

612240

COMMONWEALTH OF AUSTRALIA

Patents Act 1952-1969

CONVENTION APPLICATION FOR A PATENT

(1) Here insert (in full) Name or Names of Applicant or Applicants, followed by Address (es).

~~xx~~ (1) CHISSO CORPORATION
We
of 6-32, Nakanoshima 3-chome, Kita-ku, Ohsaka-shi,
Ohsaka-fu, Japan

(2) Here insert Title of Invention.

hereby apply for the grant of a Patent for an invention entitled: (2)
COMPOSITE FIBERS AND A FILTER ELEMENT USING THE SAME

(3) Here insert number(s) of basic application(s)

which is described in the accompanying complete specification. This application is a
Convention application and is based on the application numbered (3)

63-67903

(4) Here insert Name of basic Country or Countries, and basic date or dates

for a patent or similar protection made in (4) Japan
on 22nd March 1988

~~My~~
Our address for service is Messrs. Edwd. Waters & Sons, Patent Attorneys,
50 Queen Street, Melbourne, Victoria, Australia.

DATED this 20th day of March 19 80

(5) Signature (s) of Applicant (s) or Seal of Company and Signatures of its Officers as prescribed by its Articles of Association

(5)

CHISSO CORPORATION

by

Ian A. Scott

Registered Patent Attorney

To:

THE COMMISSIONER OF PATENTS.

21/03/89

MO07537

COMMONWEALTH OF AUSTRALIA

Patents Act 1952-1969

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION FOR A PATENT OR PATENT OF ADDITION

(1) Here
insert (in
full) Name of
Company.

In support of the Convention Application made by⁽¹⁾.....

CHISSO CORPORATION

(hereinafter referred to as the applicant) for a Patent

(2) Here
insert title
of Invention.

for an invention entitled:⁽²⁾.....

Composite fibers and a filter element using the same

(3) Here
insert full Name
and Address
of Company
official
authorized
to make
declaration.

I, ⁽³⁾ CHISSO CORPORATION

of 6-32, Nakanoshima 3-chome, Kita-ku, Ohsaka-shi,

Ohsaka-fu, Japan

do solemnly and sincerely declare as follows:

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

2. The basic application as defined by Section 141 of the Act was

made in⁽⁴⁾ Japan

on the 22nd day of March 1988, by

CHISSO CORPORATION

on XXXXXX XXXXXX XXXXXX

(4) Here
insert basic
Country or
Countries
followed by
date or dates
and basic
Applicant or
Applicants.

(5) Here
insert (in
full) Name
and Address
of Actual
Inventor or
Inventors.

3. ⁽⁵⁾ (1) Shigeru GOI, 260-21, Tateiricho, Moriyama-shi,
Shiga-ken, Japan, (2) Hideo MATSUDA, 251, Tateiricho, Moriyama-
shi, Shiga-ken, Japan and (3) Kazuyoshi NAKAZAWA, 2093-117,
Bodaiji, Kouseicho, Kouga-gun, Shiga-ken, Japan

~~is~~ are the actual inventors of the invention and the facts upon which the applicant
is entitled to make the application are as follow:

The applicant ~~is the assignee of~~ would, if a patent were
granted on an application made by the actual inventors,
be entitled to have the patent assigned to it.

4. The basic application referred to in paragraph 2 of this Declaration
was.....the first application made in a Convention country in
respect of the invention the subject of the application.

DECLARED at Tokyo, Japan

this 2nd day of March 1989

CHISSO CORPORATION

(6) Signature.

(6)

Sadao NOGI, President

To: THE COMMISSIONER OF PATENTS.

(12) PATENT ABRIDGMENT (11) Document No. AU-B-31533/89
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 612246

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COMPOSITE FIBERS AND A FILTER ELEMENT USING THE SAME
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- (71) Applicant(s)
CHISSO CORPORATION
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- (74) Attorney or Agent
WATERMARK PATENT & TRADEMARK ATTORNEYS, Locked Bag 5, HAWTHORN VIC 3122
- (56) Prior Art Documents
US 4732809
GB 2121423
- (57) Claim

1. A process for producing polyolefin/polyester composite fibers, which comprises:

subjecting a polyolefin as the sheath component thereof and a polyester as the core component thereof to composite spinning,

stretching the resulting unstretched filaments to twice or more the original length at a temperature higher than the secondary transition point of said polyester by 20°C or more and lower than the melting point of said polyolefin, and

annealing the resulting stretched filaments at a temperature higher than the secondary transition point of said polyester by 20°C or more and lower than the melting point of said polyolefin for 30 seconds or more, to obtain composite fibers having an apparent Young's modulus of 210 Kg/cm² or less.

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4. Polyolefin/polyester composite fibers produced according to the process of claim 1.

5. A process for producing a filter element, which comprises:
winding up polyolefin/polyester composite fibers according to claim 4 on a core while heating said composite fibers to the melt-adhesion temperature of the sheath component of said composite fibers to adjust the void content thereof to a desired one, and

cooling the resulting material and taking out said core.

6 1 2 2 4 6 _{m 10}

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952-69

COMPLETE SPECIFICATION

(ORIGINAL)

Class

Int. Class

Application Number:
Lodged:

Complete Specification Lodged:

Accepted:

Published:

Priority :

Related Art :

Name of Applicant : CHISSO CORPORATION

Address of Applicant : 3-chome, Kita-ku, Ohsaka-shi, Ohsaka-fu, Japan

Actual Inventor: SHIGERU GOI, HIDEO MATSUDA and KAZUYOSHI NAKAZAWA

Address for Service : EDWD. WATERS & SONS,
50 QUEEN STREET, MELBOURNE, AUSTRALIA, 3000.

Complete Specification for the invention entitled:

COMPOSITE FIBERS AND A FILTER ELEMENT USING THE SAME

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

SPECIFICATION

TITLE OF THE INVENTION

Composite fibers and a filter element using the same

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

This invention relates to polyolefin/polyester composite fibers having a low apparent Young's modulus and a filter element using the same.

2. Description of the Related Art

10 A process for producing a hollow cylindrical filter element by winding up a web composed of polyolefin composite fibers on a core while heating the web is disclosed in Japanese patent publication No. Sho 56-43139/1981. According to the process, it is possible
15 to obtain a filter element having a desired porosity by controlling the pressure at the time of winding-up, but since the raw material of the element is of polyolefin composite fibers, there has been raised a drawback that the upper limit of the service temperature is
20 as low as 80 to 90°C, and also there has been raised a problem that the filter element swells depending on the liquid passing through the element.

Further, in order to obtain a filter element
endurable to its use at high temperatures, there have
25 been an attempt of replacing the above-mentioned polyolefin composite fibers by polyester fibers

using a low melting non-crystalline polyester as the sheath component thereof and a high melting crystalline polyester as the core component thereof, but since the low melting polyester is vitreous, there has been raised a problem that the low melting polyester peels off in the form of powder at the steps of spinning and stretching or at the steps of production and use of the filter element. Further, when polyolefin/polyester composite fibers using polyethylene as the sheath component thereof and a crystalline polyester as the core component thereof are used, there is a drawback that since the apparent Young's modulus of the polyester is high, the resulting filter element is bulky and low in density; hence it is not only difficult to catch fine particles, but also the element is low in hardness and soft, and hence not endurable to practical use.

SUMMARY OF THE INVENTION

The present inventors have made extensive research in order to overcome the above-mentioned various drawbacks of conventional filter elements and as a result have achieved the present invention.

The present invention in a first aspect resides in:

(1) a process for producing polyolefin/polyester composite fibers, which comprises subjecting a polyolefin as the sheath component thereof and a polyester as the core component thereof to composite spinning,

stretching the resulting unstretched filaments to twice or more the original length at a temperature higher than the secondary transition point of the polyester by 20°C or more and lower than the melting point of the polyolefin and annealing the resulting stretched filaments at a temperature higher than the secondary transition point of the polyester by 20°C or more and lower than the melting point of the polyolefin for 30 seconds or more, and having an apparent Young's modulus of 210 Kg/cm² or less.

The present invention in a second aspect resides in:

(2) a process for producing a filter element obtained by winding up polyolefin/polyester composite fibers according to the above item (1) on a core while heating the composite fibers to the melt-adhesion temperature of the sheath component of the composite fibers *to adjust the void content*, porosity thereof to a desired one, and cooling the resulting material and taking out the core. The filter element may be prepared according to the process disclosed in Japanese patent publication No. Sho 56-43139/1981. The filter element of the present invention has a suitable void content, a high hardness, an upper limit of the service temperature as high as 140°C and a small swelling by liquid.



DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The polyolefin used in the present invention may be so far known polyolefins such as high density polyethylene, low density polyethylene, crystalline polypropylene, etc.,
5 and in the case of polyethylene, those having a melt index of 5 or higher, particularly 10 or higher are preferred, while in the case of crystalline polypropylene, those having a melt flow rate of 10 or more is preferably used.

10 The polyester used in the present invention may be those having a melting point of 200°C or higher and ethylene terephthalate units occupying 50% by weight or more of the molecule and being of fiber grade. The secondary transition point of the polyester is in the range of 65 - 85 °C.

15 Such polyolefin and polyester are subjected to composite spinning so as to give sheath and core type composite fibers according to a known process. The resulting unstretched filaments are stretched to twice or more the original length at a temperature higher than
20 the secondary transition point of the polyester by 20°C or more, preferably 30°C or more and lower than the melt-adhesion temperature of the polyolefin and then annealed at a temperature higher than the secondary transition point of the polyester by 20°C or more
25 and lower than the melting point of the polyolefin for 30 seconds or longer. If the stretching temperature is lower than the above-mentioned temperature,

the resulting composite fibers have a high apparent Young's modulus and if a filter element is produced using the fibers, only a product having drawbacks like the above-mentioned conventional techniques is obtained.

- 5 Further, if the stretching temperature is the secondary transition point or lower, when the resulting stretched fibers are used for producing filter elements, the fibers result in a high percentage of heat shrinkage at the processing temperature thereof, to yield a filter
10 element having projections and depressions on its surface and a non-uniform distribution of pore therein. If the annealing temperature is lower than the above-mentioned range, or the annealing time is less than 30 seconds, the resulting composite fibers have a high apparent Young's modulus
15 so that filter elements using such composite fibers have a high porosity and hence are unsuitable for precise filtration.

The present invention will be described in more detail by way of Examples and Comparative examples.

- 20 In addition, measurement methods employed in these examples are described below.

Apparent Young's modulus:

- This value was obtained by firstly measuring an initial tensile stress according to item 7-10
25 of JIS L1013 (testing methods for man-made filament yarns) and then calculating

the value from the above initial tensile stress according to the following equation:

Apparent Young's modulus (Kg/mm^2) =

$9 \times \rho \times (\text{initial degree of tensile resistance}) (\text{g/d})$

5 wherein as ρ , 1.15 was used in the case of PP (polypropylene)/PET (polyester) and 1.17, in the case of PE/PET.

Filtration test:

10 A suspension of fine abrasive powder (FO #1200, particle diameter 5 to 15 μm , 90%) (20 g) in water (50 l) was passed from the outer surface of a filter element into the hollow portion thereof at a rate of 2 m^3/hr in a recycle manner.

15 After 2 minutes, particles in 100 ml of collected filtrate water were collected on a membrane filter capable of collecting particles down to 1 μm in particle diameter, followed by measuring the particle diameters of 3,000 particles by means of "Luzex 450" (trademark) manufactured by Nileco Co., Ltd.

Swelling test:

20 The volume (V') of a filter element treated under a condition of boiling water (100°C , 2 hours), toluene (20°C , 5 days) or hot air (120°C , 5 days) was calculated from the value of outer diameter (d') and length (l'). The volume (V) of the filter element before the treatment was calculated in the same manner. The percentage of swelling was
25 calculated according to the following equation:

$$\frac{V' - V}{V} \times 100 = \text{percentage swelling}$$

Example 1

Composite spinning was carried out using a polyester (PET) (intrinsic viscosity 0.65, m.p. 255°C, secondary transition point 70°C) as a core component and a high density polyethylene (melt index 20, m.p. 130°C) as a sheath component in a composite ratio of 1/1 to prepare unstretched filaments (single filament fineness: 10 d), followed by stretching the filaments to 3 times the original length at 110°C and then annealing at 90°C for 3 minutes to obtain stretched filaments (single filament fineness: 3.5 d). The stretched filaments were cut to a fiber length of 51 mm to obtain staple fibers, which were then made up into a web having a basis weight of 20 g/m² by means of a carding machine, followed by heating the web successively from its end, to 140 - 150°C for 2 seconds by means of a far infrared ray heater, while sending the web horizontally, to form a web in a state where the high density polyethylene alone was melted, winding up the web in a definite amount onto a stainless steel core (outer diameter: 30 mm, 4 Kg/m) under pressure by its self-weight, cooling the web, drawing out the central core and cutting the web to obtain a filter element having an outer diameter of 70 mm, an inner diameter of 30 mm, a length of 250 mm and a weight of 240 g.

Thus obtained filter element was very hard and had neither wrinkle nor warp on both the inner and the outer

surfaces, and when its cross section was observed, pores are uniformly distributed.

The stretching conditions and apparent Young's modulus of the above stretched filaments and the results of the filtration test and swelling test of the filter element are shown in Table 1.

Example 2

Composite spinning was carried out in the same manner as in Example 1 except that a crystalline polypropylene (melt flow rate 15, m.p. 160°C) was used as the sheath component, to obtain unstretched filaments (single filament fineness: 10 d), which were then stretched to 3.5 times the original length at 140°C, followed by annealing at 135°C for 5 minutes and cutting to prepare staple fibers having a single filament fineness of 3 d and a fiber length of 51 mm, which were processed in the same manner as in Example 1 except that the heating temperature was changed to 170 -180°C, to obtain a filter element. This element was hard and homogeneous as in the case of that of Example 1. The evaluation results thereof are shown in Table 1.

Comparative examples 1 and 2

The unstretched filaments obtained in Example 1 were stretched in the same manner as in Example 1 except that the stretching temperature was changed to 70°C (Comparative example 1) or 90°C (Comparative example 2), followed

by winding up the resulting stretched filaments onto a stainless steel core in a definite quantity, cooling and cutting in the same manner as in Example 1 to obtain filter elements. The elements were both soft and not compact and had a non-uniform pore content. The evaluation results are shown in Table 1.

Reference example

Composite spinning was carried out using a crystalline polypropylene (melt flow rate 8, m.p. 160°C) as a core component and a high density polyethylene (melt index 20, m.p. 130°C) as a sheath component in a composite ratio of 1/1, to prepare unstretched filaments, followed by stretching the filaments to 3.5 times the original length at 90°C and then annealing at 100°C for 3 minutes and cutting to obtain staple fibers (single filament fineness 3 d, fiber length 51 mm). A filter element was obtained using the staple fibers in the same manner as in Example 1 except that the heating temperature was changed to 130 -140°C. This element was of a good quality but inferior in the heat resistance and solvent resistance to that of Example 1.

10

~~WHAT WE CLAIM IS~~xxxx

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A process for producing polyolefin/polyester composite fibers, which comprises:

subjecting a polyolefin as the sheath component thereof and a polyester as the core component thereof to composite spinning,

stretching the resulting unstretched filaments to twice or more the original length at a temperature higher than the secondary transition point of said polyester by 20°C or more and lower than the melting point of said polyolefin, and

annealing the resulting stretched filaments at a temperature higher than the secondary transition point of said polyester by 20°C or more and lower than the melting point of said polyolefin for 30 seconds or more, to obtain composite fibers having an apparent Young's modulus of 210 Kg/cm² or less.

2. A process for producing polyolefin/polyester composite fibers according to claim 1, wherein said polyolefin is selected from the group consisting of high density polyethylene, low density polyethylene and crystalline polypropylene.

3. A process for producing polyolefin/polyester composite fibers according to claim 1, wherein said polyester is selected from those having a melting point of 200°C or

higher and ethylene terephthalate units occupying 50% by weight or more of the molecule and being of fiber grade.

4. Polyolefin/polyester composite fibers produced according to the process of claim 1.

5. A process for producing a filter element, which comprises:
winding up polyolefin/polyester composite fibers according to claim 4 on a core while heating said composite fibers to the melt-adhesion temperature of the sheath component of said composite fibers to adjust the void content thereof to a desired one, and
cooling the resulting material and taking out said core.

DATED this 20th day of March 1989.

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