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PROCESS OF PRODUCING METALLIZING EFFECTS ON TEXTILES

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This invention relates to a process of metallizing textiles and to the resulting products.

The process of providing various textiles with a thin metal coating by depositing thereon vaporized metals in a high vacuum, thereby imparting to these textiles a metallic appearance without impairing the valuable textile properties such as flexibility, suppleness, and heat retention, is known. Nevertheless, in the case of textiles consisting of natural or artificial cellulosic material metal coatings so deposited tend to crock or peel off from the fiber or fabric particularly when such fabric or fiber is wetted.

The principal object of the present invention, accordingly, is to eliminate this difficulty, at least in part.

The invention comprises the novel products as well as the novel processes and steps of processes according to which such products are manufactured, the specific embodiments of which are described hereinafter by way of example and in accordance with which we now prefer to practice the invention.

In accordance with our invention, we have found that crocking or peeling of such metal-coated textiles is due at least in part to swelling of the cellulosic fiber on wetting same. The swelling increases the dimensions of the fiber and since the metal does not similarly swell, it is loosened and comes off. Another reason for such crocking or peeling is that cellulosic fibers, in themselves, have a low adhesion to metals so deposited as compared with natural animal fibers or completely synthetic polymer fibers. The expression "cellulosic" textile, or fabric, as used herein, is intended to designate a textile fabric composed of, or containing substantial amounts of artificial cellulosic fibers such as viscose or similar regenerated cellulose or natural cellulosic fibers, such as cotton and other cellulose containing natural fibers.

We have also found, in accordance with our invention, that the defects mentioned may be at least in part overcome by treating the cellulosic textile or fabric with an antismelling agent or agent to inhibit swelling thereof when coated with metal. Thereafter, such treatment appears to inhibit separation of the metal and to improve its adherence to the cellulosic material. A further improvement may be effected by thinly coating said material, in addition to the treatment with the anti-swelling agent, with a water-insoluble resin. When cellulosic material is so treated with both anti-swelling agent and a thin coating of resin, there is a great improvement in both the resistance to peeling or crocking. The resulting metallized products are accordingly resistant to the crocking and peeling mentioned.

Agents to inhibit the swelling of the cellulosic fiber include solutions of formaldehyde. Glyoxal and pyruvicaldehyde may also be used. These substances are employed with an acid catalyst. The so-treated textile is heated to an elevated temperature. Instead of such treatment, methylolamide resins and resins of acetone-formaldehyde may be incorporated in the textile.

For thinly coating the textile treated with the anti-

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swelling agent, we may employ water-insoluble natural resins, such as shellac or rosin. As water-insoluble plastics, there are suitable for instance film-forming resins obtained by polymerization, particularly vinyl resins, for instance polymers of vinylchloride, vinylidenechloride, vinylacetate, vinylacetal, vinylbutyral or copolymers thereof, as well as acrylic and methacrylic resins and also polystyrene resins. There can also be used film-forming resins obtained by polycondensation, particularly aminoplast-ether resins, for instance urea- or melamine-formaldehyde-ether resins, alkyd resins, for instance glyptal resin, alkyd-alkylaminoplastether co-resins or ethoxyline resins. Resins or plastics can be applied to the textile material either in the form of solutions in organic solvents or in the form of aqueous emulsions. When resins are used which have the property of condensing further at higher temperature and thereby becoming insoluble such as, for instance, urea and melamine formaldehyde-ether resins, ethylene resins, alkyd resins or alkyd-alkylaminoplast ether resins, the strength of adherence of the metal layer which is deposited by vaporization is further increased if the material treated with the metal vapor is subsequently cured, that is, after application of aluminum or other metal, by heating at an elevated temperature.

Textiles usable in the process are flat textiles, such as woven or knitted fabrics and the like of natural cellulosic fibers or regenerated cellulose. Flat textiles, such as knitted or woven fabrics, can furthermore after the treatment with the agent for reducing the swellability be calendered before the heating, which heating is part of the process for reducing the swellability, in accordance with our invention, for instance by means of a friction calender.

The following are examples of processes, in accordance with our invention, as we now prefer to practice it:

Example 1

Dyed satin which consists in the warp and filling of viscose rayon is impregnated with an aqueous solution containing per liter 100 cc. of 37% formaldehyde solution and 10 grams of oxalic acid. The treated fabric is dried on a tenter frame, heated for two minutes at 140° C., rinsed with hot water, and dried on a tenter frame. The satin is then coated with aluminum by vaporizing the same at a temperature between 800–1000° C., in a high vacuum of about 5.10⁻⁵ mm. Hg, and condensing the aluminum on the satin to form a coating in a known manner.

Example 2

Dyed viscose spun rayon poplin is impregnated with an aqueous solution containing per liter 80 cc. of 40% formaldehyde, 16 grams zinc chloride and 8 grams potash alum, dried on a tenter frame, friction-calendered, heated for 2½ minutes at 150° C., washed with hot water, dried and coated with aluminum by vaporizing and condensing the same in a high vacuum as in Example 1.

Example 3

Mercerized cotton poplin is impregnated with an aqueous solution containing per liter 50 grams dimethylol urea, 100 cc. of a 37% formaldehyde solution and 3 grams monoammoniumphosphate, dried on a tenter frame, heated for 2½ minutes at 140° C., to condense the dimethylol urea washed with water containing 2 grams soda per liter at 40° C., rinsed, dried, and thereupon treated in a high vacuum of about 5.10⁻⁵ mm. mercury, first of all with copper vapor at a temperature between 1000–1300° C. with subsequent deposition and thereupon with gold vapor at a temperature between 1000–1500° C., with subsequent deposition.

Example 4

Dyed cotton percale is impregnated with an aqueous solution containing per liter 120 grams of tetramethylolmelamine and 5 grams of triethanolaminelactate as catalyst, dried on a tenter frame, friction-calendered with heated rollers, cured at 160° C. for 3 minutes, to further condense the tetramethylolamine, washed with water containing 2 grams dodecyl sulfate per liter, dried on a tenter frame and coated with aluminum by vaporizing and condensing same as in Example 1.

Example 5

Dyed spun-rayon cretonne is impregnated with a solution containing, per liter, 100 grams of tetramethylolmelamine and a catalyst, namely triethanolamine glycolate, which gives off acid in the hot, dried on a tenter frame, friction-calendered at about 160° C., heated at 160° C. for 4 to 5 minutes in a heating chamber, washed with a synthetic detergent such as sodium salt of taurine oleate, dried on a tenter frame, impregnated with an aqueous emulsion of polyvinylbutyral, containing 4% of said polyvinylbutyral, and dried on a tenter frame. Aluminum is deposited on the so-treated fabric in the manner given in Example 1.

Example 6

Dyed viscose taffeta is impregnated with an aqueous solution containing, per liter, 40 grams pure formaldehyde and 10 grams of oxalic acid, dried on a tenter frame, heated at 140° C. for 2 minutes, rinsed with hot water, dried on a tenter frame, impregnated with an aqueous 5% emulsion of a polymethacrylate, and dried on a tenter frame. Aluminum is deposited on the so-treated fabric in the manner given in Example 1.

Example 7

Dyed "crepe lavable" of cuprammonium rayon is impregnated with an aqueous solution containing, per liter, 90 grams of dimethylolethylene urea and 1.5 grams ammonium chloride, dried on a tenter frame, heated at 145° C. for 2½ minutes, rinsed with hot water, dried on a tenter frame, impregnated with an aqueous polyvinylacetate resin emulsion containing 3% resin, and dried on a tenter frame. Aluminum is deposited on the so-treated fabric in the manner given in Example 1.

Example 8

Dyed crepe satin of viscose rayon is impregnated with a solution containing, per liter, 120 cc. glyoxal and 12 grams oxalic acid, dried on a tenter frame, heated at 145° C. for 3 minutes, washed with hot water containing 2 grams soda and 2 grams of a sodium salt of taurine oleate per liter, rinsed, dried on a tenter frame, sprinkled with a solution of a precondensate of methylolmelamine ether resin in toluene containing 8% of resin, dried, and finally heated at 140° C., for 4 minutes in order to cure the methylolmelamine resin. Aluminum is deposited on the so-treated fabric in the manner given in Example 1.

Example 9

Dyed cotton percale is impregnated with an aqueous solution containing per liter 100 grams tetramethylolmelamine and 4 grams triethanolamine glycolate. Thereupon the fabric is dried on a tenter frame, friction-calendered with heated rollers, cured at 150° C. for 4 minutes, washed with water containing 1 gram soda per liter at 60° C. and dried on a tenter frame. The fabric is then impregnated with an aqueous emulsion of a polymethacrylate containing 25 grams solids per liter, dried on a tenter frame and coated with aluminum by vaporizing and condensing the same in the manner given in Example 1.

Each of the fabrics prepared in accordance with the above examples shows a greatly improved resistance to crocking and when the materials are wet they show sub-

stantially no loss of metal coating due to swelling of the fibers. Thus, when materials of this sort are made up into wearing apparel, they show substantially no signs of crocking, even when the garments are worn over long periods and show substantially no loss of coating even when wet.

We claim:

1. A process which comprises impregnating a textile fabric of natural or regenerated cellulose fiber material with an aqueous solution of an antishwelling agent selected from the group consisting of an aldehyde and a condensable methylol compound and an acid catalyst, heating the so impregnated material at a temperature of between 120° and 180° C. for 1 to 5 minutes, coating said fabric with a thin continuous coating of water-insoluble film-forming synthetic resin selected from the group consisting of polyvinylbutyral, polyvinylacetate, polyacrylate and polymethacrylate, and vaporizing at least one metal and condensing a thin coating of said metal thereon, whereby peeling of said metal from the fabric when wet is inhibited.

2. A process which comprises impregnating a penetrable cellulosic fabric selected from the group consisting of fabric of natural and regenerated cellulose fiber with an antishwelling agent selected from the group consisting of an aldehyde and a condensable methylol compound and an acid catalyst, heating the so impregnated fabric, and vacuum-vaporizing and condensing at least one metal thereon to coat the textile therewith.

3. A process which comprises impregnating a penetrable cellulosic fabric selected from the group consisting of fabrics of natural and regenerated cellulose fiber with an antishwelling agent selected from the group consisting of an aldehyde and a condensable methylol compound and an acid catalyst, heating the so impregnated fabric, coating said fabric with a thin continuous coating of water-insoluble resin, vacuum-vaporizing at least one metal, and condensing a coating of said metal thereon.

4. A process which comprises impregnating a regenerated cellulose fabric with an antishwelling agent consisting of an aldehyde and an acid catalyst, heating the so impregnated fabric and vacuum-vaporizing and condensing at least one metal thereon to coat the fabric therewith, whereby peeling of said metal from said fabric when wet is inhibited.

5. A process which comprises impregnating a regenerated cellulose fabric with formaldehyde and an acid catalyst, heating the so impregnated fabric and vacuum-vaporizing and condensing at least one metal thereon to coat the fabric therewith, whereby peeling of said metal from said fabric when wet is inhibited.

6. A process which comprises impregnating a regenerated cellulose fabric with a methylol amide and an acid catalyst, heating the so impregnated fabric and vacuum-vaporizing and condensing at least one metal thereon to coat the fabric therewith, whereby peeling of said metal from said fabric when wet is inhibited.

7. A process which comprises impregnating a regenerated cellulose fabric with an antishwelling agent consisting of an aldehyde and an acid catalyst, heating the so impregnated fabric, coating said fabric with a thin continuous coating of water-insoluble resin and vacuum-vaporizing at least one metal and condensing a coating of said metal thereon, whereby peeling of said metal from said fabric when wet is inhibited.

8. A process which comprises impregnating a regenerated cellulose fabric with an antishwelling agent consisting of an aldehyde and an acid catalyst, heating the so impregnated fabric, coating said fabric with a thin continuous coating of an aminoplast ether resin, and vaporizing at least one metal and condensing a thin coating of said metal thereon, whereby peeling of said metal from said fabric when wet is inhibited.

9. A process which comprises impregnating a regenerated cellulose fabric with an antishwelling agent selected

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from the group consisting of an aldehyde and a condensable methylol compound and an acid catalyst, heating the so impregnated fabric, coating said fabric with a thin continuous coating of water-insoluble resin and vacuum-vaporizing aluminum and condensing a coating of said aluminum thereon, whereby peeling of said metal from said fabric when wet is inhibited.

10. A process which comprises impregnating a penetrable cellulosic fabric selected from the group consisting of fabrics of natural and regenerated cellulose fiber with an acetone-formaldehyde resin and an acid catalyst, heating said impregnated fabric to inhibit swelling thereof, coating said fabric with a thin continuous coating of water-insoluble resin, and vacuum-vaporizing at least one metal and condensing a coating of said metal thereon, whereby peeling of said metal from said fabric when wet is inhibited.

11. A cellulosic textile product selected from the group consisting of a natural cellulose and a regenerated cellulose fabric impregnated with an acid catalyzed antisealing agent selected from the group consisting of an aldehyde and a condensable methylol compound to inhibit swelling of said fabric, and having a surface coating of vacuum-vaporized metal.

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12. A viscose fabric containing cellulose impregnated with formaldehyde, having a thin coating of a water-insoluble resin thereon and a second thin coating of vacuum-vaporized metal.

13. A viscose fabric containing cellulose impregnated with formaldehyde, having a thin coating of water-insoluble resin and a thin coating of vacuum-vaporized aluminum thereon, whereby peeling of said metal from the fabric when wet is inhibited.

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