

**SPECIAL DOUBLE-FACED FABRIC, MANUFACTURING METHOD
THEREOF, AND DOUBLE-FACED BELT SLING**

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

The present invention relates to a special double-faced fabric manufactured from more than two kinds of yarns, a method of manufacturing the same, and a double-faced belt sling, a belt sling protector and the like using the special
10 fabric.

2. Description of Related Art

In general, a belt (web) sling is manufactured by machine-sewing a planar woven fabric (or a plain-weave fabric)
15 using, as a raw material, a synthetic fiber such as polyester, nylon, polypropylene or the like.

When a heavy cargo is lifted, a wire or a chain has been widely used. However, a variety of slings made of a synthetic fiber have been distributed as substitutes for the
20 wire or chain along with the development of the textile industry. Among them, since a polyester product is more cost-effective, it has been widely spread. A polyester belt sling can be utilized in various fields across the industry board due to the spread thereof. In modern times, various cargoes
25 ranging from 1 ton or less to 10 to 100 tons or so in weight

can be lifted by the polyester belt sling.

However, the polyester belt sling has a drawback compared to a conventional wire or chain sling. In other words, when a sharp edge of the polyester belt sling is cut or
5 damaged, it cannot be re-used. In terms of the characteristics of the polyester material, the sharp edge of the polyester belt sling is highly likely to be damaged quickly. In particular, the polyester belt sling entails a problem in that as a cargo increases in weight, the sharp edge
10 of the polyester belt sling used in lifting the cargo can be prone to damage, and the thus damaged product cannot be recycled any more (see FIGS. 1A to 1C). Various kinds of products are sold and used as edge protectors abutting against the sharp edge of the belt sling together with the belt sling
15 in order to protect the belt sling (see FIGS. 2A to 2F).

The application of the edge protectors to the belt sling greatly reduces the disposal of the belt sling due to damage caused by an external influence. However, the conventional polyester belt sling encounters problems in that
20 a user suffers from an inconvenience of having to purchase and use the edge protectors together with the belt sling and in that the cost increases depending on the kind the edge protector used. In addition, a worker may get injured or get in an accident where his fingers are amputated actually in the
25 process of fitting the edge protector around the edge of the

belt sling when mounting the edge protector on the belt sling.

[Prior art literature]

[Patent documents]

Korean Patent Laid-Open Publication No. 10-2017-0122652

5 (06.11.2017)

SUMMARY OF THE INVENTION

Accordingly, the present inventors have made extensive efforts to solve the above-described problems, and as a result, have found that a high functional special double-faced fabric employing two kinds of yarns can be manufactured which is cost-effective while minimizing the damage caused by a sharp edge of a final product when an upper plain-weave fabric is woven from an ultra-high molecular weight polyethylene (UHMWPE) yarn and a lower plain-weave fabric is woven from a polyester yarn, thereby completing the present invention. In other words, it is an object of the present invention to provide a special double-faced fabric, a method for manufacturing the same, a belt sling using the same, and various kinds of industrial protectors.

[0001] To achieve the above object, the present invention provides a special double-faced fabric comprising an upper plain-weave fabric woven by a warp and a weft and a lower plain-weave fabric woven by a warp and a weft. The special double-faced fabric is a double-faced fabric woven by

interweaving the upper plain-weave fabric and the lower-plain weave fabric by means of a weak yarn. The warp and weft of the upper plain-weave fabric and the lower-plain weave fabric comprise different kinds of yarns.

5 **[0002]** The present invention also provides a method for manufacturing a special double-faced fabric, comprising the steps of: preparing an upper plain-weave fabric woven from an ultra-high molecular weight polyethylene yarn and a lower plain-weave fabric woven from a polyester yarn; interweaving
10 the upper plain-weave fabric and the lower-plain weave fabric by means of a weak yarn to form a double-faced fabric; and coating the double-faced fabric with a coating agent with improved abrasion resistance, wherein the weak yarn comprises an ultra-high molecular weight polyethylene yarn. Thus, the
15 special double-faced fabric can be manufactured by performing the method.

Effects of the Invention

The special double-faced fabric of the present invention has effects in that it satisfies the physical
20 properties of products such as a belt sling, a belt sling protector and the like, particularly, it imparts strong durability and very excellent abrasion resistance to sharp edges of the products so that the products can be used without a separate edge protector, and thus the special double-faced
25 fabric can be applied to a cost-effective belt sling, and the

like.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of
5 the present invention will be apparent from the following
detailed description of the preferred embodiments of the
invention when taken in conjunction with the accompanying
drawings, in which:

FIG. 1 depicts photographs of a conventional belt sling
10 whose fabric is damaged;

FIG. 2 depicts photographs of conventional belt slings
to which edge protectors are applied;

FIG. 3 is a cross sectional view showing a special
double-faced fabric according to the present invention;

15 FIG. 4 depicts photographs of the results of blade test
measurements performed on special double-faced fabrics of
Example 1 and Comparative Example 1 in Experimental Example 1;
and

FIG. 5 depicts photographs of the results of abrasion
20 resistance test measurements performed on special double-faced
fabrics of Example 1 and Comparative Examples 2 and 3 in
Experimental Example 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

25 Hereinafter, the present invention will be described in

detail with reference to the accompanying drawings.

A special double-faced fabric of the present invention can be manufactured by a method for manufacturing a special double-faced fabric, the method comprising the steps of: (1) 5 preparing an upper plain-weave fabric woven from an ultra-high molecular weight polyethylene yarn and a lower plain-weave fabric woven from a polyester yarn; (2) interweaving the upper plain-weave fabric and the lower-plain weave fabric by means of a weak yarn to form a double-faced fabric; and (3) coating 10 the double-faced fabric with a coating agent with improved abrasion resistance.

The special double-faced fabric of the present invention comprises an upper plain-weave fabric woven by a warp 10 and a weft 20 and a lower plain-weave fabric woven by 15 a warp 50 and a weft 60, and is a double-faced fabric 30 woven by interweaving the upper plain-weave fabric and the lower plain-weave fabric, which are woven by the warps and the wefts, by means of a weak yarn 40 in such a manner that the weak yarn 40 is interlaced between the upper plain-weave 20 fabric and the lower plain-weave fabric (see FIG. 3).

In addition, each of the upper plain-weave fabric and the lower-plain weave fabric interwoven by the weak yarn may include a plurality of grooves formed thereon.

The warp and warp of the upper plain-weave fabric, and 25 the weak yarn that can be used in the present invention may

comprise an ultra-high molecular weight polyethylene (UHMWPE) yarn. As a preferred example, a UHMWPE yarn such as Dyneema or Spectra may be used. More preferably, the UHMWPE yarn has a denier of 1,600 to 1,900 dtex, a strength of 28.0 to 33.0 cN/dtex, a modulus of 1,000 to 1,300 cN/dtex, and an elongation of less than 4%. Much more preferably, the UHMWPE yarn may have a denier of 1,750 to 1,850 dtex, a strength of 29.5 to 31.0 cN/dtex, a modulus of 1,150 to 1,240 cN/dtex, and an elongation of 3.0 to 3.6%.

In addition, the warp and warp of the lower plain-weave fabric that can be used in the present invention may comprise a polyester yarn. More preferably, the warp and warp of the lower plain-weave fabric may comprise a polyethylene terephthalate (PET) yarn. Much more preferably, the PET yarn that can be used in the present invention satisfies the following physical properties: a denier of 5,200 to 6,000 dtex, a thermal shrinkage (177°C, 1 min) of 6.5 to 7.5%, a breaking elongation of 1.3 to 1.7%, and a breaking tenacity of 7.80 to 8.40 cN/dtex. Much more preferably, the PET yarn that can be used in the present invention may satisfy the following physical properties: a denier of 5,450 to 5,750 dtex, a thermal shrinkage (177°C, 1 min) of 6.6 to 7.0%, a breaking elongation of 1.35 to 1.55%, and a breaking tenacity of 7.95 to 8.25 cN/dtex.

The special double-faced fabric of the present

invention imparts strong durability to a sharp edge of a product to which the double-faced fabric is applied, and is suitable for being used as a fabric of a belt sling, various kinds of industrial protector, and the like.

5 Further, the special double-faced fabric of the present invention may further comprise a coating layer formed with an abrasion resistance-improved coating agent coated on the outer surface of the double-faced fabric depending on application fields and application products.

10 The coating agent with improved abrasion resistance in step (3) may comprise 30 to 40% by weight of a methyl acrylate-styrene copolymer, 3 to 7% by weight of a non-ionic surfactant, 0.1 to 2.0% by weight of a dye, and the balance of an organic solvent. Preferably, the coating agent with
15 improved abrasion resistance in step (3) may comprise 32.5 to 39% by weight of a methyl acrylate-styrene copolymer, 3.5 to 6.5% by weight of a non-ionic surfactant, 0.3 to 2.0% by weight of a dye, and the balance of an organic solvent. More preferably, the coating agent with improved abrasion
20 resistance in step (3) may comprise 34.5 to 39.0% by weight of a methyl acrylate-styrene copolymer, 4.0 to 6.0% by weight of a non-ionic surfactant, 0.5 to 1.8% by weight of a dye, and the balance of an organic solvent.

 The methyl acrylate-styrene copolymer, a component of
25 the coating agent with improved abrasion resistance serves to

improve abrasion resistance of the coating layer. If the content of the methyl acrylate-styrene copolymer used is less than 30% by weight, a sufficient abrasion resistance improving effect may not be achieved. If the content of the methyl acrylate-styrene copolymer used exceeds 40% by weight, a problem may occur in which, the coating layer is not formed uniformly due to too high viscosity of the coating agent, and thus the content of the methyl acrylate-styrene copolymer is preferably used within the above-specified range.

The non-ionic surfactant, a component of the coating agent with improved abrasion resistance serves to improve flowability of the coating agent comprising the methyl acrylate-styrene copolymer and the bonding strength between the coating layer and the yarns of the special double-faced fabric. If the content of the non-ionic surfactant used is less than 3% by weight, the coating property of the coating agent and the bonding strength between the coating layer and the special double-faced fabric may be deteriorated. If the content of the non-ionic surfactant used exceeds 7% by weight, the durability of the coating layer may rather decrease, and thus the content of the non-ionic surfactant is preferably used within the above-specified range. In addition, the non-ionic surfactant that can be used in the present invention may be at least one selected from among polyoxyethylene alky ether, polyoxyethylene alky phenyl ether, polyoxyethylene

polyoxypropylene alkyl ether, polyoxyethylene sorbitan tetra-
ester, and glycerin fatty acid ester. Preferably, the non-
ionic surfactant that can be used in the present invention may
be at least one selected from among polyoxyethylene alky ether,
5 polyoxyethylene alky phenyl ether, and polyoxyethylene
polyoxypropylene alkyl ether. More preferably, the non-ionic
surfactant that can be used in the present invention may be
polyoxyethylene alky ether such as polyoxyethylene
lauryl ether or the like.

10 The dye, a component of the coating agent with improved
abrasion resistance may be a conventional one known in the art.

In addition, the organic solvent that can be used in
the present invention may be at least one selected from among
esters including ethyl acetate, ketones including acetone,
15 methyl ethyl ketone and the like, ethers including diethyl
ether and the like, and glycols including propylene glycol,
dipropylene glycol, tripropylene glycol and the like

The coating agent with improved abrasion resistance may
further comprise an inorganic filler in an amount of 1 to 5%
20 by weight, preferably 2.5 to 5% by weight. The inorganic
filler may comprise at least one selected from among carbide,
sodium silicate, potassium silicate, sodium- and potassium-
based colloidal silica, aluminum hydroxide, barium sulfate,
clay, calcium carbonate, titanium oxide, Kaolin, bentonite,
25 zeolite, alumina, silica, titannia, zircornia, and lithium

oxide.

Further, the coating agent with improved abrasion resistance may further comprise a flame retardant to impart flame retardancy to the double-faced fabric. The flame retardant that can be used in the present invention may be a conventional one known in the art.

EXAMPLES

Hereinafter, the present invention will be described in further detail with reference to specific examples. It will be obvious to a person having ordinary skill in the art that these examples are provided to help understand the present invention and are not to be construed to limit the scope of the present invention.

Preparation Example 1: Preparation of Coating Agent with Improved Abrasion Resistance

A coating agent with improved abrasion resistance was prepared which comprises 38% by weight of a methyl acrylate-styrene copolymer, 5.2% by weight of polyethylene lauryl ether as a non-ionic surfactant, 1.2% by weight of a yellow dye (manufactured by DIANIX under the trade name Luminous Yellow), and the balance of methyl ethyl ketone as an organic solvent.

Preparation Examples 2 and 3 and Comparative Preparation

Examples 1 and 2

Each of coating agents with improved abrasion resistance having the physical properties as listed in Table 2 below was prepared in the same manner as described in Preparation

5 Example 1.

[Table 1]

Classification (% by weight)	Methyl acrylate- styrene copolymer	Polyethylene lauryl ether	Yellow dye	Methyl ethyl ketone
Preparation Example 1	38	5.2	1.2	balance
Preparation Example 2	32.5	5.2	1.2	balance
Preparation Example 3	38	4.0	1.2	balance
Preparation Example 4	36	6.5	1.2	balance
Comparative Preparation Example 1	28	5.0	1.2	balance
Comparative Preparation Example 2	42	5.2	1.2	balance
Comparative Preparation Example 3	38	2.5	1.2	balance
Comparative Preparation Example 4	38	7.5	1.2	balance

Example 1:

A UHMWPE yarn having the physical properties as listed in Table 2 below was prepared as a warp and a weft for an upper plain-weave fabric and a weak yarn.

5 [Table 2]

Denier	1792 dtex
Strength	30.5 cN/dtex
Modulus	1195 cN/dtex
Elongation	3.5%

A PET yarn having the physical properties as listed in Table 3 below was prepared as a warp and a weft for a lower plain-weave fabric and a weak yarn.

[Table 3]

Denier	5566.7 dtex
Coefficient of variation of fitness	0.19 CV%
Breaking strength	453.7 N
Breaking tenacity	8.15 cN/dtex
Coefficient of variation of tenacity	0.85 CV%
Breaking elongation	1.5%
Thermal shrinkage (177°C, 1 min, 0.05 g/d)	6.8%
Oil pick up	0.66%
Number of intermingles	5 n/m

10

Subsequently, as shown in FIG. 3, the UHMWPE yarn was used as the warp and weft of the upper plain-weave fabric, and the PET yarn was used as the warp and weft of the lower plain-

weave fabric. In addition, the UHMWPE yarn for the upper plain-weave fabrics was used as a weak yarn, and the UHMWPE yarns and the PET yarn were interwoven to manufacture a special double-faced fabric.

5 Next, the special double-faced fabric was coated with the coating agent with improved abrasion resistance prepared in Preparation Example 1 to form a coating layer with improved abrasion resistance on the outer surface thereof.

 The special double-faced fabric coated with the coating
10 agent with improved abrasion resistance was processed to manufacture a belt sling.

Comparative Example 1

 A double-faced fabric was manufactured in the same
15 manner as described in Example 1 except that the PET yarn used in the warp of the lower plain-weave fabric was used, instead of the UHMWPE yarn, as the warp of the upper plain-weave fabric unlike in Example 1. Thereafter, the double-faced fabric was coated with the coating agent with improved
20 abrasion resistance, which is the same as used in Example 1, to manufacture a special double-faced fabric, and then the special double-faced fabric was processed in the same manner as described in Example 1 to manufacture a belt sling.

Experimental Example 1: Blade Test Measurements

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A blade test was performed to measure the durability for a sharp edge of the special double-faced fabric manufactured in Example 1 and Comparative Example 1.

As shown in FIG.4A, in the blade test, the surface of a belt sling was cut with a cutter blade by exerting a uniform force thereon, and then the durability for a sharp edge of the special double-faced fabric was measured by whether or not the surface of the belt sling was cut.

The results of the measurements of the belt sling, performed in Example 1 were shown in FIGS. 4B and 4C, and the result of the measurement of the belt sling, performed in Comparative Example 1 was shown in FIG. 4D.

Referring to FIG. 4, it could be confirmed that in the case of Example 1, blade marks remained on the surface of the belt sling but the surface thereof was not cut whereas in the case of Comparative Example 1, the surface of the belt sling was cut.

Comparative Example 2

A special double-faced fabric was manufactured in the same manner as in Comparative Example 1 in which the upper and lower plain-weave fabrics are woven from the PET yarn. Thereafter, the special double-faced fabric not coated with the coating agent with improved abrasion resistance was processed to manufacture a belt sling.

Comparative Example 3

A special double-faced fabric was manufactured in the same manner as described in Example 1 in which the UHMWPE and PET yarns are woven. Thereafter, the special double-faced fabric not coated with the coating agent with improved abrasion resistance was processed to manufacture a belt sling.

Experimental Example 2: Abrasion Resistance Test 1

An abrasion resistance test was performed on the double-faced fabric manufactured in Example 1, and Comparative Examples 2 and 3, and the results of the abrasion resistance test were shown in FIG. 5.

The abrasion resistance test was repeatedly performed at 10,000 cycles while applying a pressure of 1,000 g according to the ASTM D3884-09, and then the abrasion resistance of the double-faced fabric was measured.

Referring to FIG. 5, it could be confirmed that the special double-faced fabric in Example 1 had a very excellent abrasion resistance. On the contrary, the special double-faced fabrics in Comparative Examples 2 and 3 exhibited a very poor abrasion resistance compared to the special double-faced fabric in Example 1.

Examples 2 to 4 and Comparative Examples 4 to 7

A double-faced fabric was manufactured in the same

manner as described in Example 1 except that as a coating agent with improved abrasion resistance, the coating agents with improved abrasion resistance used in Preparation Examples 2 to 4 and Comparative Preparation Examples 1 to 4 are used instead of the coating agent used in Preparation Example 1. Thereafter, the surface of the double-faced fabric was coated with each of the coating agents with improved abrasion resistance used in Preparation Examples 2 to 4 and Comparative Preparation Examples 1 to 4 in order to perform Examples 2 to 4 and Comparative Examples 4 to 7.

Experimental Example 3: Abrasion Resistance Test 2

An abrasion resistance test was performed on the double-faced fabric manufactured in Example 1 and Comparative Examples 2 and 3, and the results of the abrasion resistance test were shown in Table 4. The abrasion resistance test was performed in the same manner as described in Experimental Example 1, and the relative evaluation results of an abrasion resistant state were measured based on Example 1 in the abrasion resistance test. In the case where the abrasion level of the surface portion of the fabric on which the abrasion resistance test was performed is similar to that in Example 1, the abrasion level is denoted by "o". In the case where the abrasion level of the surface portion of the fabric is lower than that in Example 1, the abrasion level is denoted

by “◎”. Further, in the case where the abrasion level of the surface portion of the fabric is relatively higher than that in Example 1, the abrasion level is denoted by “× (failure)”. Thus, the relative evaluation results of the abrasion resistant state were shown in Table 4 below.

In addition, the coating property was denoted as follows based on the synthetic evaluation of whether or not the coating layer is formed uniformly without coagulation and is dried sufficiently: excellent: ◎, very good: ◦, moderate: Δ, and poor: ×.

[Table 4]

Classification	Coating agent with improved abrasion resistance	Abrasion resistance evaluation	Coating property
Example 1	Preparation Example 1	Standard	◦
Example 2	Preparation Example 2	◦	◎
Example 3	Preparation Example 3	◦	◦
Example 4	Preparation Example 4	◦	◎
Comparative Example 4	Comparative Preparation Example 1	×	◎
Comparative Example 5	Comparative Preparation Example 2	◎	Δ
Comparative Example 6	Comparative Preparation Example 3	×	×
Comparative Example 7	Comparative Preparation Example 4	×	◎

Referring to the measurement results of abrasion resistance and coating property shown in Table 4 above,

Examples 1 to 4 showed that the abrasion resistance is very good and the coating property is optimum. On the contrary, Comparative Example 4 employing a coating agent with improved abrasion resistance, which contains methyl acrylate-styrene copolymer in an amount of less than 30% by weight, showed that the coating property was excellent but the abrasion resistance was relatively poor compared to Examples 1 and 2. In addition, Comparative Example 5 employing a coating agent with improved abrasion resistance, which contains methyl acrylate-styrene copolymer in an amount of 42% by weight beyond 40% by weight, showed that the abrasion resistance was excellent but sufficient coating property was not achieved such as non-uniform formation and coagulation of the coating layer.

In addition, Comparative Example 6 in which a coating layer was formed with the coating agent with improved abrasion resistance, which contains a non-ionic surfactant in an amount of less than 3% by weight, showed that the abrasion resistance and the coating property were poor compared to Examples 1 and 3. This result is determined to be due to the fact that the bonding strength between the fabric and the coating layer is insufficient. Further, Comparative Example 7 in which a coating layer was formed with the coating agent with improved abrasion resistance, which contains the non-ionic surfactant in an amount of exceeding 7% by weight, showed that the coating property was excellent but the abrasion resistance was

poor compared to Examples 1 and 4.

It could be seen from the above Examples an Experimental Examples that the special double-faced fabric of the present invention was excellent in the mechanical and physical properties such as durability and abrasion resistance for a sharp edge of the product.

The technical spirit of the present invention should not be construed by limiting the present invention to the above-mentioned embodiments. The application range thereof is of course varied, and various modifications thereof may be made by those skilled in the art without departing from the gist of the present invention. Therefore, as long as these modifications and changes are apparent to those skilled in the art, they are included in the protective scope of the present invention.

WHAT IS CLAIMED IS:

1. A special double-faced fabric comprising an upper
plain-weave fabric woven by a warp and a weft and a lower
5 plain-weave fabric woven by a warp and a weft,

wherein the special double-faced fabric comprises a
double-faced fabric woven by interweaving the upper plain-
weave fabric and the lower-plain weave fabric by means of a
weak yarn,

10 wherein each of the upper plain-weave fabric and the
lower-plain weave fabric interwoven by the weak yarn comprises
one or more grooves formed thereon,

wherein the warp and weft of the upper plain-weave
fabric comprises an ultra-high molecular weight polyethylene
15 yarn,

wherein the warp and weft of the lower plain-weave
fabric comprises a polyester yarn, and

wherein the weak yarn comprises an ultra-high molecular
weight polyethylene yarn.

20 2. The special double-faced fabric of claim 1, wherein
the ultra-high molecular weight polyethylene yarn has a
denier of 1,600 to 1,900 dtex, a strength of 28.0 to 33.0
cN/dtex, and a modulus of 1,000 to 1,300 cN/dtex.

3. The special double-faced fabric of claim 1, wherein the polyester yarn has a denier of 5,200 to 6,000 dtex, a thermal shrinkage (177°C, 1 min) of 6.5 to 7.5%, a breaking elongation of 1.3 to 1.7%, and a breaking tenacity of 7.80 to 8.40 cN/dtex.

4. The special double-faced fabric of claim 1, further comprising a coating layer coated with a coating agent with improved abrasion resistance on the outer surface of the double-faced fabric, and

wherein the coating agent with improved abrasion resistance comprises 30 to 40% by weight of a methyl acrylate-styrene copolymer, 3 to 7% by weight of a non-ionic surfactant, 0.1 to 2.0% by weight of a dye, and the balance of an organic solvent.

5. A method for manufacturing a special double-faced fabric, the method comprising the steps of:

(1) preparing an upper plain-weave fabric woven from an ultra-high molecular weight polyethylene yarn and a lower plain-weave fabric woven from a polyester yarn;

(2) interweaving the upper plain-weave fabric and the lower-plain weave fabric by means of a weak yarn to form a double-faced fabric; and

(3) coating the double-faced fabric with a coating agent with improved abrasion resistance,

wherein the weak yarn comprises an ultra-high molecular weight polyethylene yarn.

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6. The method of claim 5, wherein the coating agent with improved abrasion resistance comprises 30 to 40% by weight of a methyl acrylate-styrene copolymer, 3 to 7% by weight of a non-ionic surfactant, 0.1 to 2.0% by weight of a dye, and the
10 balance of an organic solvent.

7. A double-faced belt sling comprising the special double-faced fabric of any one of claims 1 to 4.

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