United States Patent

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[54] **ABRASION AND WRINKLE RESISTANT COTTON CONTAINING FABRIC AND METHOD OF MANUFACTURE**
7 Claims, No Drawings

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ABSTRACT: A method for treating cotton containing fabric for obtaining improved wrinkle-resistance and improved abrasion resistance whereby the fabric is padded through a resin finishing bath containing a mixture of a thermosetting resin and a latex emulsion, is partially dried, and is cured at elevated temperature.

ABRASION AND WRINKLE RESISTANT COTTON CONTAINING FABRIC AND METHOD OF MANUFACTURE

BACKGROUND OF INVENTION

A variety of processes have been developed and used for improving the wrinkle resistance or recovery of fabrics and garments. These processes are known in general as pad, dry, and cure resin treatments where one or more resins are applied to the fabrics through padding, and the fabrics are partially dried before the resin is cured.

The inventor has filed U.S. Pat. application Ser. No. 591,488 on Nov. 2, 1966 which is owned by the assignee of the present invention, Now U.S. Pat No. 3,571,006 The present process provides an improvement over the process of the above application as the earlier process may be modified in accordance with the improved process to substantially increase the abrasion resistance of the products prepared by the process of the cited application.

The conventional thermosetting resin systems either postcured or precured, result in embrittlement and reduction of mobility of the cellulosic fibers to such an extent that tear strength and abrasion resistance are seriously impaired. Tear strength is often reduced by 50 percent and abrasion resistance is reduced by 70–80 percent.

Over the last few years, considerable research work has been in progress seeking to find ways of overcoming this problem without compromising the wash and wear or durable press performance. Many variations from the pad-dry-cure process have been developed in attempts to solve the problem. These include a vapor phase formaldehyde treatment, a multiple stage padding and curing, and a pad and wet fixation cure. The results achieved through all of these processes have been marginal and the process has been found to be cumbersome and often expensive.

SUMMARY OF INVENTION

The present invention makes use of the inclusion of a reactive synthetic rubber latex as a component in the bath that contains the thermosetting resin polymer. A latex emulsion is added directly to the resin finishing bath, and the fabric is padded through this bath, dried and then cured.

Specifically a s-1,3,5-trimethyloltriazine-2,4,6-triol is reacted with a butadiene-styrene polymer containing free carboxyl groups. These carboxyl groups react with some of the terminal hydroxyl groups of the thermosetting resin thus forming a butadiene-styrene-s-1,3,5,-trimethyloltriazine-2,4,6,-triol polymer. This polymer, in turn, through the remaining terminal hydroxyl groups of the s-1,3,5-trimethylol- triazine-2,4,6,-triol reacts with the cellulose molecules through the normal ether linkage when cured. Laboratory tests made on conventional batiste weight cotton shirting fabrics have shown abrasion resistance loss from the unfinished fabric of approximately only 40 percent. This compares with an abrasion resistance loss of 80 percent or more for conventional durable press finishes on the same fabric. This improved abrasion resistance has been achieved with no appreciable reduction in crease recovery or wash and wear appearance.

Accordingly, an object of the present invention is to provide a simplified and effective process for giving both improved abrasion resistance and wet and dry wrinkle recovery to cotton containing fabrics.

Another object of the present invention is to provide a process particularly adapted for improving the abrasion resistance of crease resistant cotton containing fabric.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiments about to be described, or will be indicated in the appended claims and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

DESCRIPTION OF PREFERRED EMBODIMENTS

A preferred embodiment of the process will now be described. The process will be described including the treatment of the fabric preparatory to the manufacturing steps in which the garment is cut and assembled from the treated cloth. The process as described below may be used with cotton fabric or with a mixture of cotton and polyesters such as the well-known blends of 50 percent cotton and 50 percent polyester or 35 percent cotton and 65 percent polyester of other mixtures of these blends.

The principal steps of the process are as follows. The first step is to wet process the fabric which is to be used in making up the garment in the conventional and known manner; that is, singe, desize, mercerize, scour, heat-set, bleach, wash and dry it.

The second step of the process comprises the preparation of an aqueous resin finishing formula with which the fabric is impregnated, dried, cured, afterwashed, and softened.

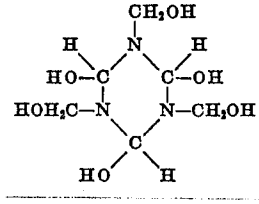
A specific example of a preferred embodiment of the finishing bath is as follows:

FORMULA OF FINISHING BATH

Chemical Component	Percent by weight
50% solution of s-1,3,5 -trimethyloltriazine-2,4,6-triol	12.60
30% solution of silicone softener (hydrogen ethyl or similar type poly-siloxane)	0.30
Amine hydrochloride catalyst	2.20
Ethylenediaminetetraacetic acid	0.03
40% solids emulsion of carboxy modified butadiene-styrene copolymer aqueous emulsion (approximately 70% carboxy modified butadiene and 30% styrene)	4.50
Water	80.57
	100.00

The resin finishing formula is prepared by adding to approximately one-third the total volume of water, the various chemicals listed in the above order. The chemicals are added slowly and with constant agitation. The last ingredient, the carboxy modified butadiene-styrene copolymer is first diluted with water approximately equivalent to its own volume before being added as the final ingredient to the overall finish. The temperature of the finishing mix should be not in excess of 90° F.

The preferred resin contained in the above bath has the following structure:



It is seen that the preferred resin lacks the primary amino characteristics of certain melamines and therefore does not discolor in the presence of chlorine which is present in most home laundering water.

The silicone softener that is added to the bath gives a physical softening to the cloth thereby giving it a better feel or "-hand." It is not an essential component and may be omitted in other embodiments of the invention.

The resin, the catalyst, the latex and the ethylenediamineteraacetic acid, the latter being added to prevent yellowing, are essential ingredients in the preferred formulation.

The carboxy modified butadiene-styrene copolymer emulsion is commercially available under the trademark "Goodrite" sold by B. F. Goodrich Co. of New York, N.Y.

The details of the preferred finishing step are as follows:

The dry fabric is padded in open width through the finishing bath and is then passed through single nip squeeze rollers so as to give minimum wet pickup of 65 percent retaining in the fabric a minimum resin solids add-on of 4.5 percent and a butadiene-styrene solids add-on of at least 1.4 percent. The fabric is dried in a conventional tenterframe dryer at a approximately 210°–230° F. to the point that it contains 6 percent to ° **percent moisture. The dried fabric is then cured for** 1 minute 30 seconds at 365° F. It is then afterward by passing it through a solution of approximately 1 percent sodium perborate and 0.1 percent of a nonionic detergent such as Triton X100 at 130° F.

Although the resin disclosed in the preferred embodiment lacks a primary amino group and is therefore immune to discoloration by chlorine, the present invention's disclosure of adding a carboxy modified butadiene-styrene copolymer to a resin finishing bath to improve the abrasive resistance of garments containing cotton can be used in conjunction with other structurally different resins which do not have this immunity to chlorine discoloration. Modifications exist whereby the resin could be a melamine, a dimethylol ethylene or propylene urea, a carbamate or a triazone. These other resins would be added in the same proportions to the finishing bath as those used above in the preferred embodiment.

The proportion of latex to resin in the preferred embodiment is given as 1 to 3. However, these proportions are not critical, and the proportion of latex to resin could be varied. The resin solids add-on could be increased from the stated 4.5 percent minimum up to about 8 percent. The amount of butadiene-styrene solids could be increased in the 1 to 3 ratio depending on the total amount of resin solids. The ratio could even be reduced if lesser abrasion resistance is desired. As a general rule as one increases the latex content the crease recovery of the fabric is reduced. As one increases the amount of resin the abrasion resistance is reduced.

It will be seen that an improved process has been provided for the manufacture of wrinkle and abrasion resistant cotton fabrics and garments formed from those fabrics. In particular a process has been provided which differs from prior processes in its ability to improve both the dry wrinkle and wet wrinkle resistance without loss in abrasion resistance of the fabrics and garments formed therefrom.

As various changes may be made in the steps herein without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. A process for treating a fabric containing cotton for improving its wrinkle and abrasion resistance comprising:

a. impregnating the fabric with an aqueous finishing solution of a cellulose reactant heat curable s-1,3,5-trimethyloltriazine-2,4,6,-triol resin, and a butadiene-styrene copolymer containing free carboxyl groups capable of reacting with at least a portion of the terminal hydroxy groups of said resin to form a cellulose-reactive butadiene-styrene-s-1,3,5,-trimethyloltriazine-2,4,6,-triol copolymer when cured, and an amine polymerization catalyst

b. reducing the moisture content of the impregnated fabric to between about 6 percent and about 10 percent by weight; and

c. curing the impregnated fabric

2. The process as claimed in claim 1 in which said solution contains about three parts of resin to one part of butadiene-styrene copolymer.

3. The process of claim 1 in which the butadiene-styrene-resin copolymer is cured at a temperature of approximately 365° F. for about 1 minute and 30 seconds.

4. A process for treating a fabric containing cotton for improving the wrinkle-resistance and abrasion-resistance comprising the steps of impregnating the fabric with an aqueous solution comprising by weight about 10 to about 15 percent of a 50 percent aqueous solution of a cellulose reactant heat curable s-1,3,5,-trimethyloltriazine-2,4,6,-triol resin, about 0.10 to about 0.50 percent of an amine hydrochloride catalyst, about 2.0 to about 3.0 percent of ethylenediaminetetraacetic acid, and about 3 to about 6 percent of a 40 percent solids emulsion of a butadiene-styrene copolymer containing free carboxyl groups capable of reacting with at least a portion of the terminal hydroxy groups of said resin to form a cellulose-reactive butadiene-styrene-s-1,3,5,-trimethyloltriazine-2,4,6,-triol copolymer when cured thereafter reducing the moisture content of the fabric to about 6 to about 10 percent, and curing the butadiene-styrene-resin copolymer contained in the fabric.

5. The process of claim 4 in which said solution further comprises about 0.1 to 0.5 percent of a 30 percent solution of a silicone softener.

6. A fabric produced by the process of claim 4.

7. A finishing emulsion for treating a fabric containing cotton to improve its wrinkle resistance and abrasion resistance comprising:

a. from about 10 to about 15 percent by weight of a —50 percent aqueous solution of a cellulose reactant heat curable s-1,3,5,-trimethyloltriazine-2,4,6,-triol resin;

b. from about 3 to about 6 percent of a 40 percent solids emulsion of a butadiene-styrene copolymer containing free carboxyl groups capable of reacting with at least a portion of the terminal hydroxy groups of said resin to form a cellulose-reactive butadiene-styrene-s-1,3,5,-trimethyloltriazine-2,4,6,-triol copolymer when cured;

c. from about 0.10 to about 0.50 percent of an amine hydrochloride catalyst; and

d. from about 2.0 to about 3.0 percent of ethylenediamine tetraacetic acid.