New Suggested Material Composition for Making Brake Pad

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Abstract:
Brake pads are a component of disc brakes used in automotive and other applications. Brake pads are steel backing plates with friction material bound to the surface that faces the disk brake rotor. In this present paper first of all find out the brake pads which is used in automobile industries and laboratory testing of the material is proceed and then thermo mechanical analysis is done for the finding out the stresses and maximum temperature. By the reference of this existing material composition the new material composition is suggest for making the brake pads and in this new composition the percentages is only change the ingredient is same.The changing in the composition percentage have advantage, it's give the more life.

Keywords: *Analysis Software, Brake Pads, Laboratory testing*

1. Introduction

Brake pads convert the kinetic energy of the car to thermal energy by friction. Two brake pads are contained in the brake caliper with their friction surfaces facing the rotor. When the brakes are hydraulically applied, the caliper clamps or squeezes the two pads together into the spinning rotor to slow/stop the vehicle. When a brake pad is heated by contact with a rotor, it transfers small amounts of friction material to the disc, turning it dull gray. The brake pad and disc (both now with friction material), then "stick" to each other, providing the friction that stops the vehicle.

In disc brake applications, there are usually two brake pads per disc rotor, held in place and actuated by a caliper affixed to a wheel hub or suspension upright. Although almost all road-going vehicles have only two brake pads per caliper, racing calipers utilize up to six pads, with varying frictional properties in a staggered pattern for optimum performance. Depending on the properties of the material, disc wear rates may vary. The brake pads must usually be replaced regularly (depending on pad material), and most are equipped with a method of alerting the driver when this needs to take place. Some have a thin piece of soft metal that causes the brakes to squeal when the pads are too thin, while others have a soft metal tab embedded in the pad material that closes an electric circuit and lights a warning light when the brake pad gets thin. More expensive cars may use an electronic sensor.

2. New Suggested Material Composition

By the reference of existing material composition of brake pad we suggest a new material composition for the better life of the brake pads. In this new suggested material the composition is same as existing material but the percentage of composition is different.

In the new suggested material, composition percentage of SiO_2 , CaO , K_2O materials are decreased as compared to existing &MgO , FeO, Fe_2O_3, Al_2O_3 is increased. By prescribed composition the Stresses acting upon the surface of brake pads were reduced by significant amount and changing in

the maximum temperature of brake pads. So that the Wear rate of brake pads is reduced and the life of brake pad is increased. For new composition we had carried out Thermal Structural analysis in which we deduced Von Misses Stress, Maximum Principle stress, Total deformation, and Maximum Temperature.

Table1. New Suggested Material Composition

Composition	Percentages
SiO_2	39.06 or < 39.06
MgO	41.15 or > 41.15
FeO	0.40 or > 0.40
Fe_2O_3	2.30 or > 2.30
Al_2O_3	0.65 or > 0.65
CaO	0.61 or < 0.61
K_2O	14.83 or < 14.83

3. Thermal Structural Analysis of New Suggested Material of Brake Pads

Thermal analysis is a vital stage in the study of brake systems, because the temperature determines the thermomechanical behavior of the structure. In the braking phase, temperatures and thermal gradients are very high. This generates stresses and deformations whose consequences are manifested by the appearance and the accentuation of cracks . It is thus important to determine with precision the temperature field of the brake disc. During stop braking, the temperature does not have time to be stabilized in the disc. A transient analysis is required. It is also essential to evaluate the thermal gradients, which requires three-dimensional modeling of the problem. The thermal loading is represented by a heat flux entering the disc through the brakepads.Many studies of brake disc thermomechanical coupling analysis have been done. Choi and Lee developed an axisymmetric finite element model for the thermoelastic contact problem of the brake disc and investigated the thermoelastic instability phenomenon of the disc brake during the drag-braking process and repeated braking process .Gao and Lin analyzed the transient temperature field and thermal fatigue fracture of the solid brake disc by a three-dimensional thermal-mechanical coupling model.

Here is the analysis work in ansys. By the use of the Finite Elements Method is used for the analysis and for the analysis,properties of the materials is require so that here is the properties of materials.

Table2. Properties of Material

Sr No.	Properties	Value	Sr No.	Properties	Value
1	Material	New Suggested	**9**	RPM-	1130
2	Young's modulus	10000 MPa	**10**	Stopping time-	2.9 sec.
3	Poisson's ratio	0.2	**11**	Density-	$2.45* 10^{-6}$ Kg/m^3
5	Compressive Strength	68.85 N/mm^2	**12**	Thermal conductivity	0.66 w/mk
6	Force	6319.31 N	**13**	Specific Heat-	$4.34*10^5$mJ/Kg ˚C
7	Velocity	60 Km/h	**14**	Thermal expansion	1.2 (10^{-5}/˚C)
8	Torque	737.28 N.mm			

4. Result and discussion

The analysisis completed in ansys by the FEM and the result of the analysis is in the form of the stresses and the maximum temperature of the materials. So that by this results the maximum principle stress and the von misses stress, deformation, directional deformation, heat flux, maximum temperature of the material is Found.

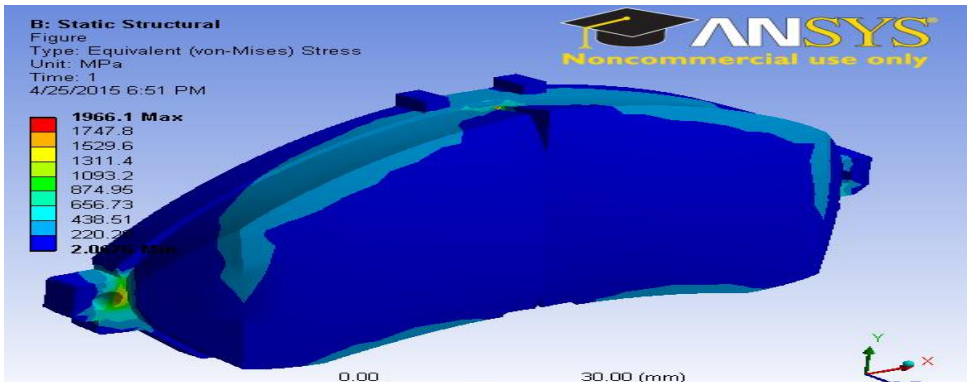

Fig 1. Equivalent Von Misses Stress

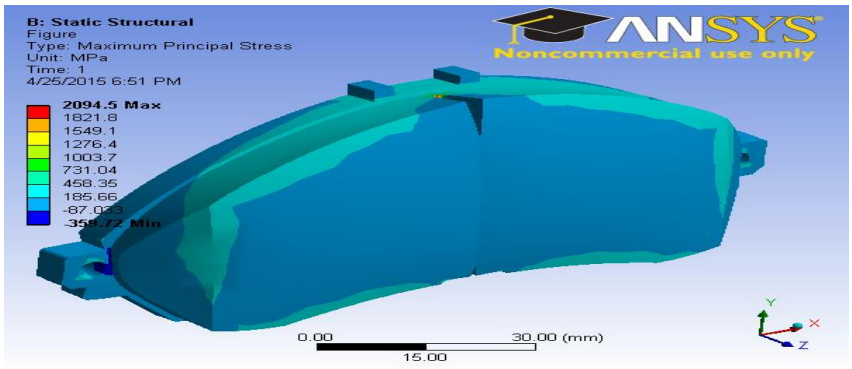

Fig 2. Maximum Principle Stress

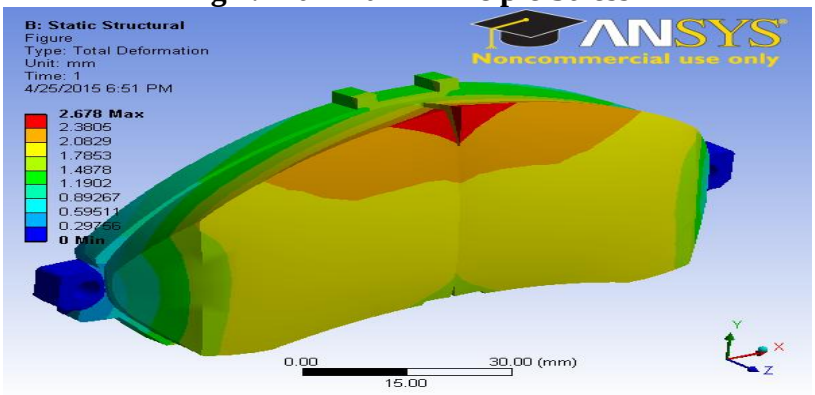

Fig 3. Total Deformation

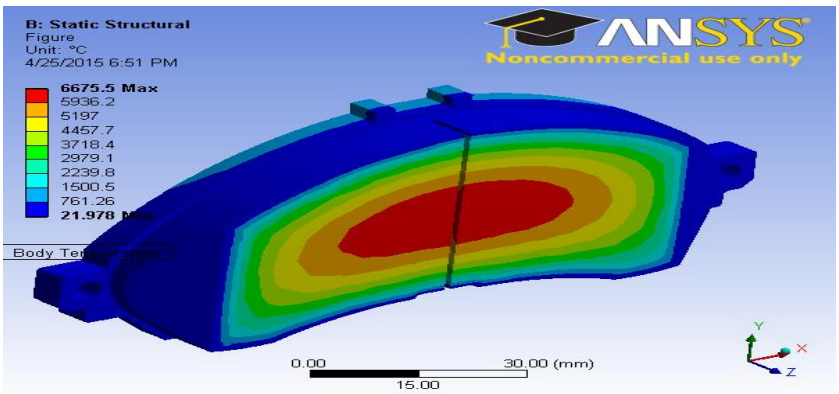

Fig 4.Maximum Temperature

Table 3 Advantages of new suggested material

Composition	Function
SiO_2	Its use as abrasive and Maintain the cleanliness of mating surface
CaO	Inhibits the corrosion in metallic pads.Help to rise the fade temperature
K_2O	Its Use as a role of asbestos , So its percentage is reduce
MgO	Its bond the friction material and filler
FeO	Its reduce the wear rate of the brake pad\
Fe_2O_3	Its improve cold friction .Its act as a mild abrasive
Al_2O_3	The hydrade form added as a polishing agent and for wear resistance .

References

1. Eco-friendly asbestos free brake-pad: Using banana peels by U.D. Idris , V.S. Aigbodion , I.J. Abubakar , C.I. Nwoye
2. Evaluation of palm kernel fibers (PKFs) for production of asbestos-free automotive brake pads by K.K. Ikpambese , D.T. Gundu, L.T. Tuleun
3. http://en.wikipedia.org/wiki/Brake_pad.
4. Morphology and properties of periwinkle shell asbestos-free brake pad by D.S. Yawas, S.Y. Aku, S.G. Amaren
5. Study of the interaction between microstructure, mechanical and tribo-performance of a commercial brake lining material by AmiraSellami , Mohamed Kchaou , RiadhElleuch , Anne-LiseCristol , YannickDesplanques
6. The effects of applied load on the coefficient of friction in Cu-MMC brake pad/Al-SiCp MMC brake disc system by D. Gultekin∗, M. Uysal, S. Aslan, M. Alaf, M.O. Guler, H. Akbulut
7. Transient thermo mechanical analysis of automotive disc brake with gray cast iron composition by A. Belhocine and M. Bouchetara
8. Wear behaviour of eutectic and hypereutectic Al–Si–Cu–Mg casting alloys tested against a composite brake pad by L. Lasa, J.M. Rodriguez-Ibabe