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An Experimental Investigation of Performance of Composite Brake Pads

By S. K. Vignesh

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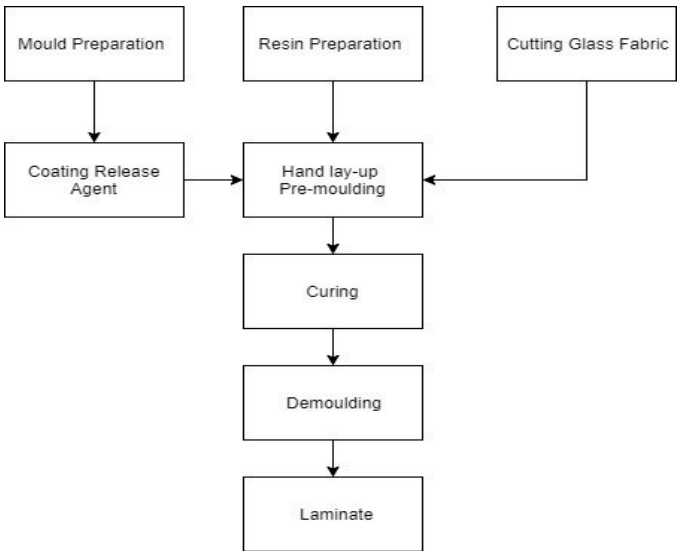
I. Introduction

Brake pad are made with materials like, graphite, brass and ceramics. This work aimed at obtaining a suitable friction material, taking cost, performance and environmental implication into consideration. For all categories of vehicles that are equipped with brake discs, brake pads form vital components. They are steel backing plates with friction material fasten to the surface facing the brake disc. There are two types of brakes are available they are drum brakes and disc brakes, usually drum brakes has shoes inside the drum and in the disc brake they contains the metal disc which would rotate inside the caliper.

Author: Assistant professor, Mechanical Department, VI Institute of technology. e-mail: Skvrajesh1995@gmail.com

II. Methadology



III. Materials

a) Glass Fibres

Glass fiber are modern materials that used in mechanical and production industries. They are been produced by the modern methods. They exhibit useful huge properties such as hardness, transparency, resistance to chemical attack, stability, and inertness, as well as desirable fibre properties such as strength, flexibility, and stiffness. Glass fibres are used in the manufacture of structural composites, printed circuit boards and a wide range of special_purpose products.

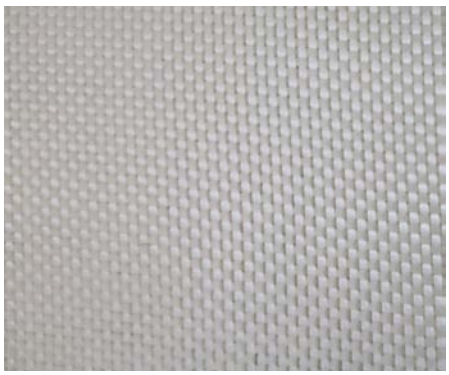


Figure 1: Glass fiber

b) Basalt fibre

Basalt rock will be wont to create not solely volcanic rock bars however conjointly volcanic rock

materials, sliced volcanic rock fibre strands, continuous volcanic rock filament wires and volcanic rock mesh. a number of the potential applications of those volcanic rock composites are: plastic compound reinforcement, soil strengthening, bridges and highways, industrial floors, heat and sound barriers for residential and industrial buildings, bullet proof vests and retrofitting and rehabilitation of structures.

Figure 2: Basalt fiber

c) Jute fibre

Jute is a important natural fiber crop in India next to cotton. In trade and trade, jute and Mesta crop along called raw jute as their uses are nearly same. Raw jute plays a very important role within the country's economy. Raw jute was first used in planting and for the packing industry. however, it's currently emerged as a flexible material for numerous applications, such as, textile industries, paper industries, building and automotive industries, use as soil saver, use as ornamental and furnishing materials, etc. Raw jute being perishable and annually renewable supply, it's thought of as associate degree setting friendly crop and it helps within the maintenance of the setting and ecological balance. Jute as a natural fibre has some definite inherent blessings.

Figure 3: Jute fiber

d) Epoxy Resin and Hardner

Figure 4: Resin and Hardner

Properties of Resin (Ly556)
Aspect (visual) clear, pale yellow liquid
Colour (Gardner, ISO 4630) ≤ 2
Epoxy content 5.30 - 5.45 [eq/kg]
Viscosity at 25 °C 10000 - 12000 [MPa s]
Density at 25 °C 1.15 - 1.20 [g/cm3]
Flash point (ISO 2719) > 200 [°C]
Storage temperature (see expiry date on original container) 2 - 40 °C [°C]

Properties of Hardener (Hy906)
Aspect (visual) clear, pale yellow liquid
Colour (Gardner, ISO 4630) ≤ 2
Viscosity at 25 ° 175 - 350 [MPa s]
Density at 25 °C 1.20 - 1.25 [g/cm3]
Flash point > 135 [°C]
Storage temperature (see expiry date on original container) 2 - 40 °C [°C]

IV. Fabrication

a) Lay-up process

Once all the materials square measure ready, the digital computer is prepared and therefore the mould preparation done; the scholars will begin with the lay-up method. the primary step is to combine the organic compound and therefore the hardener. The proportions square measure sometimes given by the provider and might be found on the containers of the hardener or organic compound. The parts will be either measured by weight for by volume however it's vital to follow these proportions specifically as this is often an entire reaction and every one element should react utterly for max strength of the matrix. it's best to live proportions victimization the degree methodology and a screw in pump that inserts into the cans of organic compound and hardener. These pumps will be purchased beside the containers of organic compound and hardener. make certain to stay the organic compound pump and instrumentation high break away the pump and instrumentation high of the hardener as a

result of any contamination can initiate the reaction and cause the ensuing mix to harden.

The admixture is performed within the mixing containers with the blending stick and may be done slowly therefore on not board any excess air bubbles within the organic compound. watch out to combine utterly and deliberately for a full 2 minutes before applying. it's best to use a "flat" stick- like tongue depressor; a spherical stick doesn't work well because it doesn't 'paddle' the mixture to mix it properly. Note: Plastic admixture containers could soften throughout the chemical reaction, therefore it's best to use containers that square measure specifically created for the aim of blending epoxy glue. These square measures usually accessible from the organic compound merchant. Next Associate in Nursing adequate amount of mixed organic compound & hardener is deposited within the mold and a brush or roller is employed to unfold it around all surface. it's vital to not add an excessive amount of organic compound, which can cause too thick of a layer, nor to feature but the required quantity, which can cause holes within the surface of the half once it's cured. Associate in Nursing estimate of the number of organic compounds required will be supported weight of glass fiber artefact. One will assume fifty-unit resin/50% unit fibre.

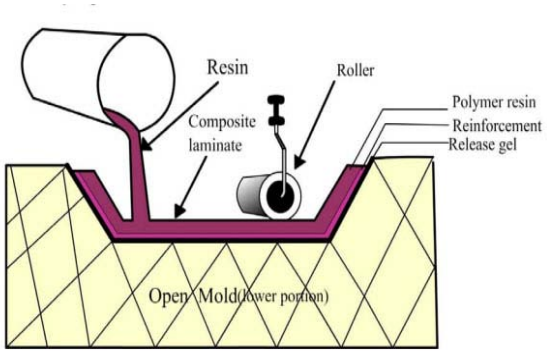


Figure 5: Hand lay-up method

Figure 6: Glass fiber-basalt and glass fiber-jute

V. Testing Methods

a) Hardness Test

The hardness test was performed with the aid of Brinell hardness tester. The specimen was indented for 10 seconds (dwell time), after which corresponding Brinell hardness numbers were calculated by using formula.

$$BHN = 2F/(\pi D(D-(D-d)^{\frac{1}{2}})$$

Where

F= Force in Kgf

D= Diameter of the indenter ball

d= Diameter of the indentation

Figure 7: Hardness test in Existing brake pad

Figure 8: Hardness test in composite material

Temperature Test

Temperature take a look at is employed to gauge the behaviour of the merchandise once exposed to varied temperature extremes. so as to accelerate the amendment in physical properties of a cloth or product, constant elevated temperature is employed.

Figure 9: Specimen prepared for temperature test

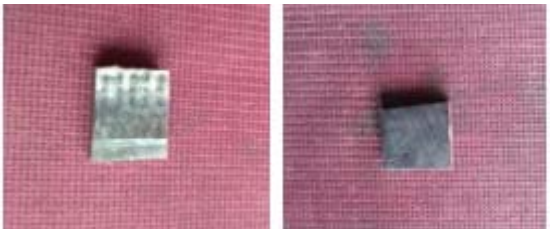


Figure 10: Specimen after temperature test

VI. Results

Table 1: Surface wear test

Material/ composition	W0 (g)	W1 (g)	Time min	Wear Rate (g/m)
Sample 1	6.12	6.02	20	0.005
Sample 2	5.192	5.150	20	0.0021
Sample 3	5.377	5.308	20	0.00345

Table 2: Water Absorption test

Material/ composition	Weight before immersion W0 (g)	Weight after immersion W1 (g)	Absorption %
Sample 1	33.7	41.52	23.2
Sample 2	30	34.23	14.1
Sample 3	32.4	38.64	19.2

Table 3: Temperature Test

Material/ composition	Temperature 1(°c)	Temperature 2 (°c)	Temperature 3 (°c)
Sample 1	150(colour changed)	200 (Edge burned)	320(fully burned)
Sample 2	150(No change)	200 (colour changed)	320 (Edge burned)
Sample 3	150(Edge colour changed)	200 (Colour turned into dark)	320 (Fully burned)

Table 4: Hardness Test

Material/ composition	Hardness number BHN	Hardness value MPa
Sample 1	4.83	13.6
Sample 2	14.43	47
Sample 3	8.12	27.2

Table 5: Tensile Test

Material/ composition	Tensile stress at break (N/mm2)
Sample 1	135.23
Sample 2	250.58
Sample 3	173.76

Table 6: Compressive Test

Material/ composition	Compressive stress (N/mm2)
Sample 1	135.23
Sample 2	250.58
Sample 3	173.76

VII. Conclution

Fibers were used as filing material to provide composite brake pad. The new factory-made automobile brake pad was tested by decisive its mechanical and tribological properties. supported properties like temperature take a look at, hardness, lastingness, and compressive strength, wear strength the final result that get from the Glass and volcanic rock fibre based mostly restraint compared favourably with the prevailing one with amphibole material.

Specimen labeled specific gave superior performance over others. Temperature check, hardness, durability, and compressive strength, wear strength of the foremost effective composite specimen, are, severally. From investigation, the results of this work indicated that fibres that is Glass and volcanic rock fibres may be effectively used as a replacement for amphibole in friction lining/ brake pad materials. in contrast to amphibole primarily based brake pad and existing brake pad, the composite brake pad developed during this work is eco-friendly with none famed health implication. it's conjointly increase the lifetime of the brake pad. And conjointly can offer additional potency compared to existing brake pad, offer additional brake power.

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