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PROCESS OF SIZING TEXTILES AND COMPOSITION THEREFOR

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This invention relates to the production of improved crepe fabrics comprising highly twisted crepe yarns having a basis of cellulose acetate or other organic derivative of cellulose, and relates more particularly to a novel, water-soluble sizing composition for application to textile yarns, such as, for example, cellulose acetate or other organic derivative of cellulose yarns whereby improved weaving and creping properties are imparted to said yarns.

An object of this invention is the provision of an improved water-soluble sizing composition adapted to be employed for the sizing of textile yarns having a basis of staple fibers or continuous filaments of a textile material.

Another object of this invention is to provide a highly efficient sizing composition comprising an aqueous solution of water-soluble cellulose acetate or other water-soluble organic acid ester of cellulose suitable for the sizing of highly twisted crepe yarns having a basis of cellulose acetate or other organic derivative of cellulose.

A further object of this invention is the production of improved crepe fabrics woven of highly twisted crepe yarns of cellulose acetate or other organic derivative of cellulose textile material by employing a lower degree of twist than heretofore and without varying the composition of the aqueous creping or boil-off bath employed for developing the crepe figure.

Other objects of this invention will appear from the following detailed description.

Fabrics of cellulose derivative materials exhibiting crepe effects are usually produced by incorporating in the fabrics cellulose acetate or other organic derivative of cellulose yarns to which a relatively high degree of twist has been imparted while said yarns are subjected to the action of hot aqueous media such as steam or hot water, and then giving these fabrics a treatment in hot, scouring or boil-off baths. The highly twisted yarns apparently undergo a buckling in the hot bath and impart the desired crepe effect to the fabrics. Suitable development of a commercially satisfactory degree of crepe normally requires a high degree of twist and a prolonged treatment in the scouring or boil-off bath, which treatment may be anywhere from 2 to 3 hours or more. Since the insertion of a high twist in the yarns is a costly and time consuming operation, any reduction in the degree of twist inserted without any lessening of the crepe effect produced on boiling-off fabrics containing said crepe-twisted yarns would be highly advantageous.

We have now found that the amount of twist

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inserted in highly twisted crepe yarns having a basis of cellulose acetate or other organic derivative of cellulose may be appreciably reduced without decreasing the crepe effect obtained in fabrics woven of said highly twisted crepe yarns when boiled off, by sizing said cellulose acetate or other organic derivative of cellulose yarns, prior to crepe twisting with a sizing composition comprising an aqueous solution of a water-soluble organic acid ester of cellulose, such as water-soluble cellulose acetate. The sized and crepe-twisted cellulose acetate or other organic derivative of cellulose yarns thus obtained, may be woven into a fabric of the desired weave and the crepe then developed in a rapid and efficient manner by immersing the fabric in a hot, aqueous scouring bath and maintaining the fabric in the boil-off bath until the desired crepe effect is produced, e. g. for about 1 to 2 hours. The crepe effect obtained by our novel process is clearly delineated and the figure fully equal to that usually obtained in spite of the reduction in the degree of twist inserted in the yarns. Thus, for example, a twist of 55 to 67 turns per inch in the sized yarn is satisfactory for the development of a commercially acceptable crepe by our novel process as compared to a twist of 72 to 77 turns per inch where unsized yarns are employed. Where yarns are sized in accordance with our novel process and then a twist of, say, 72 to 77 turns per inch inserted therein a crepe figure even better than that normally obtained with said degree of twist is produced when a fabric containing said sized and highly twisted yarn is boiled off.

The sizing composition employed in accordance with our invention is preferably prepared by dissolving from 3.5 to 10 parts by weight of a water-soluble organic acid ester of cellulose, such as cellulose acetate of an acetyl value of 19 to 29%, calculated as acetic acid, in 100 parts by weight of water and then adding thereto, if desired, from 0.4 to 2 parts by weight of a softening agent for the size film such as, for example, urea, diethylene glycol, polyethylene glycol, or propylene glycol. The resulting sizing composition may be applied to the yarn at any convenient stage in the winding of the yarns but optimum results are obtained when said size is applied to the yarns at the point where they leave the metier or spinning cabinet in which they are formed, but prior to the insertion of the crepe twist. A roller or any other convenient furnishing device for applying a controlled amount of the size may be employed. The application of about 2 to 5%,

based on the weight of the yarns, of the water-soluble organic acid ester of cellulose, calculated on a dry basis, yields smooth, strong yarns which may be efficiently woven into fabrics which produce an excellent crepe figure when boiled off.

Solutions of water-soluble organic esters of cellulose may also be used in place of the usual gelatin or starch sizes for sizing low twist yarn warps. In this case, the size can be applied either at the spinning machine or on a standard slasher, and the addition of urea or other softener such as diethylene glycol, polyethylene glycol or propylene glycol to the sizing composition is preferable. As indicated above, the use of a softener in the sizing composition may be eliminated when the water-soluble cellulose ester sizing compositions are employed for sizing crepe yarns, prior to crepe twisting, which yarns are woven as the filling in crepe fabrics which are then subjected to a boiling off treatment to develop the crepe figure. The sizing compositions may be applied to the yarns at temperatures of from about room temperature, i. e. 20° C., up to just below the boiling point of the sizing composition. Usually, the sizing composition is most advantageously applied at temperatures of 20° to 25° C. when sizing yarns which are to be crepe twisted and at 65 to 70° C. when applied to warps.

Various water-soluble organic acid esters of cellulose may be employed in preparing the sizing composition. Thus, water-soluble cellulose acetate, water-soluble cellulose propionate, water-soluble cellulose butyrate, water-soluble cellulose acetate-propionate and water-soluble acetate-butyrate may all be applied to said yarns as a size.

Where water-soluble cellulose acetate is employed, for example, the latter may be prepared by acetylating cellulose, with or without an activating pretreatment with organic acids or organic acids containing some sulfuric acid, by employing an esterifying medium comprising acetic anhydride and an acid esterification catalyst, such as sulfuric acid, together with glacial acetic acid which acts as a solvent for the cellulose acetate formed. The sulfuric acid catalyst may be present in amounts of from 9 to 15% or even 20% on the weight of the cellulose. Part of the sulfuric acid catalyst may be introduced during the pretreatment which is designed to render the cellulose more reactive. When acetylation is completed water is stirred into the reaction mixture to convert the excess acetic anhydride to acetic acid and, after the addition of a further quantity of water, the resulting solution of cellulose acetate in acetic acid containing the sulfuric acid employed as the catalyst is permitted to stand and to ripen until the cellulose acetate reaches water-solubility, i. e. when the cellulose acetate has an acetyl value of about 19 to 29%, calculated as acetic acid. The water-soluble cellulose acetate may then be purified by extracting the acetic acid present from the solution in which ripening was conducted by employing a suitable organic extractant in which the acetic acid is soluble. The water may then be evaporated to yield a dried, water-soluble cellulose acetate suitable for preparing the sizing composition. In lieu of evaporating the water, the concentration of the water-soluble cellulose acetate may be adjusted in the solution to yield a sizing composition of the desired concentration with a suitable amount of urea being added thereto.

In lieu of preparing the water-soluble cellulose acetate by a direct process involving the continuous ripening of the cellulose acetate, highly advantageous results may be obtained if the water-soluble cellulose acetate is prepared from cellulose acetate which has been prepared in the usual manner and ripened to acetone solubility, e. g. to an acetyl value of 53 to 56%, calculated as acetic acid. This acetone-soluble cellulose acetate is precipitated, washed and dried, redissolved in aqueous acetic acid and then ripened at an elevated temperature of 40 to 80° C. in the presence of a small amount of added sulfuric acid to aid the ripening.

In the preparation of the sizing composition, particularly advantageous results are obtained if the acetone-soluble cellulose acetate employed for further ripening to water-solubility comprises the fines, or small, finely-divided particles of cellulose acetate which are obtained on filtering the aqueous solution in which the precipitation of commercial, acetone-soluble cellulose acetate has been effected, after the removal, of course, of the larger and more desirable flakes or fibers by screening, or the like. The ripening of said fines to water-solubility in aqueous acetic acid at elevated temperature produces a water-soluble cellulose acetate of excellent characteristics. Such a process for the production of the water-soluble cellulose acetate size provides a very useful outlet for the utilization of such fines which are normally of such a low degree of polymerization as to be substantially worthless for the preparation of commercially valuable yarns, filaments and foils.

In order further to illustrate this invention, but without being limited thereto, the following examples are given:

Example I

40 parts by weight of water-soluble cellulose acetate having an acetyl value of about 21%, calculated as acetic acid, are dissolved in water and the solution obtained is then diluted so that the total amount of water present is about 1000 parts by weight. The sizing composition thus prepared is applied while at a temperature of 25° C. to a 120 denier, 32 filament yarn of cellulose acetate having an acetyl value of 54%, calculated as acetic acid, at the point where said yarn issues from the spinning cabinet or metier in which it is formed. A suitable roller is employed for applying the size and about 4% on the weight of the yarn of the water-soluble cellulose acetate, on a dry basis, is applied thereto. The sized yarn is downtwisted to 3 turns per inch, and then uptwisted to 67 turns per inch through steam. The crepe-twisted, sized yarns are then woven as the filling in a warp consisting of 120 ends of 100 denier, 40 filament, 5 turns per inch cellulose acetate yarn. The fabric is boiled off in a boil-off bath comprising a 0.5% aqueous solution of sulfated lauryl alcohol at a temperature of 98° C. for 90 minutes. The boil-off treatment shrinks the fabric in width from 47 inches to about 40 inches with the development of an excellent crepe figure. The crepe figure developed is equivalent to that obtained when employing an unsized crepe-twisted yarn having 77 turns per inch inserted therein and boiled off in the above manner.

Example II

70 parts by weight of water-soluble cellulose acetate having an acetyl value of 21%, calculated as acetic acid, are added to 830 parts by weight of cold water and, after soaking for 2 hours to dissolve the cellulose acetate, the solution is then

heated to 65° C. and 8 parts by weight of urea added. The solution of water-soluble cellulose acetate obtained is applied as a warp size to a 100 denier, 5 turn, 32 filament cellulose acetate yarn on a regular slasher at a temperature of 65° C. so that about 3% by weight of the size is applied to the yarn, on a dry basis. The sized warp is then woven out to form a fabric of satin construction employing a 200 denier cellulose acetate yarn in the filling. Upon examination, the fabric obtained is found to have a considerably lesser number of broken ends than a similar fabric in which the warp has been sized with the usual commercial starch sizing.

While our invention has been more particularly described in connection with the sizing of continuous filament yarns of an organic derivative of cellulose employing our novel sizing composition, the invention may also be employed satisfactorily for the sizing of spun yarns comprising staple fibers of cellulose acetate or other organic derivative of cellulose, or of cotton yarns, wool, silk, regenerated cellulose, synthetic linear polyamide condensation products or other polymeric material, casein or any other textile material requiring a size during weaving operations, whether said yarns comprise continuous filaments or staple fibers, as the case may be.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention, what we desire to secure by Letters Patent is:

1. In a process for the production of fabrics exhibiting crepe effects wherein yards of lower fatty acid ester of cellulose filaments are sized, a crepe twist inserted into said sized yarns, the sized, crepe-twisted yarns incorporated into a fabric, and the fabric treated with a hot aqueous bath to develop the crepe figure, the step of sizing the yarns of lower fatty acid ester of cellulose filaments with a sizing composition consisting of an aqueous solution containing a water-soluble lower fatty acid ester of cellulose and urea under such conditions that from 2 to 5% by weight of the said water-soluble lower fatty acid ester of cellulose is placed upon the yarns.

2. In a process for the production of fabrics exhibiting crepe effects wherein yarns of cellulose acetate filaments are sized, a crepe twist inserted into said sized yarns, the sized, crepe-twisted yarns incorporated into a fabric, and the fabric treated with a hot aqueous bath to develop the crepe figure, the step of sizing the yarns of cellulose acetate filaments with a sizing composition consisting of an aqueous solution containing a water-soluble cellulose acetate and urea under such conditions that from 2 to 5% by weight of said water-soluble cellulose acetate is placed upon the yarns.

3. In a process for the production of fabrics exhibiting crepe effects wherein yarns of cellulose acetate filaments are sized, a crepe twist inserted into said sized yarns, the sized, crepe-twisted yarns incorporated into a fabric, and the fabric treated with a hot aqueous bath to develop the crepe figure, the step of sizing the yarns of cellulose acetate filaments with a sizing composition consisting of an aqueous solution containing 3.5 to 10% by weight of a water-soluble cellulose acetate and from 0.4 to 2% by weight of urea under such conditions that from 2 to 5% by weight of said water-soluble cellulose acetate is placed upon the yarns.

4. A sizing composition for the sizing of textile yarns, consisting of an aqueous solution containing a water-soluble lower fatty acid ester of cellulose and urea.

5. A sizing composition for the sizing of textile yarns, consisting of an aqueous solution containing a water-soluble cellulose acetate and urea.

6. A sizing composition for the sizing of textile yarns, consisting of an aqueous solution containing from 3.5 to 10% by weight of water-soluble cellulose acetate and 0.4 to 2% by weight of urea.

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