TESTING OF DIMENSIONAL STABILITY OF THE FABRIC

BY

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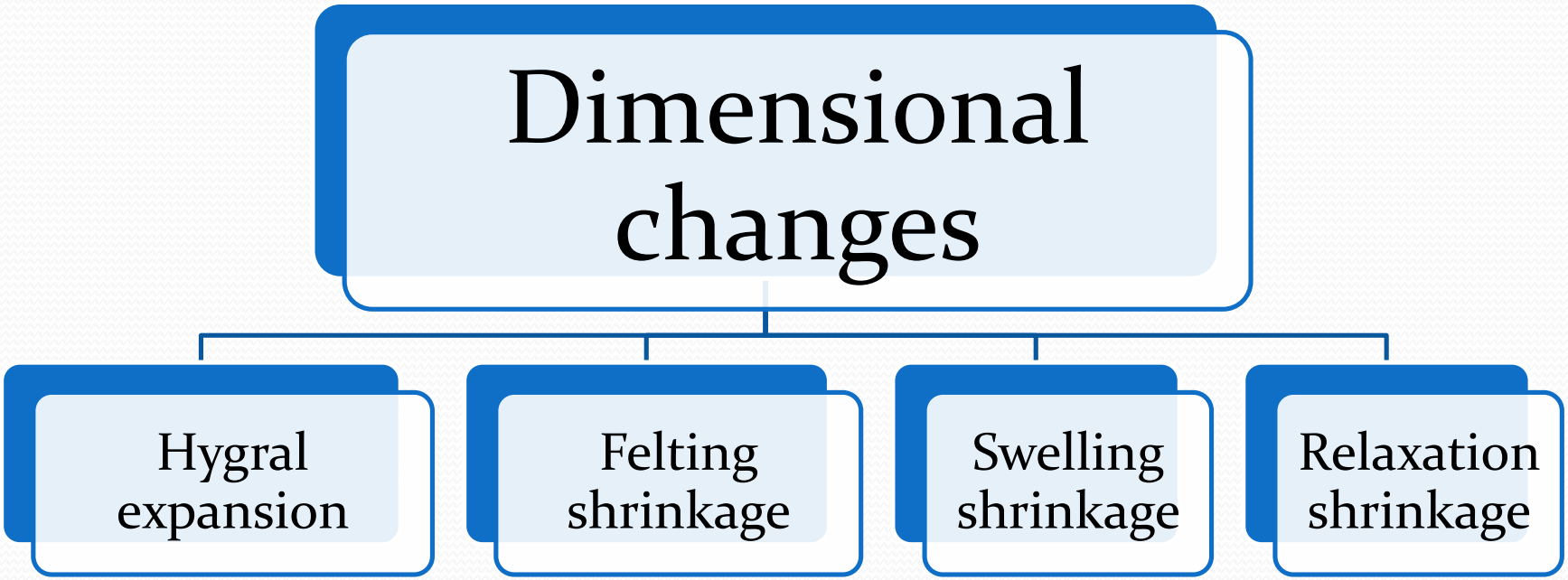
DEFINITION

- Dimensional stability is defined as the ability of a fabric to retain or hold its shape.
- Dimensional stability results when fabric neither stretches nor shrink. Stretching is related to elastic recovery, as fibers with goods elastic recovery retails their shape.
- The dimensional stability of a fabric measure of the extent to which it keeps its original dimensions subsequent to its manufacturer.

DIMENSIONAL CHANGES



HYGRAL EXPANSION

- **Hygral expansion** is a property of fabrics made from fibers that absorbs moisture, in particular fabrics made from wool . It is reversible change in dimensions which takes place when the moisture regain fabric is altered.

CAUSE OF HYGRAL EXPANSION

- Hygral expansion is caused by the straightening of the crimped yarn as it absorb moisture.
- Hygral expansion of a fabric in a finish garment can cause problems when the garment is exposed to an atmosphere of higher relative humidity than that in which it was made.
- The expansion can cause pucker at seams and wrinkling where it is constrained by other panels or fixed interlinings.

RELAXATION SHRINKAGE

- It is the irreversible dimensional change accompanying the release of fiber strains imparted during manufacture which have been set by the combined effect of time, finishing treatments, and physical restrains within the structure.
- In subsequent finishing processes such as tentering or calendaring this stretch may be increased and temporarily set in the fabric.
- Relaxation shrinkage in wool fabric is caused by stretching the wet fabric beyond its relaxed dimensions during drying.

Relaxation shrinkage= original measurement-

$$\frac{\text{final measurement)}}{\text{original measurement}} \times \underline{100\%}$$

SWELLING SHRINKAGE

- It result from the swelling and de-swelling of the constituent fibers of a fabric due to the absorption and de-sorption of a water.
- **Cause of swelling shrinkage:**

- It causes an increase in the length of the path the yarn must take off the fibers centres remain the same.
- In a fabric the warp yarn must either increase in length or the weft threads must move closer together.
- In order for the warp yarn to increase in length, tension needs to be applied to the fabric to stretch it.

FELTING OR PROGRESSIVE SHRINKAGE

- Felting shrinkage is a mechanism of shrinkage. It results primarily from a the frictional properties of the component fibers which cause them to migrate within the structure.
- This behavior is normally is considered to be significant only for fibers having scales on their surface such as wool.
- This effect can be measured directly.
- Felting is related to the directional frictional effect(DFE) which is found in wool fibre.

METHOD OF MEASURING DIMENSIONAL STABILITY

Marking out samples

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IWS Test

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Marking out

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Cubex Test

MARKING OUT SAMPLES

The general procedure for preparing and marking out of samples is laid down in the British Standard. Many dimensional stability tests follow very similar lines differentiated by the treatment given to the fabric, so that these procedures may be followed if no specific test method exist.

IWS METHOD

In this test method the relaxation shrinkage is determined from a wet treatment with mild agitation. The felting shrinkage is determined subsequently on the same samples using a more severe agitation possibly using a number of repeat cycles.

MARKING OUT

- Knitted samples of size 300×400 mm are tested double with the free edges sewn together. The marks are placed not less than 25mm. From the edge. Marks are made on the folded edge as well as in flat area of the samples.

CUBEX TEST

- This test is designed to measure the dimensional changes of wool- containing knitted fabrics during washing. It measures both relaxation and felting shrinkage as in he above test. This test is carried out in two steps :
- First the relaxation shrinkage is measured.
- Secondly any fabric shrinkage is measured.

The sample is first conditioned and measured flat.

SHRINKAGE

- Shrinkage is when a fabric becomes smaller than its original size, usually through the process of laundry. shrinkage of garments, especially when applying heat.
- Shrinkage is mainly due to yarn swelling and the resulting crimp increase , mechanical means of controlled pre shrinking have been developed , e.g. the sanforizing process.
- Fabric sample can be tested for shrinkage after laundering and dry cleaning and the percentage of shrinkage can be calculated

CAUSES OF SHRINKAGE

- For wool garment, this is due to scale on the fabric which heat and an agitation causes to stick together.
- Other fabrics are stretches by mechanical forces during productions, and can be shrink when heated (through to a lesser degree than wool).
- Some clothes are “pre-shrunk” to avoid this problem.

LAUNDRY SHRINKAGE: The laundering shrinkage of fabrics made from cellulosic staple fibers can be conveniently broken down into three types:

- First, fiber relaxation type, due to relaxation of strains imposed on fibers during processing.
- Second, fabric relaxation due to fiber and yarn swelling which results in crimp adjustment and subsequent shrinkage.
- Third, "felting" or "progressive" type due to fiber movement.

- **COMPRESSIVE SHRINKAGE :** For fabrics that are subject to relaxation shrinkage, such as cotton, linen, and rayon, it would seem logical to wash or wet the fabrics in order to allow them to return to their true dimensions.
- **PROGRESSIVE SHRINKAGE**: Wool and animal fibres are among those few fibres that show progressive shrinkage. Most textile experts believe that it is the scale structure of wool that causes this continuous shrinkage and the scale structure is also thought to be related to the felting of wool in which fibers shrink and closely together.
- **RELAXATION SHRINKAGE** : Several method can be utilized to eliminate relaxation shrinkage in wool. Because these process do not protect against felting shrinkage, fabrics that have these finishing should be dry cleaned or handle carefully during laundering .

- **DRYING SHRINKAGE:** The drying shrinkage is also an ever lasting process when concrete is subjected to drying conditions. The drying shrinkage of concrete is analogous to the mechanism of drying of timber specimen.
- **AUTOGENEOUS SHRINKAGE:** In a conservative system i.e. where no moisture movement to or from the paste is permitted, when temperature is constant some shrinkage may occur.
  - The shrinkage of such a conservative system is known as autogeneous shrinkage. Autogeneous shrinkage is of minor importance and is not applicable in practice to many situations except that of mass of concrete in the interior of a concrete dam.

THERMAL SHRINKAGE:

- Synthetic fibers that are thermoplastic or heat sensitive may shrink when subjected to heat.
- Special treatment with heat called heat setting can, however, be used to set the fiber and make it dimensionally stable.
- The synthetic fibers or fabrics that have been heat set do not shrink unless the heat setting temperature is exceeded.
- Careful control of the heat causes physical changes to take place within the fiber that alters its form, there by establishing a permanent shape into the fabric.
- In fabrics made from thermoplastic fibres. Heat may be used to fuse seams and make buttonholes.

HEAT SETTING

- Heat setting is an industrial process for removing spinning- and cabling.
- The process may also cause synthetic fibers to gain bulk or volume and is also used to stabilize fibers after processes .
- Heat setting is a thermal process which utilizes either steam or a dry convection heat source to set the fabric or yarn.
- Steam setting is a standard post-production process for a wide selection of natural and synthetic fibers intended for the garment and carpet industries.
- Heat setting benefits staple yarns as well as continuous filament yarns.

- **Current heat setting processes:** Several different heat setting processes are known in the textile industry. The most important are:
- **Autoclave heat setting:**The oldest heat setting process is autoclave heat setting. Mostly, it is a discontinuous process. Autoclave installations use vacuum and/or pressure. Textile material is brought into the autoclave either on bobbins, in skeins or loose in a container. As nearly all autoclaves are exposed to certain pressures they are usually built in cylindrical shape and mounted horizontally. Most commonly, autoclaves are loaded and unloaded from the end of the cylinder but some may be loaded from one end and unloaded from the other end. Autoclaves mounted vertically exist but are less common.

AUTOCLAVE HEAT SETTING MACHINE

Steamatic process

- The first known process of this type is the Steamatic process by Reach.
- In this case the heat setting process happens in between the ring spinning and the winding machines.
- As soon as the ring spinning frame has finished spinning, the loaded bobbins are transported into the in-line steamer.
- Those bobbins are steamed there with a vacuum method and dried again within seconds.
- After steaming and drying, the bobbins are transported on to the winding machine where they are re-wound onto a cross-wound package.
- The carpet industry currently utilizes two continuous processes, the Power-Heat-Set process and the TVP process which was derived from the autoclave technology.

Process description (Power-Heat-Set process)

- Frieze and straight Yarn after Power-Heat-Setting
- In the Power-Heat-Set process yarn is heat set with superheated steam in an open system at atmospheric pressure.
- The unprocessed yarn is provided on packages in a creel (up to 48 packages).
- At a speed of up to 700 m/min, the yarn is pulled off the packages and entered into the heat setting process.

Process description (Power-Heat-Set process) contd…….

- There are two basic ways of transportation of the yarn through the process.
- One way is to place the yarn in coils or a pattern on a belt or to wrap it onto ropes arranged as a polygon in order to convey it through the process.
- With Frieze yarns only belt conveying is utilized. Frieze is produced by a special stuffer box, the so-called Twin roll-Box (TRB).
- The heat setting process takes place at temperatures between 110 °C and 200 °C in a steam-air-mix.
- After heat setting, the yarn is cooled and wound onto packages again at the winder. In general a heat setting machine consists of six lines at eight ends (fibers) each. A daily production of up to 10.5 tons is possible.

POWER HEAT SETTING MACHINE

DURABLE PRESS, PERMANENT PRESS OR CREASE RETENTIVE FINISH

Pre-cured method:

- The fabric which consist of a heat sensitive and a non-heat sensitive fibre is generally treated by this method, like polyester ,cotton blend. the blend is impregnated with resin and cured. In this prior to garment construction fabric is pressed with especial hot head press to set heat –sensitive component of the blend.

Recured permanent press:

- This process is the same as the precured method .
- It explain above expecting that additional chemical used , breaks cured resins molecules in steam.
- This render the fabric temporarily uncured.

THANK YOU