

19



Europäisches Patentamt
European Patent Office
Office européen des brevets

11

Publication number:

0 000 839
A1

12

EUROPEAN PATENT APPLICATION

21

Application number: 78300258.7

51

Int. Cl.²: F 16 D 69/02, C 08 J 5/14

22

Date of filing: 08.08.78

30

Priority: 10.08.77 GB 33458/77

43

Date of publication of application:
21.02.79 Bulletin 79/4

84

Designated contracting states:
BE CH DE FR GB LU NL SE

71

Applicant: FERODO LIMITED
20 St. Mary's Parsonage
Manchester M3 2NL(GB)

72

Inventor: Chester, John
58 Avondale Avenue Hazel Grove
Stockport Greater Manchester(GB)

74

Representative: Wetters, Basil David Peter et al,
20 St. Mary's Parsonage
Manchester M3 2NL(GB)

54

Improvements in or relating to friction materials.

57

Composition for a friction material e.g. for a brake pad, of the type containing a fibrous reinforcement, a binder and various additives.

The friction material contains no asbestos, but has properties comparable with asbestos-based materials. The composition contains a thermoset binder including a phenol-formaldehyde resin and making up 20 to 60% by volume of the material. Besides the resin the binder can also include a heat and chemical resistant rubber, but the phenol-formaldehyde resin makes up at least 10% by volume of the composition.

The composition includes a fibre-based reinforcement which makes up to 10 to 35% by volume of the material and consists of a mixture of steel fibres or glass fibres with one or more other non-asbestos inorganic reinforcing materials e.g. steel fibre and mica, or steel fibre and milled glass.

EP 0 000 839 A1

- 1 -

This invention relates to friction materials, and more preferably to friction materials of the kind used for brake pads, brake linings, clutch facings and similar uses.

- 5 Friction Materials of this kind are generally composed of a thermoset binder, in inorganic fibrous reinforcement and various fillers and other additives. These compositions are required to withstand severe operating temperatures and pressures under repeated application without failure
10 or deterioration in friction properties and the fibrous reinforcement generally used is asbestos. Numerous proposals have been made of compositions containing other inorganic fibrous reinforcement but such materials have so far found limited commercial acceptance.
- 15 According to the present invention a friction material comprises a thermoset binder, a fibre-based reinforcement and other fillers and additives, the thermoset binder comprising a phenol-formaldehyde resin and making up
20 20% to 60% by volume of the material of which more than 10% by volume of the material is said phenol-formaldehyde resin, and the fibre based reinforcement making up between 10 and 35 per cent by volume of the material, and consisting of a mixture of steel fibres or glass fibres with one or more other non-asbestos
25 inorganic reinforcing materials.

When the fibre-based reinforcement contains glass fibres the glass fibres preferably have a length of the order of 2 to 5mm. The glass may be a conventional glass such as E-glass and will preferably have a surface dressing, as well known in the glass fibre art, to promote its adhesion to the binder. When the fibre-based reinforcement contains steel fibres the fibres are preferably fine, e.g. 0.125mm diam., and with a length in the range 1 to 5mm. The steel may be mild steel.

The fibre-based reinforcement is a mixture of materials, one at least of which is steel fibre or glass fibre. If desired a mixture of steel fibres and glass fibres may be used. Other reinforcing materials which may be included in the mixture include reinforcing fillers such as mica and woolastonite.

The thermoset binder includes a thermoset resin based on a phenol-formaldehyde resin but may also include a heat and chemical resistant vulcanized rubber, such as a nitrile rubber. Preferably a mixture of such materials is used of which the phenol-formaldehyde resin material preferably constitutes at least half. When a rubber is used it may be incorporated into the friction material in the form of a powder but is preferably incorporated in the form of a solution in a suitable organic solvent and a vulcanizing agent such as sulphur is also used.

The amount of thermoset binder is preferably in the range 20 to 32 per cent by volume of the friction material. In the manufacture of the friction materials various other materials may be included as fillers, friction and wear modifiers etc. the proportions of which can be varied to adjust the friction and other properties of the materials.

In the present case the preferred additives are particulate fillers, more preferably a mixture of such materials and friction and wear modifying materials.

The particulate fillers will generally be present in
5 an amount between 10 and 50 per cent by volume and may include such fillers as barytes, whiting, silica etc.

Examples of friction and wear modifiers are carbon, graphite, antimony trisulphide and molybdenum disulphide
10 and metals, in a finely divided form. Examples of suitable metals are copper and tin. A mixture of such materials may be used, and the total amount of such materials may be up to 40 per cent by volume.

The friction materials of the present invention are
15 particularly suited to be manufactured by a press-moulding technique in which all the ingredients of the material are compounded together, the compounded mix disintegrated and (optionally dried) and then moulded into a component such as a brake pad in a die
20 under pressure. The moulded component is then removed from the die and baked to cure the binder.

The invention provides friction materials which do not contain asbestos, and yet have comparable properties to asbestos-based friction materials.

25 The invention will now be illustrated, by way of example only, by means of the following examples.

EXAMPLES 1 to 3

For Example 1 sample disc-brake pads were manufactured according to the formulation given below in Table I:

30 The ingredients were initially compounded together, the nitrile rubber being introduced into the mixture as a powder and the compound was disintegrated and dried. The material was then moulded into pads under

pressure in a die and the mouldings baked in an oven to cure the binder.

TABLE I

5	Nitrile rubber	11.40	parts by volume per 100 parts of material
	Sulphur	3.00	
	Phenol-formaldehyde resin	20.00	
	Steel Fibres	10.00	
	Mica (K37)	5.00	
10	Carbon Black	5.39	
	Silica	6.08	
	Barytes	19.89	
	Graphite	8.48	
	Antimony trisulphide	2.39	
15	Molybdenum disulphide	1.79	
	Copper (powdered)	5.38	
	Tin (powdered)	1.20	

For Examples 2 and 3 samples were also made using the formulation given in Table I. except that the mixture of steel fibres (10 parts) and mica (5 parts) was replaced by mixtures of steel fibres (10 parts) and glass fibres (5 parts) and glass fibres (15 parts) and wollastonite (5 parts) respectively. In the latter case the proportions of the other ingredients in the total mix were correspondingly reduced.

In each case the sample pads produced were tested and found to have friction properties comparable to asbestos-containing materials.

Examples 4 and 5

These Examples illustrate different proportions of binder and reinforcing materials. Sample disc-brake pads were manufactured according to the formulations given below in Table II. The ingredients were initially compounded together, the nitrile rubber being introduced into the mixture as a 15 - 20% solids content solution in trichloroethylene, and the phenol-formaldehyde resin

as a 70% solids content solution in methylated spirits. The compound was disintegrated and dried and then moulded into pads under pressure in a die and the mouldings baked in an oven to cure the binder.

- 5 In the following table the formulations are expressed in parts by volume.

TABLE II

<u>Example</u>	<u>4</u>	<u>5</u>
Nitrile Rubber	6.03	12.00
10 Sulphur	3.18	3.18
Phenol-Formaldehyde resin	14.91	12.00
Steel Fibres	10.00	10.00
Mica	3.50	-
15 Milled E. Glass	-	10.00
Powdered Coke	13.96	10.00
Anorthite	6.99	5.00
Alumina	0.50	0.50
Barytes	25.46	20.82
20 Graphite	8.97	-
Carbon Black	-	10.00
Antimony Trisulphide	2.00	2.00
Copper	4.50	4.50

- In Example 4 the reinforcement was a mixture of Steel Fibres and mica (as in Example 1) but in Example 5 the reinforcement was a mixture of the steel fibres and milled E Glass, the latter being a dust composed of very short lengths of milled glass fibre. In Example 5 the binder included equal amounts of rubber and resin.
- 30 In dynamometer tests of the pads produced the coefficient of friction μ of the material of Example 4 varied from 0.26(cold) to 0.44(hot) and that of the material of Example 5 varied from 0.30(cold) to 0.55(hot).

The wear of the material of Example 4 was as good as, or better than, most conventional materials of comparable friction level. The wear of the material of Example 5 was reasonable for the level of friction, although
5 higher than that of the material of Example 4.

The assembly shear strength of two pads of each material were measured, the values obtained for Example 4 being 2330 and 2140 psi and those for Example 5 being 2340 and 2230 psi

10 (Assembly Shear Strength = load required to shear
material off the backplate
area of friction material
bonded to the backplate)

CLAIMS:

1. A friction material comprising a thermosetting binder, a fibre-based reinforcement and other fillers and additives wherein the thermoset binder
5 comprises a phenol formaldehyde resin and makes up 20% to 60% by volume of the material of which more than 10% by volume of the material is said phenol formaldehyde resin and the fibre-based reinforcement makes up between 10 and 35% by volume
10 of the material and consists of a mixture of steel fibres or glass fibres with one or more other non-asbestos inorganic reinforcing materials.
2. A friction material according to Claim 1 comprising glass fibres having a length in the range 2 to
15 5mm.
3. A friction material according to Claim 1 ro 2 comprising steel fibres having a length in the range 1 to 5mm.
4. A friction material according to Claim 3 in which
20 the steel is mild steel.
5. A friction material according to any one of Claims 1 to 4 in which the reinforcement consists of a mixture of steel fibres and glass fibres.
6. A friction material according to any one of Claims
25 1 to 4 comprising as reinforcing material a reinforcing filler.
7. A friction material according to Claim 6 in which said reinforcing filler is mica or wollastonite.
8. A friction material according to Claim 7 in which
30 the reinforcing material is a mixture of steel and mica or a mixture of glass and woolastonite.

0000839

9. A friction material according to any one of the preceding claims which includes as a binder a heat and chemical resistant vulcanized rubber.
10. A friction material according to Claim 9 in which
5 said rubber is a nitrile rubber.
11. A friction material according to any one of the preceding claims which the amount of thermoset binder is in the range 20 to 32 per cent by volume of the material.
- 10 12. A friction material according to any one of the preceding claims which includes one or more particulate fillers in an amount between 10 and 50 percent by volume.
13. A friction material according to Claim 12 in which
15 said particulate filler comprises barytes, whiting or silica.
14. A friction material according to any one of the preceding claims comprising one or more friction or wear modifiers in an amount up to 40 percent
20 by volume.
15. A friction material according to Claim 14 in which said friction and wear modifiers are selected from carbon, graphite, antimony trisulphide and molybdenum disulphide and brass, copper and tin
25 in finely divided form.



European Patent
Office

EUROPEAN SEARCH REPORT

0000839
Application number
EP 78 30 0258

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	<u>FR - A - 1 575 746 (FERODO)</u> * Page 2, lines 6-11; page 5, lines 16-35; page 6, lines 11-46; abstracts 1-5, 7 *	1,5,6, 7,8,9, 10,12, 13,15	F 16 D 69/02 C 08 J 5/14
			TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
			F 16 D 69/02
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
			&: member of the same patent family, corresponding document
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 14-11-1978	Examiner BOULON