PROCESS FOR PRODUCING PERMANENT CREASES AND OTHER DESIRABLE PROPERTIES IN TEXTILE FABRICS
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4 Claims

ABSTRACT OF THE DISCLOSURE

Process for producing a permanent crease in garments made from wrinkle-resistant fabric and the product thereof comprising impregnating the fabric, prior to cutting and sewing of the garment, with a composition comprising a predominant amount of a reactive thermoplastic polymer having a reactive group and a minor amount of a thermosetting reactant, drying the resin-impregnated fabric and heating the fabric sufficiently to cure the resin and effect cross-linking between the reactive thermoplastic polymer and the thermosetting reactant, thereby rendering the impregnated textile fabric receptive to permanent creasing by pressing at elevated temperatures, cutting and sewing the fabric to produce the desired garment, and pressing a permanent crease in the garment without further curing of the resin.

This invention relates to a process for producing a permanent crease in garments made from resin impregnated wrinkle-resistant fabrics, after cutting and sewing of the garment, and without the necessity of any heating of the garment to cure the resin after pressing of the crease therein, or any pretreatment of the garment to permit creasing. No heretofore has been able to obtain this commercially important result despite numerous efforts.

There is present wide commercial interest in wrinkle resistant fabrics that are adapted to be creased permanently when cut and sewn to produce certain garments, such as men's trousers and women's pleated skirts. But the major problem has been that of obtaining adequate permanent wrinkle resistant effects, by treatment of the fabric with resins or other chemicals before the fabric is converted into garments, and still leave the fabric receptive to permanent creasing of the garment without heating of the garment, after creasing, to cure the resin.

One of the current processes that has attracted substantial attention in this field is disclosed in Warnock Patent No. 2,974,432, issued Mar. 14, 1961. It provides ultimate wrinkle resistant properties by first resin impregnation of the fabric, next drying of the fabric at a low temperature to avoid curing of the resin, followed by cutting and sewing of the fabric to produce garments such as men's slacks, pressing creases in the slacks with the usual heated press or iron, then suspending the creased slacks in an oven and heating the slacks in the oven for a period of time and at sufficiently high temperature to cause the resin to cure or set and to render the crease permanent. This prior process has the disadvantage of not being able to complete the finishing of the fabric at the finishing plant by persons especially skilled in finishing processes and techniques, and requires the garment manufacturer to complete the finishing of the fabric, i.e., the curing of the resin.

This prior patented process also has the objection of requiring careful control of the drying process at the finishing mill to prevent over drying or preliminary curing of the resin, which in turn would prevent permanent creasing by the garment manufacturer; or premature curing of the resin during storage of the fabric, which likewise would prevent subsequent creasing of the garment by the garment manufacturer.

Also, it requires the garment manufacturer to make substantial capital investment in curing ovens which are already available at the finishing plant but cannot be used for the reason that final curing of the conventional resin impregnated fabric, before garment manufacture, would prevent subsequent permanent creasing of the fabric in the garment.

Another prior process involves curing of the resin in the fabric at the finishing plant to give the wrinkle resistant property, followed by making of the garment and imparting the crease by a special procedure. The latter comprises applying an acid or other suitable chemical to the restricted area of the garment where the crease is to be made and then pressing the garment along the line of the treatment. This process has the objection of requiring special treatment by the garment manufacturer beyond his usual field of experience, and renders the creasing operation tedious. Further, the acid treatment creates the problem of spotting or discoloration of the goods.

With the single exception mentioned above, which created other problems, all of the prior attempts of which we are aware in the field of permanent creases, have contemplated curing of the resin after the crease has been imparted to the finished garment, for the reason that it was not considered possible or practical to provide a permanent crease in a garment made from fabric in which the resin impregnant had already been cured prior to cutting and sewing of the garment.

In accordance with the present invention, we have accomplished the long desired objective of being able to complete the resin finishing of the fabric at the finishing plant, by using a special form of resin composition which gives good wrinkle resistance and at the same time permits imparting of a permanent crease in garments formed from fabrics treated with this special resin composition, after the garment is produced. One of the important and unique features of our invention which has made this possible for the first time, is the use of a resin composition that comprises a soluble reactive thermosetting resin component in minor amount, e.g., 20%—40%, and an insoluble reactive thermoplastic resin component in unusually large proportion, e.g., 60%—80%.

Another important feature of our invention is the use of special forms of the thermoplastic resin component which contain reactive side groups that effect cross-linking of the thermoplastic component with the thermosetting component. The thermoplastic polymer component is a medium soft to medium hard, film forming, linear, water insoluble (in latex form) copolymer (or mixture of copolymers) formed from a preponderant amount, e.g., about 80%—99%, of one or more monomers of the type

\[
CH = C - R_1
\]

in which \( R_1 \) is selected from the group consisting of hydrogen, alkyl, and aryl and \( R_2 \) is selected from the group consisting of cyano, chloro, alkylcarboxy, and acetoxy, and a minor amount, e.g., about 1%—20%, of one or more monomers of the type

\[
CH = C - R_3
\]

in which \( R_3 \) is selected from the group consisting of hy-
drogen, chloro, alkyl, aryl, alkoxy, acetoxy, and R₄ is selected from the group consisting of carboxy, amino, amido, hydroxalkyl, aminooalkyl, and amidoalkyl.

Illustrative but non-limiting examples of the above mentioned preponderant amount of monomers are butadiene, acrylonitrile, styrene, acrylic esters, vinyl acetate, and vinyl chloride. Illustrative but non-limiting examples of the minor amount of monomers are acrylonitrile acid, methacrylic acid, acrylamide, and methacrylamide.

The soluble reactive component, i.e., the thermosetting resin of the resin composition, may be any of the reactants or reactant resins used to crosslink cellulose and give wrinkle resistant properties to cellulose fabrics. It may be selected from the group consisting of the condensation products of urea and formaldehyde, ethylene urea and formaldehyde, amino triazine and formaldehyde, and alkyl carbamate and formaldehyde.

The resin accelerator may be selected from the group consisting of acid, ammonium salt, amine salt or metal salt. Suitable examples are magnesium chloride, zinc nitrate and 2-amino-2-methyl-1-propanol hydrochloride.

Illustrative but non-limiting examples of suitable resinous compositions, which contain predominant proportions of the thermoplastic component with reactive side groups, and minor proportions of the thermosetting component, for impregnating the fabric so as to obtain good wrinkle resistant effects yet render it susceptible for imparting a permanent crease in garments produced from this fabric, are as follows:

Example I
A solution is prepared by mixing the following ingredients:

<table>
<thead>
<tr>
<th>Parts by wt.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>33.0</td>
</tr>
<tr>
<td>Non-ionic wetting agent (trimethyl nonyl ether of polyethylene glycol)</td>
<td>1.0</td>
</tr>
<tr>
<td>Magnesium chloride (50% solution) (on basis of anhydrous salt)</td>
<td>10.0</td>
</tr>
<tr>
<td>Thermosetting reactant (50% solution) (mixture of water soluble, essentially monomeric condensation products of melamine, formaldehyde, and methanol, having the empirical composition of the dimethyl ether of trimethyl melamine)</td>
<td>16.0</td>
</tr>
<tr>
<td>Water dispersion (45%) of a soft thermoplastic copolymer formed from ethyl acrylate, lauryl methacrylate, acrylamide, and methacrylic acid</td>
<td>30.0</td>
</tr>
<tr>
<td>Water dispersion (45%) of a medium hard thermoplastic copolymer formed from ethyl acrylate, methyl methacrylate, and methacrylate acid</td>
<td>10.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

The solution described above is applied on a three roll padder at 55% wet pick up (14% of the combined dry weight of the thermosetting reactant and thermoplastic copolymer on the basis of the dry weight of the fabric) to a twill fabric (7 ounces per square yard) containing 50% cotton and 50% polyester fibers. The fabric is dried at 250–300° F in a steam heated tenter frame and cured 2 minutes at 325–350° F in a gas heated curing oven.

The fabric weighs approximately 8 ounces per square yard and contains a resinous composition in the amount of approximately 12 percent of the finished fabric. It has durable wrinkle resistance and durable shrink stabilization.

Example II
A solution is prepared by mixing the following ingredients:

<table>
<thead>
<tr>
<th>Parts by wt.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>45.6</td>
</tr>
<tr>
<td>Non-ionic wetting agent (trimethyl nonyl ether of polyethylene glycol)</td>
<td>1.0</td>
</tr>
<tr>
<td>Hydrochloride (30%) of 2-amino-2-methyl-1-propanol</td>
<td>6.4</td>
</tr>
<tr>
<td>Thermosetting reactant (80% solution) (mixture of water soluble, essentially monomeric condensation products of melamine, formaldehyde, and methanol, having the empirical composition of the dimethyl ether of trimethyl melamine)</td>
<td>9.0</td>
</tr>
<tr>
<td>Water dispersion (45%) of a reactive thermoplastic (formed from 92.5% ethyl acrylate, 5% methyl methacrylate, and 2.5% acrylic acid)</td>
<td>38.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

The solution described above is applied on a three roll padder at 55% wet pick up (12% of the combined dry weight of the thermosetting reactant and the reactive thermoplastic polymer on the basis of the dry weight of the untreated fabric) to vat dyed cotton twill weighing 7 ounces per square yard. The fabric is dried at 250–300° F in a steam heated housed tenter frame and cured 2 minutes at 325–350° F in a gas heated curing oven.

The finished fabric weighs approximately 8 ounces per square yard. It contains approximately 10.5% resinous composition on the basis of the weight of finished fabric. The fabric has durable wrinkle resistance and durable shrink resistance.

Example III
Same as Example II except that the reactive thermoplastic polymer is formed from 43% butadiene, 52% styrene, and 5% acrylic acid.

Example IV
Same as Example II except the reactive thermoplastic polymer is formed from 64% butadiene, 31% acrylonitrile, and 5% methacrylic acid.

Example V
A solution is prepared by mixing the following ingredients:

<table>
<thead>
<tr>
<th>Parts by wt.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>36.0</td>
</tr>
<tr>
<td>Non-ionic wetting agent (trimethyl nonyl ether of polyethylene glycol)</td>
<td>1.0</td>
</tr>
<tr>
<td>Zinc nitrate (30% solution) (on basis of anhydrous salt)</td>
<td>8.5</td>
</tr>
<tr>
<td>Thermosetting reactant (45% solution) (formed from 56% ethyl acrylate, 40% ylal ethylenoeura)</td>
<td>16.0</td>
</tr>
<tr>
<td>Water dispersion (45%) of a reactive thermoplastic polymer (formed from 92.5% ethyl acrylate, 5% methyl methacrylate and 2.5% acrylic acid)</td>
<td>38.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

The solution described above is applied on a three roll padder at 55% wet pick up (12% of the combined dry weight of the thermosetting reactant and the reactive thermoplastic polymer on the basis of the dry weight of the untreated fabric) to a twill fabric weighing 5 ounces per square yard. The fabric is dried and cured in a heated tenter frame for 2 minutes at 325° F. The finished fabric weighs approximately 5.6 ounces per square yard. It has durable wrinkle resistance and durable shrink resistance.

In the above described processes for preparing the wrinkle resistant, shrink stabilized fabric which can be permanently creased by hot pressing in the presence of moisture, the fabric is usually dried and cured in a housed tenter frame and cured in an oven operating in tandem. However, when a fast curing reactant-accelerator composition is used, such as disclosed in Example V above, the fabric may be dried and cured in a housed tenter frame alone.

The amount of resin composition, containing both the thermoplastic and thermosetting components, used for treating the fabric in accordance with our invention, may
vary widely with different types of fabrics and in general, the dry weight of resin will vary from approximately 6% to 27% based on the total weight of the treated fabric.

For the final step of producing garments with permanent creases in accordance with our invention, the fabrics treated with any of the resins described in the foregoing examples and in accordance with the process steps discussed above, may be used. The garments made with these fabrics may be fashioned by conventional cutting and sewing operations, commonly employed in the production of man's trousers and women's skirts, and without requiring any skill on the part of the garment manufacturer with respect to finishing of the fabric. In other words, the fabric as shipped from the finishing mill is ready for immediate fabrication into the desired garments and pressing of a permanent crease or creases in the garments so produced. The permanent creases may be imparted by conventional means, such as for example steam emitting hot head presses adjusted to give a minimum pressure on the garment of about 10 pounds per square inch and a minimum temperature of about 330°F. After pressing of the permanent creases in the garments, they require no further processing.

Fabrics suitable for use in the above described process or product consist of fibers made from cellulose or hydrophilic cellulose derivatives, blends of these fibers with each other, or blends of these fibers with other fibers. Suitable but non-limiting examples are cotton, linen, rayon, cellulose acetate, cotton-polynysac rayon, cotton-polyamide, cotton-polyester, cotton-acrylic, rayon-mod-acrylic, cotton-polypropylene, cotton-cellulose tricatetate, and rayon-wool.

It is believed that the wrinkle resistant and permanent crease properties of the garments made from the above described resin impregnated fabrics are obtained because a portion of the reactant and accelerator penetrates the cellulose fibers and on curing crosslinks the cellulose molecules to give a wrinkle resistant and shrink stabilized fabric; and another portion of the reactant and accelerator and substantially all of the thermoplastic polymer remains on the surface of the fibers and on curing forms a coating of a crosslinked thermoplastic composition. This coating of crosslinked thermoplastic composition imparts to the fabric that property which results in a permanent crease when the garment made from the fabric is pressed at an elevated temperature in the presence of moisture.

Various modifications and changes may be made in the above described processes and components without departing from the scope of our invention as defined in the appended claims.

We claim:

1. A process for producing a permanent crease in garments made from wrinkle resistant fabrics comprising impregnating the fabric, prior to cutting and sewing of the garment, with an aqueous resinous composition comprising a predominant amount of 60% to 80% of an insoluble reactive thermoplastic polymer having a reactive group selected from the class consisting of carboxy, hydroxy, amino and amido groups, and a minor amount of 20% to 40% of a soluble reactive thermosetting resin component, drying the resin impregnated fabric and heating the fabric sufficiently to cure the resin and effect crosslinking between the reactive thermoplastic polymer and the thermosetting resin component to form a crosslinked thermoplastic coating which renders the impregnated textile fabric receptive to permanent creasing by pressing at elevated temperatures, cutting and sewing of the fabric to produce the desired garment, and pressing a permanent crease in the garment without further curing of the resin.

2. A process as defined in claim 1 and in which the thermoplastic polymer is formed from a major proportion of monomers selected from the group consisting of butadiene, acrylonitrile, styrene, acryic esters, vinyl acetate, and vinyl chloride, and a minor proportion of monomers selected from the group consisting of acrylic acid, methacrylic acid, acrylamide, and methacrylamide.

3. A process as defined in claim 1 and in which the thermosetting reactant is selected from the group consisting of urea formaldehyde, ethylene urea formaldehyde, amino triazine formaldehyde and alkyl carbamate formaldehyde.

4. A process for producing permanent creases and other desirable properties in textile fabrics comprising impregnating the fabric with an aqueous resinous composition comprising about 60% to 80% of an insoluble reactive thermoplastic polymer having a reactive group and formed from an acrylic ester and an acrylic acid, and about 20% to 40% of a soluble reactive thermosetting resin component, drying the resin impregnated fabric and heating the fabric sufficiently to cure the resin and effect crosslinking between the reactive thermoplastic polymer and the thermosetting resin component to form a crosslinked thermoplastic coating which renders the impregnated textile fabric receptive to permanent creasing by pressing at elevated temperatures, and pressing a permanent crease in the fabric without further curing of the resin.

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