Investigation of Tribological Properties for Brake pad Material: A Review

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Abstract – The aim of this review paper is to represent a general study on the alternative material for the brake pad material. Instead of the conventional material if we used the composite material the cost, weight can be reduced and the life of that brake material can be increased in low cost. We can combine the two or more material and from that the one material can manufactured and that material shows the superior properties of that combined material and eliminate the unrequired properties.

Keywords – Wear & Friction Monitor, frictional force.

I. INTRODUCTION

A vehicle brake is a brake used to slow down a vehicle by converting its kinetic energy into heat. The basic hydraulic system, most commonly used, usually has six main stages. The brake pedal, the brake boost (vacuum servo), the master cylinder, the proportioning valves and finally the road wheel brakes themselves. Graphite powder is used as friction modifier since 2003 in brake pad material which can play a vital role in this direction. The literature shows that graphite powder when used as friction modifier helps in improving the thermal conductivity of the composites brake pad material. It also helps in the controlling the hardness of the brake pad to the desired level. So the synthetic fiber is a good choice for the composition. Carbon fibers as reinforcement and graphite powder as friction modifier are two potential carbon materials which are useful in the formation of asbestos free brake pad materials. For tribo-performance, hardness of materials plays a crucial role and can be controlled by suitable modifications in the composition of the composite material. In case of friction based brake pads, hardness could be reduced by using graphite powder as friction modifier without affecting flexural properties. Samples made with Kevlar pulp showed superior tribological properties.

II. LITERATURE REVIEW

P. Thiyagarajan (2003) has introduced a carbon fibers as reinforcement and graphite powder as friction modifier in the brake pad material, by his research he concluded that the brake pad material can play a vital role in this direction. The study reports the influence of these modifications on the thermal properties like coefficient of thermal expansion (CTE).

R. B. Mathur (2004) In spite of unparalleled combination of essential material properties for brake linings and clutch facings, replacement for asbestos is seriously called for since it is a health hazard. Once asbestos is replaced with other material then composition and properties of brake pad changes.

U.D. Idris (2013) The use of asbestos fiber is being avoided due to its carcinogenic nature that might cause health risks. A new brake pad was produced using banana peels waste to replaced asbestos and Phenolic resin (phenol formaldehyde), as a binder was investigated.

D. Gultekin (2010) In this paper’s study, the frictional and wear characteristics of sintered copper matrix composite brake pads against cast Al–Si/SiCp brake disc and the effects of applied load on the coefficient of friction have been reported. Tribological behavior of Cu-MMC/Al-MMC couple was studied using Pin-on-Disc tribometer.

Rukiye Ertan (2010) In his study, a brake lining composition was investigated experimentally to investigate the effects of the manufacturing parameters on the tribological properties and to obtain optimal manufacturing parameters for improved tribological behavior.

III. FRICTION MATERIALS

A. Asbestos

Asbestos become the major material for friction material composition over eight decade and become more widespread during the industrial revolution in 1866. Asbestos were from Greek word which mean “unquenchable” or “inextinguishable” is a set of six naturally occurring silicate minerals exploited commercially for their desirable physical properties.

B. Kevlar or Aramid

The use of non-metallic friction material seems to become the solution forth asbestos friction material. Friction material made from Kevlar or aramid fiber.
Aramid fiber (a generic expression denoting fiber made from the condensation product of isophthalic orterephthalic acids and morphenylene diamine such as Kelvar fibre sareal so widely used as reinforcing fiber, but they are a deferent class of fiber in that the relatively so fiber. They are very light an d exhibit excellent thermal stability, with a very good stiffness to weight ratio.

C. Fibertuff

Fibertuff is a product designed to give the wear of a ceramic facing, yet have the engagement and disengagement qualities of an organic material. Fibertuff intended to wear against its mating surfaces like organic material. Used primarily in the stamped steel and 14" cast units, this product offers greater life than organic material with many of the same qualities that organic friction has traditionally offered. Around-town delivery trucks and mid-range applications find that this product works best.

IV. TRIBOLOGY

Tribology is the study of the friction, wear and lubrication of engineering surfaces with a view of understanding surface interactions in detail and then prescribing improvements in given applications. One of the important objectives in tribology is the regulation of the magnitude of frictional force according to whether we require a minimum or a maximum frictional force.

Quantitative values for friction and wear in the forms of coefficient of friction and wear rate depend on the following basic groups of parameters:

1. The structure of the system, i.e. its components and their relevant properties;
2. The operating variables, i.e. load (stress), kinematics, time and temperature; Mutual interaction of the system's components.

A. Friction

Friction is the resistance to motion, which occurs whenever one body slides over another. Whenever there is contact between two bodies under a normal load W, a friction force is required to initiate and maintain relative motion. This force is called frictional force, F. Three basic facts have been experimentally established:

1. The frictional force, F, always acts in a direction opposite to that of the relative displacement between the two contacting bodies;
2. The frictional force, F, is a function of the normal load on the contact,

\[ F = \mu F_N \]

Where \( \mu \) = coefficient of friction,

\( F_N = \) Normal Load.

3. The frictional force is independent of a nominal area of contact.

B. Wear

Wear is commonly defined as the undesirable deterioration of a component by the removal of material from its surface. It occurs by displacement and detachment of particles from surface. The mechanical properties of steel are sharply reduced due to wear.

V. EXPERIMENTAL SET UP

reaction against speed, load, temperature, and wear. The test rig uses paralytic gray cast iron disc with give specification in chart and a brake pad sample in the form of pin of different diameter & length. Each test sample can be mounted on load arm and press against the rotating disc.
The rotating cast iron disc has a constant sliding speed max. 2000 rpm and the test duration max 99hrs. The surface of the sample and disc has to be grounded with 320-grid sand paper before beginning the test. The normal load can be varied up to 200 N to achieve a constant friction force. The frictional coefficient can be calculated by measuring the normal and shear forces every 5 seconds over the entire duration of the test. The weight and thickness of the samples can be noted before and after the friction to calculate the total wear of the sample. Infrared sensors are used to record the temperature of the contact interface during the test and readings can be recorded every second.

VI. EXPERIMENT

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Graphs

VII. CONCLUSION

- Steel wool has excellent structural reinforcement property and high thermal stability.
- Steel wool has lesser density than carbon fiber.
- Steel wool has lesser wear rate.
- Steel wool has cheaper manufacturing cost as compare to asbestos organics.
- Steel wool presented better mechanical properties on various parameters when tested against materials like aramids.

REFERENCES