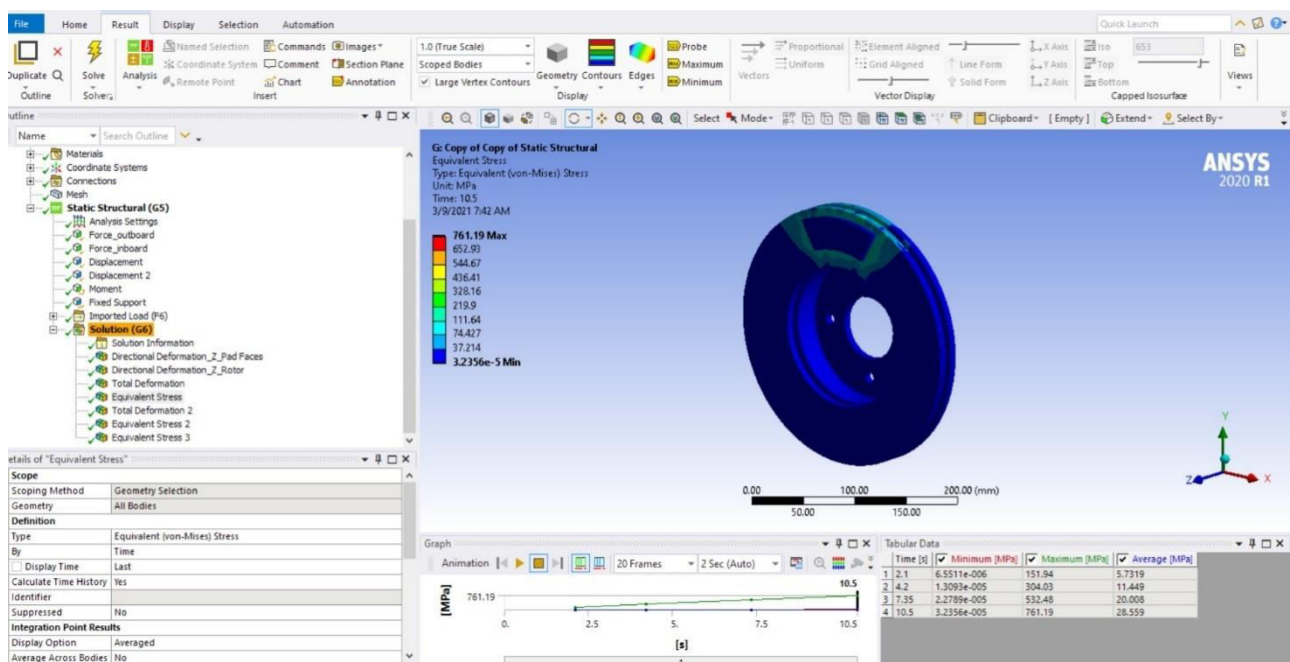
(Fig-20)

Heat flux:



(Fig-21)

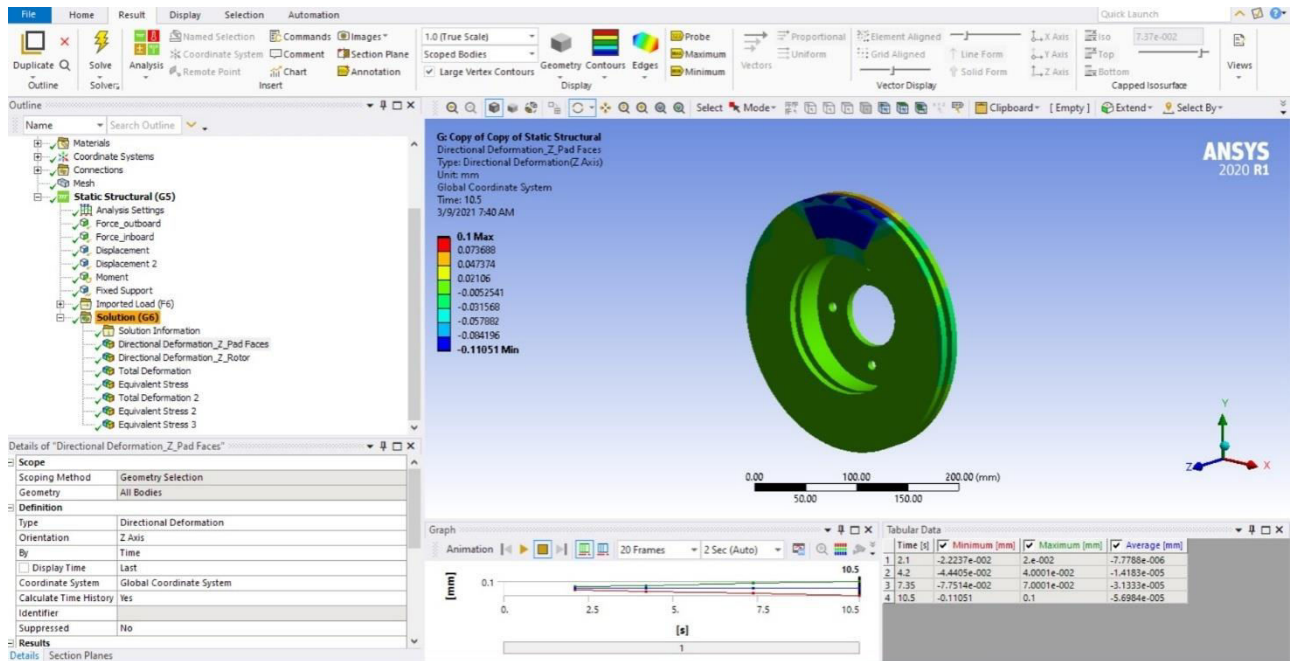
Stress:



(Fig-22)

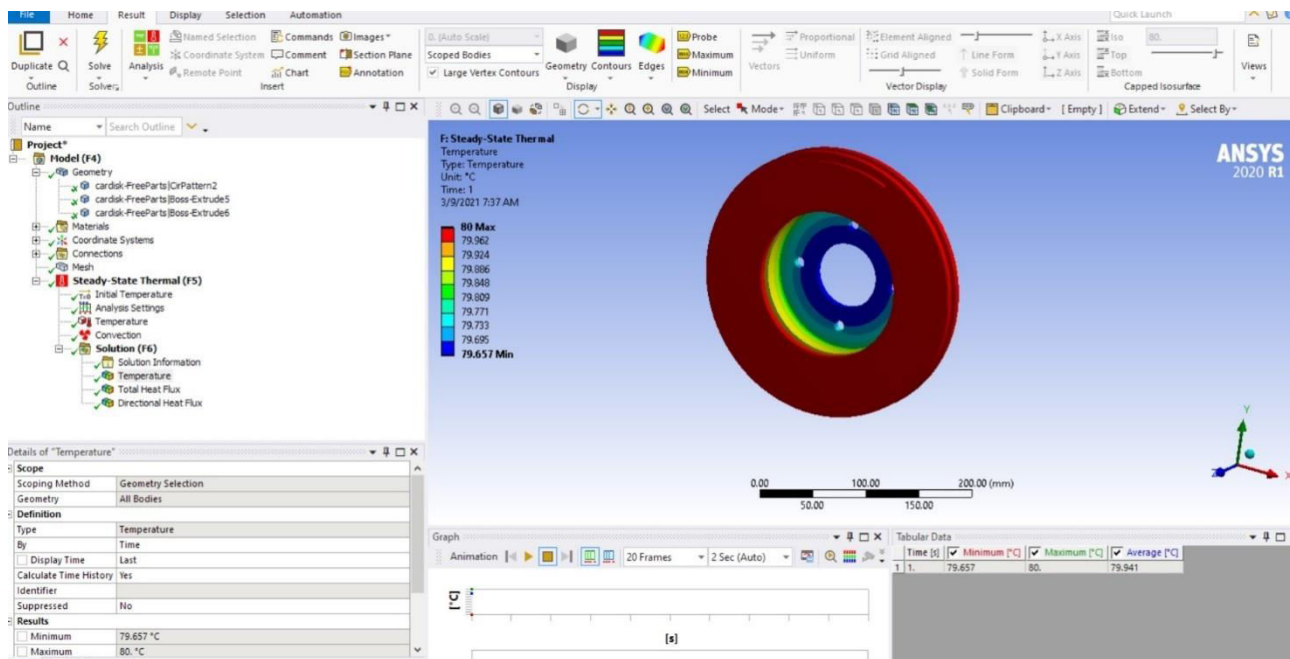


Directional deformation pad force:



(Fig-23)

Temperature distribution:



(Fig-24)

**III. RESULT AND DISCUSSION**

		GREY CAST IRON	Al / 5% SiC	Al / 10% SiC
1	Temperature(°C)	70	78	80
2	Total deformation(mm)	0-0.000239	0-0.11246	0-0.11261
3	Total Thermal flux(KW/mm <sup>2</sup> )	0.0005312	0.0030607	0.004002
4	Structural von-Mises Stress (N/mm <sup>2</sup> )	0.12-181.87	0.11-208.7	0.09-179.3
5	Equivalent Stress (N/mm <sup>2</sup> )	34.055	28.559	24.649
6	Directional heat flux(KW/mm <sup>2</sup> )	0.002024	0.0020546	0.0020431
7	Directional deformation(mm)	-0.11-0.97	-0.11-0.1	-0.11-0.12

**IV. CONCLUSION**

1. Mechanical properties of AlSiC metal matrix composites are investigated.
2. It is found that the elongation tends to decrease according to the increase in weight percentage of silicon carbide and hence it leads to increase in hardness.
3. Density of the AlSiC with different composition of SiC metal matrix composites is investigated. Little increase in density, but very high increase in strength.
4. It appears that the hardness increases results to decrease in elongation % of AlSiC metal matrix composites.
5. Tensile strength of the aluminum silicon carbide metal matrix composites increases gradually at the increased composition of the silicon carbide in it but at 10% of SiC in Al give the best tensile strength as per the weight percentage.

**REFERENCES**

1. A.A. Adebisi, M.A. Maleque, M.M. Rahman "METAL MATRIX COMPOSITE BRAKE ROTOR: HISTORICAL DEVELOPMENT AND PRODUCT LIFE CYCLE ANALYSIS" International Journal of Automotive and Mechanical Engineering (IJAME) ISSN: 1985-9325(Print); ISSN: 2180-1606 (Online); Volume 4, pp. 471-480, July-December 2011
2. Chetan Kale, Prof. Ganesh Kesheore "DESIGN AND ANALYSIS OF DISC BRAKE "2019 IJRTI | Volume 4, Issue 5 | ISSN: 2456-3315
3. MAHMOOD HASAN DAKHIL, A. K. RAI, P. RAVINDER REDDY, AHMED ABDULHUSSEIN JABBAR "DESIGN AND STRUCTURAL ANALYSIS OF DISC BRAKE IN Automobiles" International Journal of Mechanical and Production Engineering Research and Development (IJMPERD) ISSN(P): 2249-6890; ISSN(E): 2249-8001 Vol. 4, Issue 1, Feb 2014, 95-112
4. Venkatramanan R, Kumaragurubaran SB, Vishnu Kumar C, Sivakumar S, Saravanan B "Design and Analysis of Disc Brake Rotor" International Journal of Applied Engineering Research ISSN 0973-4562 Volume 10, Number 19 (2015)
5. Thirumal. J, Srinivasan. K, Suresh Babu. S.V., "DESIGN AND ANALYSIS OF Al/TiC MMCs FOR DISC BRAKE "International Research Journal of Engineering and Technology (IRJET) Volume: 07 Issue: 03 | Mar 2020



- 6.Prof. Mit Patel, Mansi Raval, Jenish Patel, "Design of Disc Brake's Rotor" International Journal of Engineering Development and Research (© 2016 IJEDR | Volume 4, Issue 4 | ISSN: 2321-9939
- 7.Goutham Kumar Reddy Challa, Abhinoy Krishna Guduru, Siddhartha Patlari, Dr.M.Madhavi., "Design and Analysis of Carbon Fiber / Epoxy Resin Brake Rotor ", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X, Volume 12, Issue 4 Ver. V (Jul. - Aug. 2015),
- 8.Rathod Abhik, Umasankar V., M. Anthony "Evaluation of Properties for Al-SiC Reinforced Metal Matrix
- 9.Raosahab Pind, Prof. Swami M.C. "Analysis and Computational Investigation of Brake Disc for Composite Material".
- 10.Surendhar C, Natarajan P, Mohanraj M, Vijay P. "Wear Behaviour of Aluminium Metal Matrix Composite for Brake Rotor Application".





**Impact Factor:  
7.512**



# **INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH**

**IN SCIENCE | ENGINEERING | TECHNOLOGY**

**📞 9940 572 462 📞 6381 907 438 ✉ ijirset@gmail.com**



**[www.ijirset.com](http://www.ijirset.com)**

Scan to save the contact details