

TUBE CORE FOR HUMID ENVIRONMENT

FIELD OF THE INVENTION

The present invention is directed to a tube core including a moisture barrier, which maintains the integrity of the tube core over time and/or after exposure to humidity. A method for preparing a tube core that meets these goals while minimizing the weight of paper included in the tube core is also provided.

BACKGROUND OF RELATED TECHNOLOGY

Textiles yarns can be wound onto cores to provide a yarn package after yarns are prepared. This permits ease of storage, shipping, and subsequent use of the yarns. Typically, the core is exposed to the force of the yarn which is under tension during the winding process. If the core lacks sufficient strength, it may collapse under the pressure exerted by the yarn, resulting in failure of the core and making the yarn package unusable for its intended purpose. Other factors that contribute to potential core failure are the types of yarn (elastic yarns can provide a greater force) and exposure to moisture/humidity.

SUMMARY OF THE INVENTION

The challenge of developing a tube core that maintains its strength is generally addressed by reinforcing the tube core with additional materials. In other words, a tube core including a greater weight of paper will generally provide a tube core that has more strength. However, the addition of paper to the tube core increases the cost of the tube core. The present invention seeks a solution that will permit the tube core to maintain its strength over time and with exposure to moisture/humidity without substantial cost.

In one aspect a tube core is prepared that includes an internal moisture barrier layer. The interior moisture barrier permits the tube core to maintain its strength and resist failure over time without the additional cost of including layers of additional paper/additional weight of paper. The article of one aspect includes yarn and a tube core, the tube core includes:

- (a) a surface layer including a yarn contacting surface,
- (b) at least one moisture barrier which is an interior moisture barrier layer;
- (c) two or more paper layers;

where the weight of the paper layers is minimized such that the tube core including the moisture barrier and the paper layers maintains radial strength over time and exposure to humidity

compared to a tube core excluding an interior moisture barrier; and the tube core has a total weight about 60g or less.

Another aspect provides a method for minimizing the weight of paper in a tube core while maintaining strength of the tube core over time or after exposure to a humid environment including:

- (a) providing a tube core comprising:
 - (i) a surface layer including a yarn contacting surface,
 - (ii) at least one moisture barrier which is an interior moisture barrier layer;
 - (iii) two or more paper layers;
- (b) winding a yarn onto said tube core;
- (c) exposing said tube core to a humid environment;
- (d) observing integrity of tube core;
- (e) if tube core has maintained its integrity, then prepare a new tube core including a lower weight of paper.

A further aspect includes a method for minimizing the weight of paper in a tube core while maintaining strength of the tube core over time or after exposure to a humid environment including:

- (a) providing a tube core comprising:
 - (i) a surface layer including a yarn contacting surface,
 - (ii) at least one moisture barrier which is an interior moisture barrier layer;
 - (iii) two or more paper layers;
- (b) exposing said tube core to a humid environment;
- (c) testing the radial strength of said tube core;
- (d) if tube core has provides adequate strength, then prepare a new tube core including a lower weight of paper.

An additional aspect includes a method for minimizing the weight of paper in a tube core while maintaining strength of the tube core over time or after exposure to a humid environment including:

- (a) providing a tube core comprising:
 - (i) a surface layer including a yarn contacting surface,
 - (ii) at least one moisture barrier which is an interior moisture barrier layer;

- (iii) two or more paper layers;
- (b) exposing said tube core to a humid environment;
- (c) testing the radial strength of said tube core;
- (d) calculating the yarn pressure and using this data to compare with the tube core radial strength, to select the correct tube core for the product type
- (e) if tube core has provides adequate strength, then prepare a new tube core including a lower weight of paper.

DETAILED DESCRIPTION OF THE INVENTION

The term "cores" or "tube cores" are used herein interchangeably and are intended to include all such articles which may be used for textile winding, whether they define a tube, cone or other shape. They may be used with a variety of materials such as threads, filaments, fibers, yarn, etc., and of whatever composition such as spandex, nylon including nylon bulk continuous filament, silk, cotton, jute, linen, wool, rayon, etc.

The tube cores of one aspect include a surface layer, at least one moisture barrier layer that is an interior moisture barrier and two or more layers of paper. Typically, the surface layer will also include a moisture barrier and several layers of paper are included.

The cores are prepared on any of a variety of well-known devices to prepare wound paper tubes. Typically, this includes preparing strips of the paper (also commonly referred to as paper board or card board), combined with the interior moisture barrier layer. The surface layer which may also include or be a moisture barrier layer, can be applied as a coating, film or impregnated into the external yarn contacting surface of the core. The surface layer may be combined with the paper strips or applied separately to the tube core after winding.

One or more of the combined paper strips which include paper, interior moisture barrier and optionally the surface layer are helically wound onto a mandrel of the desired shape (such as a cylindrical tube or cone). The seams are adhered with a suitable adhesive as desired. In an example of a continuous process, the lead-end of all except the first of which are previously glued to the tail-end of another, and which form predetermined angles with the axis of the mandrel. After preparation of the tube, they may be cut into the desired lengths, such as between 50mm and 70mm. The cutting may be performed before or after the application of the

surface layer. The tube will generally have a ratio of weight (g) to length (mm) of about 1.09 or less.

The paper layers may include cellulosic fiber as is well-known in the art. These materials are commonly referred to as paperboard or cardboard. One aspect seeks to reduce the amount of paper while maintaining the strength of the core over time.

Moisture barrier layers that are useful for cores are also well-known in the art. At least one moisture barrier is included in the tube cores, which is interior. This means that the moisture barrier includes paper on either side of the moisture barrier. The interior moisture barrier may include film, a coating, or is impregnated into said tube core. A variety of useful materials may be used as the moisture barrier including, but not limited to, vinyl chloride resin, acrylic, polyurethane, phenolic resin, polyester, polyolefin, foil, and combinations thereof.

Adhesives may be included in the layers of the tube core as needed to ensure the integrity of the structure. Useful adhesives include pressure sensitive adhesives, hot melt adhesives, reactive adhesives, etc.

The methods of determining the amount of paper that may be excluded from the tube core include observation of the tube core in use (after yarn has been wound onto the tube core) or testing of the tube core in the absence of wound yarn. The testing/observation is intended to duplicate conditions to which a yarn package (yarn plus the core) would be exposed during processing, shipping or use. This includes exposure to a high temperature and humid environment. Temperatures may be at or above about 27°C, including at or above about 30°C. The humidity may be about greater than about 70%, including greater than about 80% or greater than about 90%. The humid environment may include humidity of 90% for prolonged periods of time. The testing also occurs over time such as approximately seven days. Typically, the core will become saturated with moisture at some time within the seven day period.

Several tube core testing methods are known in the art. One such method is described in U.S. Patent No. 5,339,693 to Rowlands et al. The disclosure of which is incorporated herein by reference.

While there have been described what are presently believed to be the preferred embodiments of the invention, those skilled in the art will realize that changes and modifications may be made thereto without departing from the spirit of the invention, and it is intended to include all such changes and modifications as fall within the true scope of the invention.

Claims:

1. An article comprising yarn and a tube core, said tube core comprising:
 - (a) a surface layer including a yarn contacting surface,
 - (b) at least one moisture barrier which is an interior moisture barrier layer;
 - (c) two or more paper layers;wherein the weight of said paper layers is minimized such that the tube core comprising said moisture barrier and said paper layers maintains radial strength over time and exposure to humidity compared to a tube core excluding an interior moisture barrier;
and said tube core has a total weight about 60g or less.
2. The article of claim 1, wherein said yarn is spandex.
3. The article of claim 1, wherein said tube core has a ratio of weight (g) to length (mm) of about 1.09 or less.
4. The article of claim 1, wherein said surface layer comprises a surface moisture barrier.
5. The article of claim 1, wherein said interior moisture barrier comprises a material selected from the group consisting of vinyl chloride resin, acrylic, polyurethane, phenolic resin, polyester, polyolefin, foil, and combinations thereof.
6. The article of claim 1, wherein said tube core further comprises an adhesive.
7. The article of claim 1, wherein said interior moisture barrier includes a film, a coating, or is impregnated into said tube core.
8. A method for minimizing the weight of paper in a tube core while maintaining strength of the tube core over time or after exposure to a humid environment comprising:
 - (a) providing a tube core comprising:
 - (i) a surface layer including a yarn contacting surface,
 - (ii) at least one moisture barrier which is an interior moisture barrier layer;
 - (iii) two or more paper layers;
 - (b) winding a yarn onto said tube core;
 - (c) exposing said tube core to a humid environment;

- (d) observing integrity of tube core;
 - (e) if tube core has maintained its integrity, then prepare a new tube core including a lower weight of paper.
9. The method of claim 8, wherein said humid environment has a humidity greater than about 80%.
10. The method of claim 8, wherein said tube core is saturated with moisture due to exposure to the humid environment.
11. A method for minimizing the weight of paper in a tube core while maintaining strength of the tube core over time or after exposure to a humid environment comprising:
- (a) providing a tube core comprising:
 - (i) a surface layer including a yarn contacting surface,
 - (ii) at least one moisture barrier which is an interior moisture barrier layer;
 - (iii) two or more paper layers;
 - (b) exposing said tube core to a humid environment;
 - (c) testing the radial strength of said tube core;
 - (d) if tube core has provides adequate strength, then prepare a new tube core including a lower weight of paper.
12. A method for minimizing the weight of paper in a tube core while maintaining strength of the tube core over time or after exposure to a humid environment including:
- (a) providing a tube core comprising:
 - (i) a surface layer including a yarn contacting surface,
 - (ii) at least one moisture barrier which is an interior moisture barrier layer;
 - (iii) two or more paper layers;
 - (b) exposing said tube core to a humid environment;
 - (c) testing the radial strength of said tube core;
 - (d) calculating the yarn pressure and using this data to compare with the tube core radial strength, to select the correct tube core for the product type
 - (e) if tube core has provides adequate strength, then prepare a new tube core including a lower weight of paper.