FORM 1

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

642493

APPLICATION FOR A STANDARD PATENT

I\We,

ISOVER SAINT-GOBAIN

of "LES MIROIRS"
18 AVENUE D'ALSACE
92400 COURBEVOIE
FRANCE

hereby apply for the grant of a standard patent for an invention entitled:

MINERAL FIBRES WHICH CAN DECOMPOSE IN A PHYSIOLOGICAL MEDIUM.

which is described in the accompanying complete specification

Details of basic application(s):

Number of basic application	Name of Convention country in which basic application was filed	Date of basic application
90/06841	FR	01 JUN 90

My/our address for service is care of GRIFFITH HACK & CO., Patent Attorneys, 601 St. Kilda Road, Melbourne 3004, Victoria, Australia.

DATED this 27th day of May 1991

ISOVER SAINT-GOBAIN

GRIFFITH HACK & CO.

TO: The Commissioner of Patents.

M 027316 270591

AUSTRALIA

PATENTS ACT 1952

CB3 30537 AM **B**

APPLICATION BY ASSIGNEE OF INVENTOR

DECLARATION IN SUPPORT OF AN APPLICATION FOR A PATENT no. 77318/91

NAME OF APPLICANT

In support of an application made by ISOVER SAINT-GOBAIN
Siège Social : 18, avenue d'Alsace
92400 COURBEVOIE
~~Cedex 27 - 92096 PARIS LA DÉFENSE~~

TITLE

for a patent for an invention entitled:

MINERAL FIBRES WHICH CAN DECOMPOSE IN A PHYSIOLOGICAL MEDIUM

FULL NAME AND ADDRESS OF SIGNATORY

I, S. LE VAGUERESE

of ISOVER SAINT-GOBAIN, "Les Miroirs", 18 Avenue D'Alsace
92400 Courbevoie, FRANCE

do solemnly and sincerely declare as follows:

1. I am authorised by the above mentioned applicant for the patent to make this declaration on its behalf.

FULL NAME AND ADDRESS OF INVENTOR(S)

2. The name and address of each actual inventor of the invention is as follows:

1. Sylvie THELOHAN
2. Alain DE MERINGO
3. Hans FURTAK
4. Wolfgang HOLSTEIN ****See reverse for Inventors' addresses

SEE NOTES OVER

3. The facts upon which the applicant is entitled to make this application are as follows:

The applicant would be entitled to have assigned to it a patent granted to any of the actual inventors in respect of the said invention.

DELETE PARAGRAPHS 3 AND 4 FOR NON-CONVENTION APPLICATION

4. The basic application(s) as defined by Section 141 of the Act was (were) made as follows:

Country FRANCE on 1st June 1990

in the name(s) ISOVER SAINT-GOBAIN

and in on

in the name(s)

PLACE AND DATE OF SIGNING

5. The basic application(s) referred to in the preceding paragraph was (were) the first application(s) made in a Convention country in respect of the invention the subject of this application.

Declared at Courbevoie, FRANCE

this Sixteenth day of May 19 91

Signed S. Le Vaguerese

Position S. LE VAGUERESE

GRIFFITH HACK & CO

PATENT AND TRADE MARK ATTORNEYS

MELBOURNE · SYDNEY · PERTH

AU9177318

(12) PATENT ABRIDGMENT (11) Document No. AU-B-77318/91
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 642493

(54) Title
MINERAL FIBRES WHICH CAN DECOMPOSE IN A PHYSIOLOGICAL MEDIUM

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(56) Prior Art Documents
EP 247817

(57) Claim

1. A mineral fibre which can decompose in the presence of a physiological medium comprising the following constituents according to the following weight proportions in addition to impurities having a total weight content of equal to or less than 3%:

SiO_2	37 to 58%
Al_2O_3	4 to 14%
CaO	7 to 40%
MgO	4 to 16%
P_2O_5	1 to 10%
Fe_2O_3	0 to 15% (total iron expressed in this form)

and the combined weight of Na_2O and K_2O is from 0.1% to 7%, wherein the amount of CaO + MgO + Fe_2O_3 is greater than 25%.

6. A product for heat and/or sound insulation comprising at least partially of mineral fibres having a chemical composition in accordance with any on of the preceding claims.

AUSTRALIA

PATENTS ACT 1952

Form 10

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE

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Related Art:

TO BE COMPLETED BY APPLICANT

Name of Applicant: ISOVER SAINT-GOBAIN

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Australia.

Complete Specification for the invention entitled:
MINERAL FIBRES WHICH CAN DECOMPOSE IN A PHYSIOLOGICAL MEDIUM.

The following statement is a full description of this invention including the best method of performing it known to me:-

MINERAL FIBRES WHICH CAN DECOMPOSE IN A PHYSIOLOGICAL MEDIUM

The present invention relates to the sphere of mineral fibres; more precisely its object is mineral fibres of which the composition is such that they decompose as soon as they are in contact with a physiological medium.

Buildings are frequently insulated with respect to heat and sound by means of products essentially consisting of mineral wool, such as rock wool. The particular arrangement of the premises to be insulated often leads the personnel responsible for fitting these products to cut them in situ. This operation causes the fibres to break and possibly some of them to be dispersed into the atmosphere. It results therefrom that sometimes a fibre may accidentally be inhaled.

Although the harmfulness of the inhaled fibres has not been proven, the need is felt to reassure users by offering them a product which can dissolve easily in a physiological medium.

The aim of the present invention is to propose mineral fibres of which the composition is such that they decompose rapidly when in contact with a physiological medium.

In particular, the aim of the present invention is fibres which can be obtained by conventional techniques of external centrifuging.

These techniques are used to form fibres from glasses obtained by melting raw materials such as blast furnace slag or basalts. Some of these techniques, also known as free centrifuging, consist in pouring a thin stream of molten glass onto the peripheral strip of a centrifuging wheel, rotating at high speed about a shaft perpendicular to the direction of the thin glass stream. Under the effect of centrifugal force, some of the glass is converted into fibres, the remainder being conveyed to a further wheel where the same phenomenon occurs; three or four wheels may thus be interposed along the path of the molten glass.

The aims of the invention are achieved by modifying the known glass compositions used in free centrifuging techniques. On the basis of compositions of this type, essentially comprising

silica and alumina, alkaline earth oxides, the inventors discovered that the addition of phosphorus pentoxide enables glasses to be obtained which, in fibre form, decompose rapidly in a physiological medium.

The glasses according to the invention furthermore have properties which, as regards the main ones among them, are similar to those of known glasses. It is thus that they can be converted into fibres using conventional centrifuging wheels.

According to the present invention there is provided a mineral fibre which can decompose in the presence of a physiological medium comprising the following constituents according to the following weight proportions in addition to impurities having a total weight content of equal to or less than 3%:

SiO_2	37 to 58%	
Al_2O_3	4 to 14%	
CaO	7 to 40%	
MgO	4 to 16%	
P_2O_5	1 to 10%	
Fe_2O_3	0 to 15%	(total iron expressed in this form)

and the combined weight of Na_2O and K_2O is from 0.1% to 7%, wherein the amount of CaO + MgO + Fe_2O_3 is greater than 25%.

~~invention is expressed in the form of ferric oxide.~~

The compositions defined in this manner may be prepared from pure constituents but are generally obtained by the melting of a mixture of vitrifiable raw materials possibly with the addition of other oxides such as titanium oxide and manganese oxide, considered as impurities within the scope of the invention. The total content of these impurities is equal or less than approximately 3 weight percent.

In order to be able to be used in external centrifuging techniques, the compositions according to the invention advantageously have adequate viscosity at a relatively low temperature. This depends to a great extent on the total amount of the oxides SiO_2 and Al_2O_3. Within the scope of the invention, the amount of these oxides is generally equal to or greater than approximately 50 weight percent.

In addition, the production of the fibres depends on the ability of the glass, which is great to a lesser or greater extent, to develop crystals in its mass. This phenomenon, known as devitrification, is characterised by several

temperatures: that at which the rate of crystal growth is at its maximum and that at which this rate of growth is zero (liquidus).

In the main part, this phenomenon is intensified to a greater or lesser extent depending on the total amount of alkaline earth oxides. Within the scope of the invention, this amount is less than approximately 40 weight percent.

In order to ensure that the fibres are sufficiently heat resistant, it is desirable for the amount of $CaO + MgO + Fe_2O_3$ to be greater than approximately 25 weight percent.

The range of preferred compositions according to the invention is delimited by the following weight proportions:

SiO_2	45 to 57%
Al_2O_3	3 to 6%
CaO	20 to 30%
MgO	6 to 16%
Fe_2O_3	0.1 to 4%
P_2O_5	1 to 7%
$Na_2O + K_2O$	0.1 to 5%
Impurities	$\leq$ 3%

A further area of compositions according to the invention is defined by the following weight proportions:

SiO_2	39 to 50%
Al_2O_3	7 to 13%
CaO	20 to 30%
MgO	6 to 16%
Fe_2O_3	0.1 to 4%
P_2O_5	3 to 9%
$Na_2O + K_2O$	0.1 to 5%
Impurities	$\leqslant$ 3%

The advantages of the invention are given in the following description, illustrated by some non-limiting examples.

The measurements of the degree of decomposition in the physiological medium were performed on fibres of which the diameter is constant and is approximately 10 µm.

These fibres are immersed in a solution which simulates an extracellular fluid and of which the composition is as follows (expressed in g/l):

$MgCl_2.6H_2O$	0.212
NaCl	6.415
Na_2HPO_4	0.148
$Na_2SO_4.2H_2O$	0.179
$CaCl_2.4H_2O$	0.318
$NaHCO_3$	2.703
(Na_2 tartrate).$2H_2O$	0.180
(Na_3 citrate).$5,5H_2O$	0.186
Na lactate	0.175
Na pyruvate	0.172
Glycine	0.118

The test conditions selected for determining the degree of decomposition of the glass fibres in this solution are as follows: two hundred mg of fibres are placed between two perforated discs separated by a circular ring. These two discs, 4.3 centimetres in diameter, are covered with a polycarbonate filter. This assembly forms a measuring cell through which there circulates the solution of which the flow rate is regulated by a peristaltic pump. This flow rate is 40 ml per day, the duration of the test being 20 days. The cell and the flask containing the attacking solution are maintained at a temperature of 37° C. After passing through the cell, the attacking solution is collected in bottles in order to be analysed subsequently.

The amount of dissolved silica is measured by analysis; the weight of dissolved silica in relation to the weight of silica initially present in the fibre gives a percentage result, which is a good indicator of the capacity of the fibre tested to decompose in a physiological medium.

The compositions tested and the results obtained are presented in tables 1 and 2 enclosed.

Table 1 shows the compositions according to the invention and two known compositions used as a reference (glasses no. 1 and no. 4).

The presence of phosphorus pentoxide in the compositions according to the invention always results in an increase in the amount of silica dissolved in the attacking solution of the fibres obtained from the said compositions, as compared with fibres of which the composition comprises hardly any phosphorus.

Table 2 contains some test results obtained when this observation is applied.

A comparison of glasses nos. 1 and 3, on the one hand, and glasses nos. 4 and no. 6, on the other,

shows that the effect of reducing the alumina and replacing this amount by silica causes a considerable increase in the degree of decomposition of the fibres tested.

A comparison between glasses nos. 2 and 3, and between glasses nos. 5 and 6, shows that in glasses of which the degree of decomposition is considerable, the substitution of silica by phosphorus pentoxide causes a remarkable increase in the degree of decomposition on the fibres tested.

The influence of phosphorus pentoxide on the degree of decomposition of the fibres is still quite considerable in a glass with a high alumina content, as displayed by glasses nos. 4 and 7.

The phosphorus is added to the vitrifiable mixture in the form of disodic phosphate or calcium phosphate for example. When the amount of phosphate introduced into the vitrifiable mixture is relatively large, its melting may sometimes be difficult. It is for this reason that the phosphorus pentoxide content of the compositions is less than or equal to approximately 10 weight percent.

The compositions according to the invention, which have both the viscosity and devitrification properties suitable for the fibre-drawing process by external centrifuging, and, in the fibre state, have a high rate of decomposition in a physiological medium, comprise less than approximately 7 weight percent of alkaline oxides.

The mineral fibres according to the invention listed in table n° 1 are all resistant at a temperature of approximately 700°C. It was found that samples blocks of those fibres (100 kg/m^3) heated into an oven during 30 minutes show a sagging lower than 10% at 700°C.

The glasses according to the invention may be converted into fibres by known external centrifuging devices, such as those described in patents US-A-2 663 051, EP-A-0 167 508 or Fr-A- 2 609 708, for example.

The fibres obtained in this way enable excellent quality fibrous products suitable for numerous applications to be obtained. Thus, for example, the fibres according to the invention are advantageously used in the form of geometrically well-defined panels, strengthened by a polymer binder, or in the form of tubular products for insulating pipes. The fibres according to the invention may also be used in the form of a mat sewn over cardboard or metal grilles, in the form of a strip, or even in bulk form by filling.

TABLE NO.1

Compositions in weight percentages

Constituents	Glass n°1	Glass n°2	Glass n°3	Glass n°4	Glass n°5	Glass n°6	Glass n°7	Glass n°8
SiO_2	47,1	49,9	56,4	45,7	49,7	52,7	39,7	44,9
Fe_2O_3	12,9	12,9	12,9	2,1	2,1	2,1	2,1	10
Al_2O_3	13,8	4,5	4,5	11,5	4,5	4,5	11,5	4,5
CaO	10,3	10,3	10,3	29,5	29,5	29,5	29,5	29,5
MgO	9,1	9,1	9,1	7,4	7,4	7,4	7,4	7,4
Na_2O	2,7	2,7	2,7	1,4	1,4	1,4	1,4	1,4
K_2O	1,2	1,2	1,2	1,3	1,3	1,3	1,3	1,3
P_2O_5	0,3	6,5	0,3	0,1	3	0,2	6	3
impurities	2,6	2,9	2,6	1,0	1,1	0,9	1,1	0,7

TABLE NO.2

Chemical resistance in physiological medium

Amount of dissolved SiO_2 (in percent)

duration of test	Glass n°1	Glass n°2	Glass n°3	Glass n°4	Glass n°5	Glass n°6	Glass n°7	Glass n°8
20 days	0,7	5,1	2,5	0,9	11,4	5,2	2,6	5,3

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A mineral fibre which can decompose in the presence of a physiological medium comprising the following constituents according to the following weight proportions in addition to impurities having a total weight content of equal to or less than 3%:

SiO_2	37 to 58%	
Al_2O_3	4 to 14%	
CaO	7 to 40%	
MgO	4 to 16%	
P_2O_5	1 to 10%	
Fe_2O_3	0 to 15%	(total iron expressed in this form)

and the combined weight of Na_2O and K_2O is from 0.1% to 7%, wherein the amount of CaO + MgO + Fe_2O_3 is greater than 25%.

2. A mineral fibre according to claim 1, in which the combined total amount of SiO_2 + Al_2O_3 is greater than approximately 50%.

3. A mineral fibre according to claim 1 or 2, in which the amount of CaO + MgO is less than 40%.

4. A mineral fibre according to any one of the preceding claims, comprising:

SiO_2	45 to 57%
Al_2O_3	3 to 6%
CaO	20 to 30%
MgO	6 to 16%

Fe_2O_3	0.1 to 4%
P_2O_5	1 to 7%
$Na_2O + K_2O$	0.1 to 5%

5. A mineral fibre according to any one of claims 1 to 3, comprising:

SiO_2	40 to 50%
Al_2O_3	7 to 13%
CaO	20 to 30%
MgO	6 to 16%
Fe_2O_3	0 to 4%
P_2O_5	3 to 9%
$Na_2O + K_2O$	0.1 to 5%

6. A product for heat and/or sound insulation comprising at least partially of mineral fibres having a chemical composition in accordance with any on of the preceding claims.

7. A mineral fibre substantially as hereinbefore described with reference to any one of the foregoing examples.

8. A product for heat and/or sound insulation substantially as hereinbefore described with reference to any one of the foregoing examples.

Dated this 13th day of August 1993
ISOVER SAINT-GOBAIN
By its Patent Attorneys:
GRIFFITH HACK & CO
Fellows Institute of Patent Attorneys of Australia.

MINERAL FIBRES WHICH CAN DECOMPOSE IN A PHYSIOLOGICAL MEDIUM

ABSTRACT

The present invention relates to mineral fibre compositions which can decompose when in contact with a physiological medium.

Advantageous compositions comprise the following constituents in the proportions by weight defined below:

SiO_2	37 to 58%
Al_2O_3	4 to 14%
CaO	7 to 40%
MgO	4 to 16%
P_2O_5	1 to 10%
Fe_2O_3	0 to 15% (total iron expressed in this form)

the amount of CaO + MgO + Fe_2O_3 being greater than 25%, and the oxides Na_2O and K_2O, of which the total percentage is less than 7 %.