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BLEACHING PROCEDURE FOR FIBERGLASS FABRICS

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ABSTRACT OF THE DISCLOSURE

Fiberglass fabrics and other siliceous fiber fabrics in the greige condition are rendered clean and white prior to applying dye or finish by heat-treating the fabrics at a temperature sufficient to set crimp in the glass yarns, to volatilize volatile components of the sizing on the fabric and to dextrinize the starches in the sizing, then treating the fabric with a concentrated bleaching solution, drying at relatively high temperature, and washing and rinsing.

DISCLOSURE

This invention relates to the treatment of siliceous fiber fabrics, especially fiberglass fabrics, prior to applying a dye or finish and particularly to a treatment which renders the fabric clean and white.

Fiberglass fabrics in the greige state have an inferior hand and poor draping characteristics. It is known that these faults can be corrected by coronizing, that is, subjecting the fabric to intense heat at about 1000° F.–1200° F. which has the effect of softening the fibers, removing internal tension and imparting a permanent crimp to the fibers, the overall effect being to render the fabric softer and more drapable and remarkably wrinkle resistant. The intense heat also burns off organic matter such as the previously applied sizing materials. It is also known to subject the fabric, usually in roll form, to a lower temperature in an oven effective to burn off sizing but insufficient to produce crimping of the fibers. Conventionally the fabric is then passed without further treatment through a bath of pigment dispersed in resin emulsions, usually applied by padding, followed by curing at elevated temperature.

The conventional intense heat treatment of the greige fabric, referred to above, successfully produces the desired physical characteristics but sometimes suffers from difficulties with respect to the removal of sizing components. One disadvantage is that the heat treatment does not completely remove flashes of high size content which occasionally occur on the yarn. Another disadvantage is that a grayish carbon residue sometimes remains on the fabric, giving a dull, dirty appearance to the fabric when subsequently finished in light or white shades.

The present invention overcomes these difficulties by providing a process which produces a clean white fabric, free of sizing residue and ash, to which dye may be applied without giving rise to dull areas. The process is carried out by first subjecting the freige fabric to a controlled heat treatment which, while less intense than coronizing, effects the desired crimping action, volatilizes the volatile components of the previously applied sizing and, most importantly, dextrinizes the sizing starches to brown carbonaceous residues rather than producing a grey ash. The heating step may be carried out in an oven of conventional design. Oven temperatures of about 600° F. to 1450° F. and fabric temperatures of about 600° F. to 1000° F. are suitable. Dwell time in the oven will vary with fabric weight and oven temperature. At high oven temperatures as little as 6 seconds dwell time may suffice.

Then the fabric, which conventionally would pass directly to the resin-dye bath or other industrial finishing

solutions such as Volan or a silane, is treated at room temperature with a bleach solution, preferably by padding. An aqueou solution of sodium hypochlorite of between 0.3% and 15% available chlorine is preferred, although aqueous solutions of calcium hypochlorite, hydrogen peroxide, potassium permanganate, sodium perborate or sodium chlorite may be used.

Following the application of the concentrated bleach solution the wet fabric is passed to a drying oven which heats the fabric to 180° F. to 250° F. Retention time in the oven and the oven temperature required to achieve this cloth temperature and to dry the fabric will vary with fabric weight and style and are such that the action of the liberated chlorine decolorizes the brown carbonaceous residues. In this regard it may be that the action of the chlorine on the dextrinized starches is not a true bleaching action, and it is preferred to refer to the procedure as a whitening procedure. Dextrin, the name applied to carbohydrate mixtures formed by the decomposition or degradation of starch by the heat, acids or enzymes and intermediate in chemical structure between starch and sugars, is chemically reactive with chlorine and other oxidizing agents to produce colorless residues, but the reaction is not necessarily a typical bleaching reaction even though a bleaching action may accompany the primary reaction. In any event, the technique differs from typical bleaching techniques in that the liquid reagent is applied to the fabric in a first step at room temperature and as a second step the temperature of the fabric is raised in a dryer to effect both the chemical reaction and drying. In fact the dwell time and oven temperature may be controlled so as to dry the fabric before the action of the chlorine has been completed. In this regard the fabric should be just dry. Moisture content from 0.5% to 5% can be tolerated, but the fabric must not get "bone-dry."

After emerging from the drying oven the fabric is washed in a detergent solution and then rinsed in clear water to remove the colorless residues and again dried in a drying oven. After this the fabric may be either roller up and stored to be finished at a later time, or it may have the finish applied in the regular manner by padding and drying operations. Certain fabric constructions are more difficult than others to clean and have a tendency to lose tensile strength during the process. For these fabrics the wash and rinse cycle is critical to maintaining tensile strength within the prescribed specifications for this characteristic.

While the process has particular utility in preparing fiberglass fabrics, it is also applicable to other fabrics of siliceous fibers such as quartz, asbestos and silica.

Example 1

Fabric: Leno weave
Warp: ECD 225 1/0 glass—39 ends/inch
Filling: ECDE 150 1/0 glass—24 picks/inch
Weight: 0.163 lbs./yard
Unit speed: 75 yds./min.
Temperature of oven: Average 1180° F.
Bleach bath: 7.5% available chlorine
Temperature: Cool (about 70° F.)

The bleach bath is made by diluting commercial sodium hypochlorite solution (15% available chlorine) with 50% cold tap water. After passing through the oven the fabric is passed through the bleach bath in a padder, and is squeezed lightly, using 20 lbs. air pressure on the cylinders of the pad.

The fabric is then passed over a skyroll to give some preliminary reaction time at ambient room temperature before entering the drying oven—time 12 seconds; drying oven temperature 350°; exposure time 16.8 seconds. Fabric temperature reaches 180° F. to 220° F.

Fabric from the drying oven enters a room temperature soap bath containing 1% Lawnette Special Detergent. Without squeezing, the fabric is immediately rinsed through several passes in an overflowing rinse box containing water at 160/190° F. The fabric is squeezed lightly and enters a drying oven at 350° F., where it is held for 33 seconds, or long enough to dry thoroughly.

The fabric is then either rolled up, or is finished by passing immediately into the finishing part of the equipment.

Example 2

Fabric: 1 x 2 Twill
Warp: ECDE 150 1/0 glass—54 ends/inch.
Filling: DE 75 1/0 "401" Textured glass—36 picks/inch
Weight: 0.390 lb./yard
Unit speed: 100 yds./min.
Temperature of oven: Average 1260° F.

Fabric is passed through the oven and enters the bleaching bath in a padder. Bleach bath contains:

0.75% available chlorine and
0.5% Lawnette Special Detergent.

The formulation of the bleach bath is:

	Parts
Sodium hypochlorite (15% solution)	5
Lawnette Special Detergent	½
Water	94½
	100

The fabric is squeezed lightly, and is passed over a skyroll to give 9 seconds lag time before passing into a drying oven held at 440° F. Fabric temperature reaches 180° to 220° F., and is just dry after a dwell time of 12.6 seconds.

The fabric is rinsed through several passes in an overflowing rinse box containing water at 160°/190° F. The fabric is squeezed lightly and passed into a dryer at 540° F., time 25 seconds. Fabric is then either rolled up or passed into the finishing equipment.

In the examples the following identifying letters have been employed:

E—a typical electrical glass composition, such as silicon dioxide (52–56 parts), calcium oxide (16–25 parts), aluminum oxide (12–16 parts), boron oxide (8–13 parts, sodium oxide (up to 1 part), and magnesium oxide (up to 6 parts)
C—continuous filament yarn
D—filament diameter of 0.00021 inch
DE—filament diameter of 0.00025 inch
1/0—one strand twisted and no second operation applied

401—a single strand textured glass yarn manufactured by Owens-Corning Fiberglas.
Lawnette Special Detergent—the name applied to bulk quantities of Tide, manufactured by Proctor and Gamble

What is claimed is:

1. A process for treating a siliceous fiber fabric in the greige condition to remove sizing and other materials prior to dyeing or finishing said process comprising heating the fabric to a fabric temperature of about 600° F.–1000° F. at which starch components of the sizing are degraded to dextrin but not to free carbon and at which the volatile components of the starch are volatilized and then chemically converting the dextrin to colorless residues by applying to the fabric an aqueous solution of a bleaching agent and drying the fabric.

2. A process as in claim 1 wherein the bleaching agent is sodium hypochlorite.

3. A process as in claim 1 wherein the fabric is dried at about 180° F.–250° F. and is then washed and dried.

4. A process as in claim 1 wherein the fabric is a glass fiber fabric.

5. A process for treating fiberglass fabric in the greige state preparatory to dyeing or finishing said process comprising: heat treating the fabric at fabric temperatures of between 600° F. and 1000° F. at which the fibers crimp and the fabric is rendered soft and drapable and at which starch sizing is degraded to dextrin but not to free carbon; applying to the fabric an aqueous solution of a compound selected from the group consisting of sodium hypochlorite, calcium hypochlorite, hydrogen peroxide, potassium permanganate, sodium perborate and sodium chlorite; simultaneously drying and heating the fabric to chemically convert the dextrin to colorless residues; and washing and rinsing the fabric to remove the colorless residues.

6. A process as in claim 5 wherein the drying and heating is carried out at a fabric temperature of about 180°–250° F. and the moisture content of the fabric is maintained between about 0.5% and 5%.

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