LYOCELL-POLYESTER FABRIC AND METHODS OF MANUFACTURE

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A fabric is disclosed and includes warp yarns of only lyocell fiber, and weft yarns of multifilament polyester only, where the fabric has a warp yarn count from Ne40 to Ne120, a weft yarn count from 15 D (denier) to 100 D, a thread count (TC) between 200 and 2000, with ends per inch in warp between 100 and 250, and picks per inch in weft being between 100 to 1800. In one embodiment, the lyocell fiber is lyocell fiber resulting from being spun in an environment where the relative humidity is maintained at between 40% and 50%, or between 44% and 46%. The resulting fabric has low shrinkage, good durability, a desirable softness, a cool feel due to its moisture-wicking properties, and an excellent uniformity in color when dyed.
SELECT LYOCELL FIBERS

FEED AND BEAT FIBERS

CARD FIBERS INTO SLIVERS

FEED SLIVERS TO DRAWING ZONE

SPIN AT CONTROLLED RELATIVE HUMIDITY

TWIST SPUN LYOCELL

UTILIZE AUTO-CONER

SELECT POLYESTER YARN

APPLY LYOCELL TO WARPING MACHINE

STRENGTHEN LYOCELL YARN

DRAWING-IN PROCESS

WEAVE WARP LYOCELL AND POLYESTER WEFT YARNS TOGETHER INTO FABRIC

SINGE, DESIZE, SCOUR, WASH, DYE
LYOCELL-POLYESTER FABRIC AND METHODS OF MANUFACTURE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to Indian application serial number 6472/CHE/2015, filed on Dec. 2, 2015, which is hereby incorporated herein by reference in its entirety.

BACKGROUND

The present disclosure relates to textiles. More particularly, the present disclosure relates to textiles using a combination of materials, one in warp and another in weft. The yarns may be single or double yarns, although the disclosure is not limited thereto.

STATE OF THE ART

Fabrics are typically classified by the materials utilized and by the thread count (i.e., the number of threads in one square inch of finished fabric). The thread count (TC) is commonly recognized as setting the quality standard for the textile. Finished products which are produced by using the fabrics are also labeled based on the thread count of fabric. For lower thread count, coarser count yarn may be used and for higher thread count, finer count yarn will be used to match the required grams per square meter of fabric.

In some cases it is known to blend materials together in making threads that are used in the fabric. For example, polyester and rayon may be blended together in the thread formation and the blend may be used in the warp and weft to make a fabric, or the blend may be used in the warp, and another material such as cotton may be used in the weft in the manufacture of the fabric.

SUMMARY

A fabric using lyocell in the warp and a multifilament polyester in the weft is disclosed. The lyocell is chosen to have a count of between Ne40 and Ne120, and the polyester yarn is chosen to have a count of between 15 denier and 100 denier. In one embodiment, the fabric is woven from 100 to 250 ends per inch in warp and 100 to 1800 picks per inch so that the thread count of the fabric is between 200 TC to 2000 TC or threads per square inch. In one embodiment, the tensile strength of the lyocell-polyester fabric in the warp direction is between 4 and 15 pounds and between 4 and 20 pounds in the weft direction (ASTM D1424 method). In one embodiment the fill ratio of the fabric in warp to weft is between 1:1 and 1:10.

In one embodiment, in spinning the lyocell fibers, the relative humidity is maintaining at between 40% and 50% in order to provide lyocell fibers that will provide desirable softness and moisture-wicking properties.

The disclosed lyocell-multifilament polyester fabric has surprising advantageous characteristics including low shrinkage, good durability, a desirable softness, a cool feel due to its moisture-wicking properties, and an excellent uniformity in color when dyed. The disclosed lyocell-multifilament polyester fabric has particular application for use in bed linens, although it is not limited thereto.

DETAILED DESCRIPTION

A fabric is made by weaving lyocell yarn and polyester yarn, with only lyocell fiber in the warp and only polyester in the weft. Lyocell is a regenerable cellulose fiber made from dissolving pulp of e.g., eucalyptus trees, using a dry jet-wet spinning process. A known brand of lyocell is sold under the trade name TENCEL® R, a trademark of Lenzing AG of Lenzing Austria. Polyester is a category of polymer that contains the ester functional group in its main chain and most commonly refers to polyethylene terephthalate (PET). Polyester is generally synthesized by utilizing a polycondensation reaction. More particularly, an alcohol and carboxylic acid are reacted to form a carboxylic ester. To assemble the polymer, water formed by the reaction is continually removed by azetrope distillation.

In one aspect, lyocell fibers are often classified in to two categories: standard fibers and micro fibers. The staple length and micronaire value of standard TENCEL fiber is 38 mm and 1.35 tex respectively (where 1 tex = 1 gram/10,000 m). In one embodiment, standard TENCEL fiber is used for producing yarn from Ne40/1 to Ne70/1 (where Ne is the English count). The staple length and micronaire value of micro TENCEL is 34 mm and 0.9 tex respectively. In one embodiment, micro TENCEL is used for producing yarn from Ne70/1 to Ne120/1. If desired, in one embodiment, standard and micro lyocell fibers may be mixed in a desired ratio during spinning of the yarn.

In one embodiment, the basic warp yarn count of the fabric is between Ne40/1 and Ne120/1. The polyester yarn count in the weft is between 15 D (denier) and 100 D. The fabric is woven from 100 to 250 ends per inch in the warp and 100 to 1800 picks per inch in the weft. The thread count of the fabric is between 200 TC and 2000 TC (where TC is thread count or threads per square inch).

In another embodiment, doubled yarn Ne40/2 to Ne120/2 is used in the warp. The polyester yarn count in the weft is between 15 D (denier) and 100 D. The fabric is woven from 100 to 250 ends per inch in the warp and 100 to 1800 picks per inch in the weft. The thread count of the fabric is between 200 TC and 2000 TC (where TC is thread count or threads per square inch).

Turning to the FIGURE, a flow chart of the method of manufacture of the lyocell-polyester fabric is seen. At 10, the lyocell fibers are chosen based on the desired count of the fabric. At 20, the fiber is opened and fed into the bale opener. Here the fibers are opened by beaters. Since the fiber length is uniform, beating is kept to a minimum. At 30, the fibers are converted into sliver form by carding. In carding, mild opening is given to the fiber, waste is removed and paralyzing of fibers takes place. In one aspect, because of standard length in fiber, waste will be a bare minimum and hence the resulting production in carding is large (40 kg/hour/carding). In one embodiment, carding is conducted at between 680 and 760 points/square inch.

At 40, six to eight carding slivers are fed into the drawing zone and the uniformity of sliver is better than carding. It is processed through draw frame twice to get better results. At 50, the output of draw frame sliver is taken to a spinning machine such as a Simplex machine, and the
output from Simplex machine is a roving with a mild twist. In one embodiment, the relative humidity is carefully maintained at between 40% and 50% during spinning. In one embodiment, the relative humidity is carefully maintained at between 44% and 46% during spinning for best results. The result of spinning is a roving hank at typically between 1.4 to 2.75 hanks/pound. Thereafter, at 60, the roving is taken to a ring frame for twisting the yarn. In one embodiment, the roving yarn is twisted at between 3.9 to 4.2 TM (twists multiplier). At 70, the ring cops are wound into a cone in an auto-coner after elimination of process faults in the yarn. If required, yarn is doubled in TFO for high end value added products.

At 80, the polyester yarn used in the weft of the lyocell-polyester fabric is chosen. The weft count ranges from 15 Denier to 100 Denier. The number of filaments in the polyester yarn may vary based on the desired count and end product. It will be appreciated that the polyester yarn may be chosen at any point prior to weaving.

The lyocell warp yarns are then prepared. In particular, the ends per inch in the warp are from 100 to 250. Based on the specific requirements, at 90, the number of ends in the warping machine and number of beams are decided. In one embodiment, the warp beams are produced with zero unwinding tension to minimize the loss in elongation during the process. The pressure applied on the warping beam during winding is maintained from 150 daN to 200 daN to prevent or minimize a change in the shape of the yarn. In one embodiment, the unwinding speed of the yarn from a full cone is started at approximately (plus or minus 10%) 250 meters per minute and after completing approximately 1500 meters length, the unwinding speed is increased to up to approximately 800 meters per minute.

In one embodiment, at 100, the warp beam by applying modified starch to the lyocell yarn so it can withstand the stress and strain of weaving. In one embodiment, additional care is taken to minimize the slippage of the warp sheet in hot cylinders in sizing machine. The sizing add-on varies from 4% to 14% depending on the count, construction of the fabric and loom speed. In the drying cylinders used during the starch application, in one embodiment, the temperature is maintained between 115º C. to 145º C.

At 110, the sized beams are taken to drawing-in where there is a sort change in the loom. The reed count used to produce the lyocell-polyester fabric is from 32 (dents per inch) to 74 (dents per inch) based on the thread count of the fabric. The warp yarn is drawn through droppers, healds (heddles) and reeds in the drawing-in process.

At 120, the weaving process is conducted. In one embodiment, the drawn beam is taken from the drawing-in department to loom in the weaving department in case of a sort change in loom. In another embodiment, the beam is loaded and knotted with the previous warp in the loom. The lyocell-polyester fabric may be woven in plain, satin, twill, drill, stripes, herring bone and other doby weaves, among other manners. In one embodiment, the lyocell-polyester fabric is woven in an air jet weaving machine using a satin weave. The speed of the weaving machines may vary widely. By way of example only, the speed may vary from 500 to 700 picks per minutes based on the count and construction of the fabric. The air consumption of the air jet machines is from 30 to 60 CFM. The lyocell-polyester fabric may also be produced in rapier, projectile and magnetic levitation bullet looms.

As part of the weaving process 120, the lyocell warp yarn is passed through the let-off back rest roller, warp stop motion, heald and reed. The woven fabric is passed through take up pressure rollers to cloth roll in the loom. The polyester weft yarn is drawn from its package to the feeding point in the loom via stop motions, guides and a weft accumulator. The determined length of the weft is set in the accumulator and inserted in the weaving machines by means of air or projectile or rapiers or magnetic levitation bullets.

In one embodiment, the fabric warp tensile strength of the resulting fabric is between 4 lbs and 15 lbs (ASTM D1424 method), and the fabric weft tensile strength is between 4 lbs and 20 lbs. In one embodiment, the fabric fill ratio is between 1:1 and 1:10.

After weaving, the produced grey lyocell-polyester fabric may be taken from the loom to the warehouse for inspection and packing. Thereafter, the fabric may be sent to a processing department for subsequent processing and finishing. More particularly, the grey fabric received from weaving may be made into bigger batches in rolls as per the order length. Thereafter, it may be processed through a singeing process to remove protruding fibers in the fabric. Both the front and back sides of the fabric may be singed. Afterwards, the fabric may be desized, where the size applied on the yarn in preparation for weaving is removed. Then processed fabric may then be passed through scouring and washing processes. If desired, the fabric may be treated with caustic soda, or it may be processed through a mercerizing machine.

The fabric is then ready for dyeing, such that the color is applied on the fabric. In one embodiment, a jigger dyeing machine is used to dye the fabric. Alternatively, the fabric may be dyed using a cold pad batch (CPB) or continuous dyeing range (CDR) dyeing machine. Thereafter, the dyed fabric may be subject to finishing where one or more of a softer, resin, antistatting agent and silicon softener may be added. In one embodiment, the finished fabric has a good hand feel.

In one embodiment, the fabric produced with lyocell in warp and polyester in weft is used for producing the bed linens in various sizes. The bed linens are labeled according to the thread count of fabrics used; from 200 TC to 2000 TC. It will be appreciated that the lyocell-polyester fabric may be used to make other fabric products.

The lyocell-polyester fabric having a lyocell warp yarn count between Ne40/1 and Ne120/1 or between Ne40/2 and Ne120/2 and a polyester weft yarn count between 15 denier and 100 denier, where the fabric is woven from 100 to 250 ends per inch in the warp and 100 to 1800 picks per inch in the weft and the thread count of the fabric is between 200 TC and 2000 TC, and where the lyocell yarn is spun in an environment where the relative humidity is carefully maintained at between 40% and 50% during spinning, has surprising advantageous characteristics including low shrinkage, good durability, a desirable softness, a cool feel due to its moisture-wicking properties, and an excellent uniformity in color when dyed.

There have been described and illustrated herein several embodiments of a lyocell-polyester fabric and a method of manufacturing the same. While particular embodiments have been described, it is not intended that the
disclosure and claims be limited thereto, as it is intended that the invention be as broad in scope as the art will allow and that the specification be read likewise. Thus, while particular machines have been disclosed in the making of the lyocell yarn, it will be appreciated that other machines could be used as well. In addition, while particular types of weaving machines have been disclosed, it will be understood that other weaving machines can be used. It will therefore be appreciated by those skilled in the art that yet other modifications could be made to the provided invention without deviating from its spirit and scope as claimed.

What is claimed is:

1. A fabric, comprising:
   warp yarns consisting of lyocell fiber; and
   weft yarns consisting of multifilament polyester, wherein
   said fabric has a warp yarn count from Ne40 to Ne120, a
   weft yarn count from 15 D (denier) to 100 D, a thread
   count (TC) between 200 and 2000 with ends per inch
   in warp between 100 and 250 and picks per inch in weft
   being between 100 to 1800.

2. A fabric according to claim 1, wherein:
   said lyocell fiber is lyocell fiber resulting from being spun
   in an environment where the relative humidity is maintai
   ned at between 40% and 50%.

3. A fabric according to claim 2, wherein:
   said relative humidity is maintained at between 44% and
   46% during spinning.

4. A fabric according to claim 2, wherein:
   said fabric has a warp tensile strength between 4 lbs and
   15 lbs and said fabric has a weft tensile strength of
   between 4 lbs and 20 lbs.

5. A fabric, comprising:
   warp yarns consisting of lyocell fiber, said lyocell fiber
   resulting from being spun in an environment where the
   relative humidity is maintained at between 40% and
   50%; and
   weft yarns consisting of multifilament polyester, wherein
   said fabric has a warp yarn count from Ne40 to Ne120, a
   weft yarn count from 15 D (denier) to 100 D, a thread
   count (TC) between 200 and 2000.

6. A fabric according to claim 5, wherein:
   said fabric has a warp tensile strength between 4 lbs and
   15 lbs and said fabric has a weft tensile strength of
   between 4 lbs and 20 lbs.

7. A method of making a fabric, comprising:
   obtaining lyocell fibers;
   carding the fibers to form slivers and processing the
   slivers in a draw frame;
   spinning the processed slivers in a spinning machine;
   twisting the spun fibers into a lyocell yarn;
   obtaining a multifilament polyester yarn; and
   weaving said lyocell yarn in warp and said polyester yarn
   in weft into said fabric where said fabric has a warp
   yarn count from Ne40 to Ne120, a weft yarn count from
   15 D (denier) to 100 D, a thread count (TC) between
   200 and 2000.

8. A method according to claim 7, wherein:
   said spinning is conducted in a controlled environment at
   between 40% and 50% relative humidity.

9. A method according to claim 8, wherein:
   said weaving is conducted with lyocell yarn ends per inch
   in warp between 100 and 250 and polyester yarn picks
   per inch in weft being between 100 to 1800.

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