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(54) Title: **WOVEN FABRIC MADE OF TWISTED YARNS AND METHOD OF MANUFACTURE THEREOF**

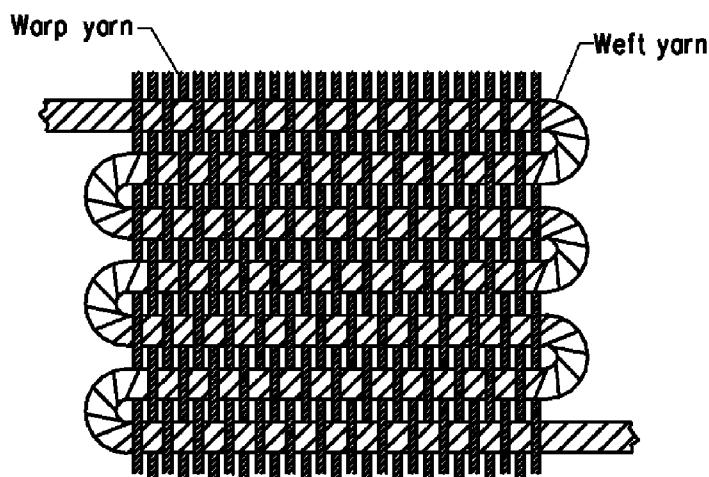


FIG. 1

(57) Abstract: The present invention provides a woven fabric consisting of twisted multifilamentary yarns in the weft and warp and wherein the yarn in weft is more twisted than the yarn in warp. Also provided is a process for preparation of chiffon like fabric. The fabric of the present invention is useful for making aesthetically appealing apparel which has the chiffon effect. The fabrics with chiffon lines provided by this invention are unique because they are 3-dimensional, straight and uniformly placed.



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TITLE

**WOVEN FABRIC MADE OF TWISTED YARNS AND METHOD OF
MANUFACTURE THEREOF**

5 This application claims the benefit of India Provisional Application 3231/DEL/2011, filed November 14, 2011 which is herein incorporated by reference.

FIELD OF THE INVENTION

10 This invention relates to a woven fabric made from twisted yarns wherein the twist of a weft yarn is greater than the twist of a warp yarn that form the fabric.

BACKGROUND

15 Fabrics are the largest segment of the textiles market in Asia-Pacific, accounting for 43% of the market's total value and there is demand for chiffon based fabrics for manufacturing apparel, and fine furnishings.

20 The word chiffon comes from the French word "chiffe," meaning "rag," and the fabric has a soft flowing texture. Silk chiffon is an elegant, sheer fabric with a soft drape, stretch and shimmering appearance. Although both polyester and silk chiffon are used mostly in garments such as evening dresses, and bridal wear, they are also used in furnishings such as drapes. Polyester chiffon is more versatile because it comes in a variety of stripes and patterns and is available in several different weights.

25 Chiffon was made exclusively of silk until nylon was invented in 1938. In 1958, polyester was produced and polyester chiffon became more widely used because of its cost and durability. Traditionally, silk chiffon has been used around the world. The delicate fibers of silk stretch or shrink if you wet the fabric and will not return to their original shape. Polyester chiffon costs less and is easier to care for; it is now more

30 frequently used than silk in garments. While polyester is more durable than silk, it is harder to dye. Unlike silk, one can wash polyester chiffon.

Chiffon is delicate, sheer and transparent. It is therefore a popular choice for wedding dress, overskirts, sheer sleeves and wraps, and also used for making loose tops and full pants. Chiffon is also an excellent choice for making full circle skirts and light, floaty veils. Several variations in the fabric, texture and design patterns have been introduced to the users, who constantly crave for newer varieties. Chiffon is made from cotton, silk or synthetic fibers. Chiffon can be dyed to almost any shade, but chiffon made from polyester can be difficult to dye. Under a magnifying glass it resembles a fine net or mesh which gives chiffon some see-through properties

However, certain bio based PTT based fabrics such Sorona® can be dyed at a lower temperature and maintain their color fastness. In conjunction with this distinctive characteristic, fibers made with Sorona® offer additional advantages over both polyester (PET) and nylon. It has a softer feel and supports easier, more versatile dyeability with excellent wash fastness and UV resistance.

Woven fabrics made from PET or PTT filaments are known in the art and have been studied for elasticity (*Textile Research Journal* (2011), 81(8), 865-870) and stretchability (*Fibers and Polymers* (2003), 4(2), 84-88). A method for manufacturing seersucker fabric with excellent elasticity by alternately arranging PET shaped yarn and PTT false-twist yarn as warp and/or weft and weaving is reported in KR1054570. US6705353 and JP2002069789 also describe false twist yarns used in woven fabric to provide a woven stretch fabric. JP11093036 discloses a woven fabric with warp of PTT and weft of PET. US4475330 discloses a woven mixed fabric consisting of a polyester multifilament yarn of boiling shrinkage not more than 6% as warp or weft and a polyester multifilament yarn having a twist multiplier K of 15000-25000 as weft or warp providing a woven crepe fabric.

The apparel/garment segment is one where customers or end users keep craving for novelty and uniqueness. There is always a need for fabrics with newer texture, looks and durability. In addition, the fabric should be dyeable and must have

the ability to be used in innovative and contemporary designs as a much desired feature.

SUMMARY OF THE INVENTION

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A woven fabric made of twisted multifilament yarns wherein a twisted weft yarn consists essentially of PTT and a twisted warp yarn is selected from a group consisting of PTT, PET and blends thereof wherein the twist of the weft yarn is greater than the twist of the warp yarn.

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Further provided is a process for making a woven fabric comprising the steps of:

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- (a) individually twisting the multifilament yarns to convert the yarns into twisted weft yarns and twisted warp yarns wherein the twist of the weft yarn is greater than the twist of the warp yarn;
- (b) conditioning the twisted yarns;
- (c) warping and weaving the yarns; and
- (d) finishing of fabric.

20

The process for making a woven fabric wherein the finishing process includes any or all the steps of:

25

- a) relaxation of grey fabric to produce chiffon effect;
- (b) pre-heat setting;
- (c) weight reduction;
- (d) heat setting;
- (e) printing and
- (f) final setting of the fabric.

BRIEF DESCRIPTION OF THE DRAWING

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Figure 1 illustrates the weaving of warp and weft yarns resulting in a fabric.

Figure 2 illustrates a single image comparison of the prominent, uniformly spaced, straight lines in a PTT chiffon fabric verses a PET fabric.

DETAILED DESCRIPTION OF THE INVENTION

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Twisted PTT yarns in weft and twisted yarns selected from PTT, PET, or blends thereof on the warp are provided resulting in surprising straight lines (chiffon effect) across the length of the fabric which can lead to fabrics & garments with unique visual and textural features. The fabric has chiffon characteristics. The chiffon fabric described herein has desirable features such as softness to skin, drapability, bounce and stretch recovery. Due to the boiling shrinkage of PTT FDY (fully drawn yarn), the chiffon effect becomes prominent. The continuous, straight, 3-dimensional, uniformly spaced lines are unique and give an impression of pure-silk chiffon.

15 Accordingly, an aspect of the present invention is a woven fabric made of twisted multifilament yarns in the weft and warp directions, wherein the yarn in the weft direction (weft yarn) is made of PTT and the yarn in the warp direction (warp yarn) is made of another yarn selected from a group PTT, PET or blends thereof, and the weft yarn is more twisted than the warp yarn. In other words, the twist of the weft yarn is greater than the twist of the warp yarn that forms the woven fabric.

20

In one embodiment the weft yarn is made of 100% PTT.

In one embodiment of the present invention the yarn in weft has a twist of 2000-3200 turns per meter, or 2800-3200 turns per meter.

25

In another embodiment of the present invention the weft yarn has shrinkage in boiling water of 6-9%.

30 In another embodiment of the present invention, the warp yarn is PET and the weft yarn is PTT.

In another embodiment of the present invention, the warp yarn and weft yarn are both PTT.

5

In another embodiment of the present invention, the PTT used is biobased.

10

In one embodiment, the woven fabric according to this invention has a chiffon effect and is considered a chiffon fabric. An embodiment of the invention is a process for making a woven fabric comprising the steps of:

- (a) individually twisting the multifilament yarns to convert each of them into twisted yarns;
- (b) conditioning the twisted yarns;
- (c) warping and weaving; and
- (d) finishing of fabric.

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In one embodiment of the present invention, the finishing process includes any or all the steps of:

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- a) relaxation of grey fabric to produce chiffon effect;
- (b) pre-heat setting;
- (c) weight reduction;
- (d) heat setting
- (e) printing; and
- (f) final setting of the fabric.

25

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A “woven” fabric has two or more thread systems that cross each other at right angles, known as the warp and the weft. Warp yarns are the yarns along the length of the fabrics and are also called ends. Weft yarns are another set of threads that move perpendicular to warp yarns. Weft yarns are interchangeably called woof, filling or weft. Weft yarns are interlaced with warp yarns in a crosswise direction to make a fabric. The warp yarn threads run in the direction of production, and are wound onto a

warp beam in the desired width and spacing (ends per inch). This is schematically depicted in Figure 1.

Alternate raising and lowering of the heald frames causes warp threads that are supported by these frames to form a passageway (shed), through which the weft thread
5 can be inserted. After weft thread insertion, the weft thread is beaten firmly against the edge of the fabric by a reed. The relative positions of warp threads are then changed, binding the newly inserted weft thread in its place.

“Twist” is a general term applicable to all textiles made by the twisting
10 together of simple yarns or ply yarns. According to direction of twist, it is of two types, namely S- Twist and Z- Twist. A single yarn has S twist if, when it is held in the vertical position, the fibers inclined to the axis of the yarn conform in the direction by slope to the central portion of the letter “S”. A single yarn Z twist if, when it is held in the vertical position, the fibers inclined to the axis of the yarn conform in the
15 direction of slope to the central portion of the letter “Z”. A new twist is usually applied in the direction opposite to that of the preceding operation. Successive twisting in the same direction leads to very hard twisted yarns characterized by low extensibility. The process of twisting serves as a convenient way of increasing strength, improving stretch behavior, reducing unevenness, and achieving special surface and color effects.
20 The twist can be reported as twist multiplier K or turns per meter. The turns per meter can be converted to twist multiplier using following equation:
$$K = (\text{Number of twists per meter}) \times \sqrt{\text{denier}}.$$

According to B.S. 2085:1954 handbook, P 114, twist is inserted into an
25 element of a yarn by the relative relation of its two ends, a logical method of measuring the twist is to reverse the process and count how many turns are required to un-twist the fibers until they are parallel again. This is a direct method.

Boiling water shrinkage or shrinkage in boiling water is the shrinkage in length
30 in percent which is caused by boiling water. This shrinkage value helps in deciding about the fabric end width and also yarn spacing during weaving.

The term “chiffon” as used herein is used to describe a woven, lightweight, extremely sheer, transparent, airy, and soft silk fabric, containing very fine, twisted filament yarns. This fabric is used mainly in evening dresses, scarves, stole, blouse, 5 dupatta, ladies suit, veil or burqa, saree and other women’s garments, and also in decorative textiles like those used for curtains. The tightly twisted yarns could be either in the filling or the warp or both. It is very strong, despite filmy look and wears very well. In chiffon, the arrangement of warps and wefts is used to bring a straight line effect along the length of a fabric. It is well known that softness is an aesthetic 10 feature that is valued particularly for apparel fabrics, where skin contact is prevalent. Consumers often judge the softness of a fabric by assessing its feel or drape (the ease with which conforms to the shape of the body).

“Drape” is an important visual clothing attribute. The way a fabric drapes is a 15 fundamental property of clothing aesthetics. Drapability is defined as the way in which a fabric hangs (falls) over a three-dimensional form, the flow of fabric into folds. Different fabrics drape differently, for example, limply like jersey fabric, stiffly like taffeta, and falling in soft folds like chiffon (TAYLOR, M.A. 1990. Technology of Textile Properties, 3rd Ed., Forbes Publications, London).

20

Conditioning of the twisted yarns by heat setting is done to relax yarns, to prevent them from snarling, to enable them to be worked efficiently in the following processes and to fix yarn-twisting. Warping a warp yarn into a warp beam helps in preparing even sheets of yarn and making the yarn strong enough to handle the stress 25 of weaving without too much end breaking. A weft yarn which forms the weft component yarn is inserted across the warp yarns to produce a grey woven fabric.

Long-Jet Relaxation is treating the fabric in a long-tube jet dyeing machine where the fabric gets relaxed in the length and the width direction (shrinkage). This 30 results in the generation of the chiffon lines in the fabric along the length of the fabric.

Typical conditions used in case of 100% PET chiffon fabrics have a hold time of about 60 minutes at 130°C.

5 In a preheat set, the fabric is heat-set in a stenter frame with width control. This helps in achieving the finished fabric target width. Typical heat-set condition for 100% PET fabrics is in the range of 195-200°C for 45 sec.

10 In a weight reduction step, surface saponification of PET yarns helps in achieving fluidity in the fabrics which results in better bounce, softness, smoothness and lighter hand-feel. This is done using Caustic Soda Solution at 95°C.

Set for print (for printed fabrics) is done on a Stenter Frame to make the fabric width suitable for printing on the Flat-bed printing machine. After printing the fabric is cured in a loop ager. Typical conditions for print fixation of disperse dyes on PET
15 fabrics are 175°C for 7 minutes

In a stenter finishing, softener emulsions are applied on stenter frame.
Zero-Zero machine imparts surface smoothness and bulk to the fabric.

20 Grey/greige fabric is the term used for fabrics before they are printed or piece-dyed. The quality of greige fabric can vary and thus, can affect the outcome of the dye or print job and overall "hand" of the fabric purchased at the retail or garment-manufacturing level. Greige fabric is the common name for fabrics that are taken direct from the weaving or knitting machine. The grey fabric is relaxed in a long jet
25 machine during which time the twisted yarns in the warp and weft tend to relax. In an embodiment of the present invention there are more twists in weft yarns found in the weft direction than in warp yarns found in the warp direction, as they relax, the fabric is restrained in a pattern in the warp direction and unbalanced in the width due to a uni-directional twist. As a result, the width of the fabric collapses and straight line
30 patterns or chiffon effect is created in the fabric along the length of the fabric. Denting helps in spacing the warp yarns together which pronounces the chiffon lines.

The basic principle/reason for the reduced weight of the chiffon fabric (weight reduction) is the saponification of the ester bonds with sodium hydroxide, in which some of the ester bonds in the polymer chains are split, forming disodium terephthalate and ethylene glycol. During the process, the surface of the polyester fibers is removed layer by layer. The character of the fiber surface is changed and craters and deep holes are formed. The fiber becomes delustred, and this in turn improves the handle, appearance and flow properties of fabrics, giving them a soft, silk-like texture.

10

“Dyeing” and “finishing” the grey fabric results in producing designs and effects on the fabric as required in the commercial market. The term “finishing” used herein refers to a process performed on yarn or fabric after weaving or knitting to improve the look, performance, or "hand" (feel) of the finished textile or clothing. The different finishing techniques are bio-polishing, raising, fulling, calendaring, anti-microbial finishing, anti-static finishing, non-slip finishing and others known in the art. Suitable finishing agents are required for these finishes.

15

The following examples are only illustrated to further describe the invention and should no way be construed to limit the scope of the invention.

20

TEST METHODS:

Twist was measured by a direct method outlined in B.S. 2085:1954 (B.S. handbook, p. 114).

25

Boiling water shrinkage is measured by a conventional method, wherein the skeins are treated without tension during 15 minutes in hot water (95° C), dried and conditioned at standard conditions and shrunk length is determined.

EXAMPLE 1:

A PET (Recron®) yarn of 50 D/ 24 f was subjected to a twisting procedure (S and Z twist) on a Alidhra FHT-100 Two-for-one (TFO) twister to provide a twisted yarn of 2000 turns/m forming the warp component of the fabric. A PTT (Sorona®) yarn of 50D/36 f was subjected to a twisting procedure (S twist) on a Alidhra FHT-100 Two-for-one (TFO) twister to provide a twisted yarn of 3000 turns/m forming the weft component of the fabric.

The warp yarns were heat treated at a temperature of 90° C for 50 minutes in a vacuum setter. The weft yarn was heat treated at a temperature of 80° C for 40 minutes in a vacuum setter.

This was followed by warping and weaving using following specifications:
Warp density= 104 threads per inch (2S twist yarns alternating with 2 Z yarns)
Reed space= 68 inches
Denting pattern= 1, 2, 2, 2, 3
Pick density= 76 threads per inch
Grey width of 62"

The grey fabric thus obtained was relaxed in STAR Long-jet machine using the following conditions:
Loading at room-temperature
Rate of Rise of Temperature (after 80°C): 0.5°C / min
Treatment time: 90 minutes at 130°C

The fabric was then Pre-heat-set using the following condition:
Temperature =180°C
Speed = 30 mpm
Set width on stenter chains = 47"

The fabric was then subjected to weight reduction on a TEXFAB Jet Dyeing machine using the following conditions:
Caustic Soda of 14 gpl

Gradient = 0.5°C per min after 80°C

Duration = 60 minutes at 110°C, so as to achieve linear density of 58 glm. This was followed by washing and neutralization.

The fabric was heat set on Harish Stenter Frame using the following conditions:

5 Temperature = 165°C

Speed = 30 mpm

Set-width on stenter chains = 47"

10 The fabric was then batched using a batching stenter at 130°C and width of 46.5 inches. The fabric was printed using disperse dye print paste, dried at 130°C and cured at 175°C for 7 minutes for print-fixation. This was followed by washing the fabric at 95°C for 30 minutes to remove un-fixed color. The fabric was dried and final-set at 46.5" inches on a stenter frame at 150°C using softener (hand-feel improvement). This fabric was then passed through a Zero-Zero machine where the
15 fabric moves in between a steam heated cylinder at 90°C and Rubber blanket.

The fabric width returned out with a width of 45 inches as a result of the relaxation in the Zero-Zero machine.

Test results on this fabric are as below:

Tear Strength – Warp Torn – 3.7 lbf

20 Tear Strength – Weft Torn – 2.4 lbf

Tensile Strength – Warp – 30.4 lbf

Tensile Strength – Weft – 24.1 lbf

Dimensional Stability (after 3rd Wash) Warp – (-) 0.4

Dimensional Stability (after 3rd Wash) Weft – (-) 1.6

25 Gsm – 52.7

EXAMPLE 2:

A fabric was made by a method similar to that described in example 1, except that after relaxation, the fabric was directly subjected to weight reduction without the preheat-set step followed by a heat set on stenter frame at 180°C instead of 165°C in
 5 example 1.

The fabric width returned out with a width of 44 inches as a result of the relaxation in the Zero-Zero machine.

Test results on this fabric are as below:

- 10 Tear Strength – Warp Torn – 3 lbf
- Tear Strength – Weft Torn – 2 lbf
- Tensile Strength – Warp – 23.6 lbf
- Tensile Strength – Weft – 19.7 lbf
- Dimensional Stability (after 3rd Wash) Warp – (-) 0.4
- 15 Dimensional Stability (after 3rd Wash) Weft – (-) 0.4
- Gsm – 50

EXAMPLE 3:

- 20 A PET (Recron®) yarn of 50 D/ 36 f was subjected to a twisting procedure (S and Z twist) on a Alidhra FHT-100 Two-for-one (TFO) twister to provide a twisted yarn of 1800 turns/m forming the warp component of the fabric. A PTT (Sorona®) yarn of 50D/36 f was subjected to a twisting procedure (S twist) on a Alidhra FHT-100 Two-for-one (TFO) twister to provide a twisted yarn of 2800 turns/m forming the
 25 weft component of the fabric.

The warp yarns were heat treated at a temperature of 90° C for 50 minutes in a vacuum setter. The weft yarn was heat treated at a temperature of 78° C for 40 minutes in a vacuum setter.

This was followed by warping and weaving using following specifications:

- 30 Warp density- 104 threads per inch (2S twist yarns alternating with 2 Z yarns)
- Reed space- 62 inches

Denting pattern= 1, 2, 3

Pick density= 76 threads per inch

Grey width of 56"

Grey linear density = 75

5

The grey fabric thus obtained was relaxed in STAR Long-jet machine using the following conditions:

Loading at room-temperature

Rate of Rise of Temperature (after 80°C): 0.5°C / min

10 Treatment time: 90 minutes at 130°C

The fabric was then Pre-heat-set using the following condition:

Temperature = 180°C

Speed = 30 mpm

Set width on stenter chains = 47"

15

The fabric was then subjected to weight reduction on a TEXFAB Jet Dyeing machine using the following conditions:

Caustic Soda of 14 gpl

Gradient = 0.5°C per min after 80°C

20 Duration = 60 minutes at 110°C, so as to achieve linear density of 55 glm. This was followed by washing and neutralization. The fabric was heat set on Harish Stenter Frame using the following conditions:

Temperature = 165°C

25 Speed = 30 mpm

Set-width on stenter chains = 47"

30 The fabric was then batched using a batching stenter at 130°C and width of 46.5 inches. The fabric was printed using disperse dye print paste, dried at 130°C and cured at 175°C for 7 minutes for print-fixation. This was followed by washing the fabric at 95°C for 30 minutes to remove un-fixed color. The fabric was dried and final-

set at 46.5" inches on stenter frame at 150°C using softener (hand-feel improvement). This fabric was then passed through a Zero-Zero machine where the fabric moves in between a steam heated cylinder at 90°C and Rubber blanket.

5 The fabric width returned out with a width of 44.5 inches as a result of the relaxation in the Zero-Zero machine.

Test results on this fabric are as below:

Tear Strength – Warp Torn = 2.9 lbf

Tear Strength – Weft Torn = 2.9 lbf

Tensile Strength – Warp = 26.3 lbf

10 Tensile Strength – Weft = 23.2 lbf

Dimensional Stability (after 3rd Wash) Warp = (-) 0.4

Dimensional Stability (after 3rd Wash) Weft = (-) 2.4

Gsm – 48.6

15 **EXAMPLE 4:**

A fabric was made by a method similar to that described in example 3, except that after relaxation, the fabric was directly subjected to weight reduction without the preheat-set step followed by a heat set on a stenter frame at 180°C instead of 165°C in example 3.

20

The fabric width returned out with a width of 43.5 inches as a result of the relaxation in the Zero-Zero machine.

Test results on this fabric are as below:

Tear Strength – Warp Torn = 2.5 lbf

25 Tear Strength – Weft Torn = 1.1 lbf

Tensile Strength – Warp = 17.6 lbf

Tensile Strength – Weft = 10.3 lbf

Dimensional Stability (after 3rd Wash) Warp = (-) 0.4

Dimensional Stability (after 3rd Wash) Weft = (-) 1.2

30 Gsm = 47.4

As can be seen from examples above, inclusion of a pre- heat-set helps in achieving a better yield on fabric width.

COMPARATIVE EXAMPLE 5:

5

A PET (Recron®) yarn of 50 D/ 36 f was subjected to a twisting procedure (S and Z twist) on a Alidhra FHT -100 Two-for-one (TFO) twister to provide a twisted yarn of 1800 turns/m forming the warp component of the fabric. Another PET (Recron®) yarn of 50D/36f was subjected to a twisting procedure (S twist) on a
10 Alidhra FHT-100 Two-for-one (TFO) twister to provide a twisted yarn of 2800 turns/m forming one part of weft component(Weft Yarn-1) of the fabric. Another PTT (Sorona®) yarn of 50D/36f was subjected to a twisting procedure (S-twist) on a Alidhra FHT-100 Two-for-one(TFO) twister to provide a twisted yarn of 2800 turns/m forming second part of the weft component(Weft Yarn-2) of the fabric.

15 The warp yarns were heat treated for 50 minutes in a vacuum setter at a temperature of 90°C. The weft yarns were heat treated for 40 minutes in a vacuum setter at a temperature of 80°C

This was followed by warping and weaving using following specifications

Warp density- 104 threads per inch (2S twist yarns alternating with 2 Z yarns)

20 Reed space= 57 inches

Denting pattern- 1, 2, 3

Pick density= 76 threads per inch

Following order was used while weaving.

For the initial 10 metres Warp yarn-1 was used and subsequently Warp Yarn-2 was
25 used for the next 10 metres of fabric production. Demarcation was done at the point of Weft Yarn change.

The grey fabric thus obtained was relaxed in TEX FAB Long-jet machine using the following conditions:

Loading at room-temperature

30 Rate of Rise of Temperature: 0.5°C / min

Treatment time: 60 minutes at 130°C

The fabric was subjected to weight reduction on a TEXFAB Terelena machine. This was followed by washing and neutralization. The fabric was dyed in a jet dyeing machine at 130°C followed by washing and self-drying.

5 This fabric was later observed to compare the difference between the two parts of the fabric. The fabric was manually stretched on both the sides of the demarcation line and a picture was taken across the demarcation line.

Figure 2 shows a single image comparison of the prominent, uniformly spaced, straight lines in a PTT Chiffon fabric made of twisted multifilament yarn wherein the warp is PET and the weft is PTT as described in example 1 and 2 as compared to the
10 chiffon lines in a PET chiffon fabric wherein the warp and weft are both PET described in comparative example 5.

The fabrics with a preheat-set step show better stability as compared to same
15 fabrics that did not undergo the preheat-set step. Hence, they show higher finished fabric width in a finished stage.

PROPHETIC EXAMPLE 6

A PTT (Sorona®) yarn of 40 D/ 12 f is subjected to a twisting procedure (S
20 and Z twist) to provide a twisted yarn of 2000 turns/m forming the warp component of the fabric. Another PTT (Sorona®) yarn of 50D/36 f is subjected to a twisting procedure (S twist) on a Alidhra FHT-100 Two-for-one (TFO) twister to provide a twisted yarn of 2800 turns/m forming the weft component of the fabric .

The warp yarns are heat treated at a temperature of 100° C for 60 minutes in a vacuum
25 setter. The weft yarn is heat treated at a temperature of 90° C for 45 minutes in a vacuum setter.

This is followed by warping and weaving using following specifications:

Warp density- 76 threads per inch (2S twist yarns alternating with 2 Z yarns)

Reed space- 62 inches

30 Denting pattern= 1, 1, 4

Pick density= 64 threads per inch

The grey fabric thus obtained is relaxed in STAR Long-jet machine using the following conditions:

Loading at room-temperature

- 5 Rate of Rise of Temperature (after 80°C): 0.5°C / min

Treatment time: 90 minutes at 130°C

The fabric is then Pre-heat-set using the following condition:

Temperature = 180°C

Speed = 30 mpm

- 10 Set width on stenter chains = 47"

The fabric is then subjected to weight reduction on a TEXFAB Jet Dyeing machine using the following conditions:

Caustic Soda of 14 gpl

- 15 Gradient = 0.5°C per min after 80°C

Duration = 60 minutes at 110°C. This is followed by washing and neutralization. The fabric is heat set on Harish Stenter Frame using the following conditions:

Temperature = 165°C

- 20 Speed = 30 mpm

Set-width on stenter chains = 47"

- 25 The fabric is then batched using a batching stenter at 130°C and width of 46.5". The Fabric is printed using Disperse Dye print paste, dried at 130°C and cured at 175°C for 7 minutes for print-fixation. This is followed by washing the fabric at 95°C for 30 minutes to remove un-fixed color. The fabric is dried and final-set at 46.5" inches on stenter frame at 150°C using softener (hand-feel improvement). This fabric is then passed through a Zero-Zero machine where the fabric moves in between a steam heated cylinder at 90°C and Rubber blanket.

30

We claim:

1. A woven fabric made of twisted multifilament yarns wherein a weft yarn consists essentially of PTT and a warp yarn selected from a group consisting of PTT,
5 PET and blends thereof wherein the twist of the weft yarn is greater than the twist of the warp yarn.
2. The woven fabric as claimed in claim 1 wherein the weft yarn has a twist in the range of 2800-3200 turns per meter.
- 10 3. The woven fabric as claimed in claim 1 wherein the weft yarn has shrinkage in boiling water of 6-9%.
4. The woven fabric as claimed in claim 1 wherein the warp yarn is PET and the
15 weft yarn is PTT.
5. The woven fabric as claimed in claim 1 wherein the warp yarn and weft yarn are both PTT.
- 20 6. The process for making a woven fabric comprising the steps of:
(a) individually twisting multifilament yarns to convert the yarns into twisted weft yarns and twisted warp yarns wherein the twist of the weft yarn is greater than the twist of the warp yarn;
(b) conditioning the twisted yarns;
25 (c) warping and weaving and
(d) finishing of fabric.
7. The process for making a woven fabric of claim 6 wherein step 6(d) comprises:
30 a) relaxation of fabric to produce chiffon effect;
(b) pre-heat setting;

(c) weight reduction:

(d) heat setting;

(e) printing; and

(f) final setting of the fabric.

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8. The woven fabric as claimed in claim 1 wherein the fabric is a chiffon.

9. The fabric as claimed in claim 1 wherein the PTT is bio-based.

10 10. The woven fabric as claimed in claims 1 wherein the fabric is used for making
furnishings, apparel or decorative textiles.

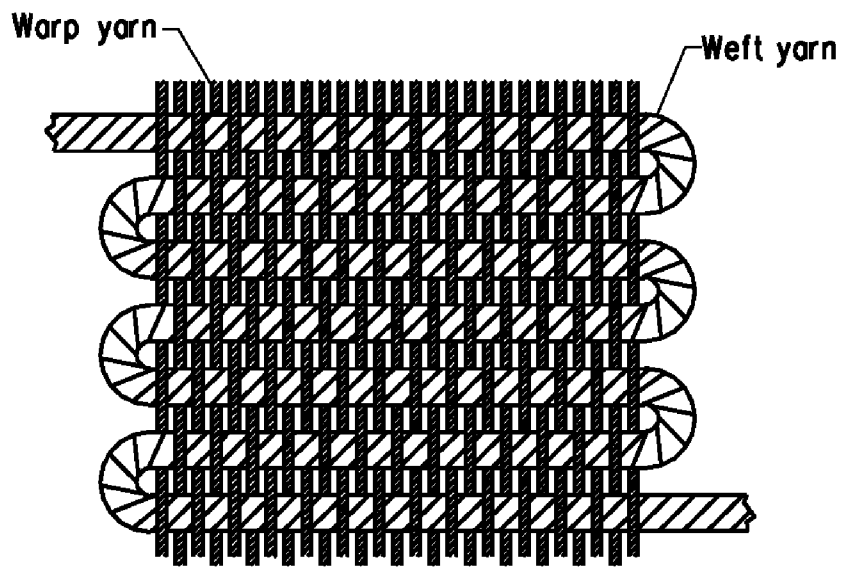


FIG. 1

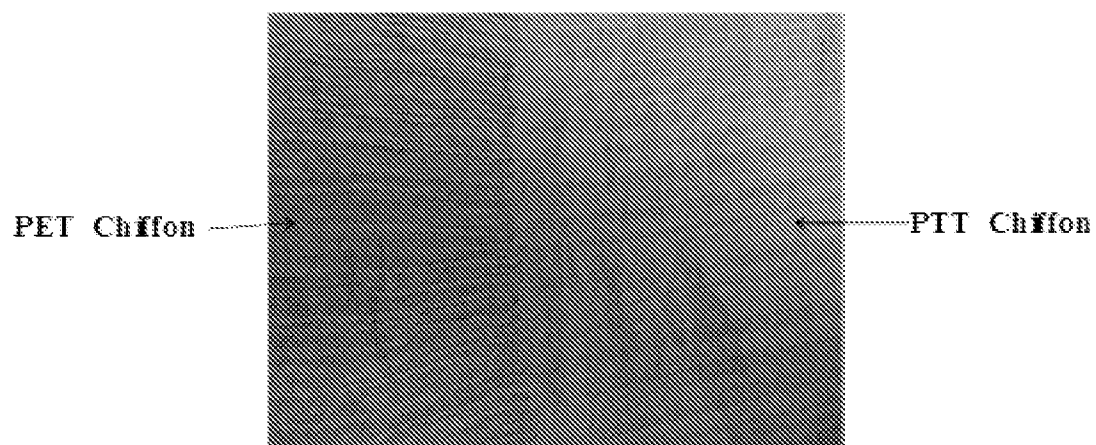


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/064859

A. CLASSIFICATION OF SUBJECT MATTER

INV. D03D15/04 D06C23/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D03D D06C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 11 093037 A (ASAHI CHEMICAL IND) 6 April 1999 (1999-04-06)	1,2,5,6, 10
Y	abstract paragraph [0005]; claim 1	3,4,7-9
Y	EP 1 298 236 A1 (ASAHI CHEMICAL IND [JP]) 2 April 2003 (2003-04-02) cited in the application examples 1-29 examples comparative 1-7 examples 31-34 tables 1,2	3,4,7-9
A	JP 11 100747 A (ASAHI CHEMICAL IND) 13 April 1999 (1999-04-13) abstract; example 1	1
	-/--	



Further documents are listed in the continuation of Box C.



See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

18 December 2012

Date of mailing of the international search report

04/01/2013

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/064859

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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