July 20, 1971 A. A. SCARBOROUGH 3,594,206

LATEX RECOATING PROCESS

Filed June 4, 1968 2 Sheets-Sheet 1

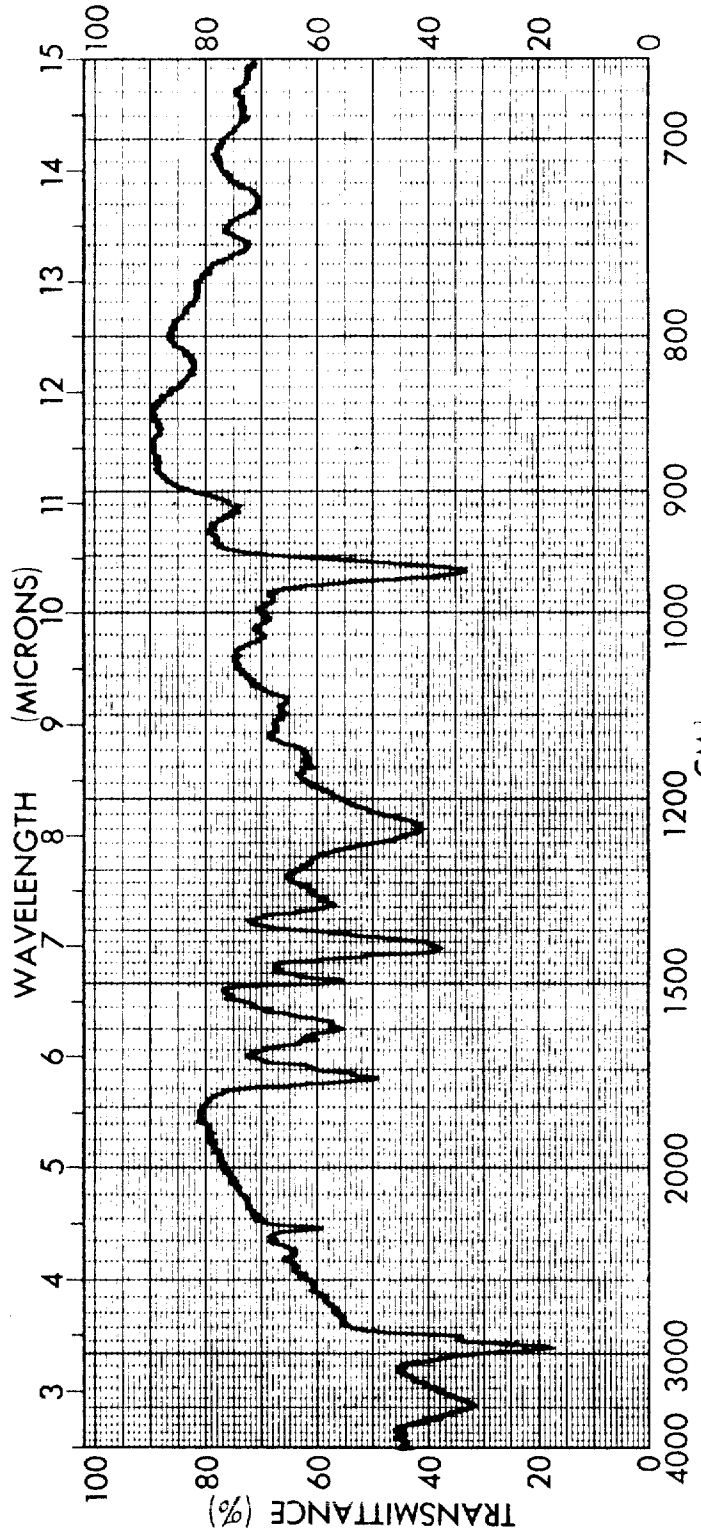



FIG 1

LATEX RECOATING PROCESS

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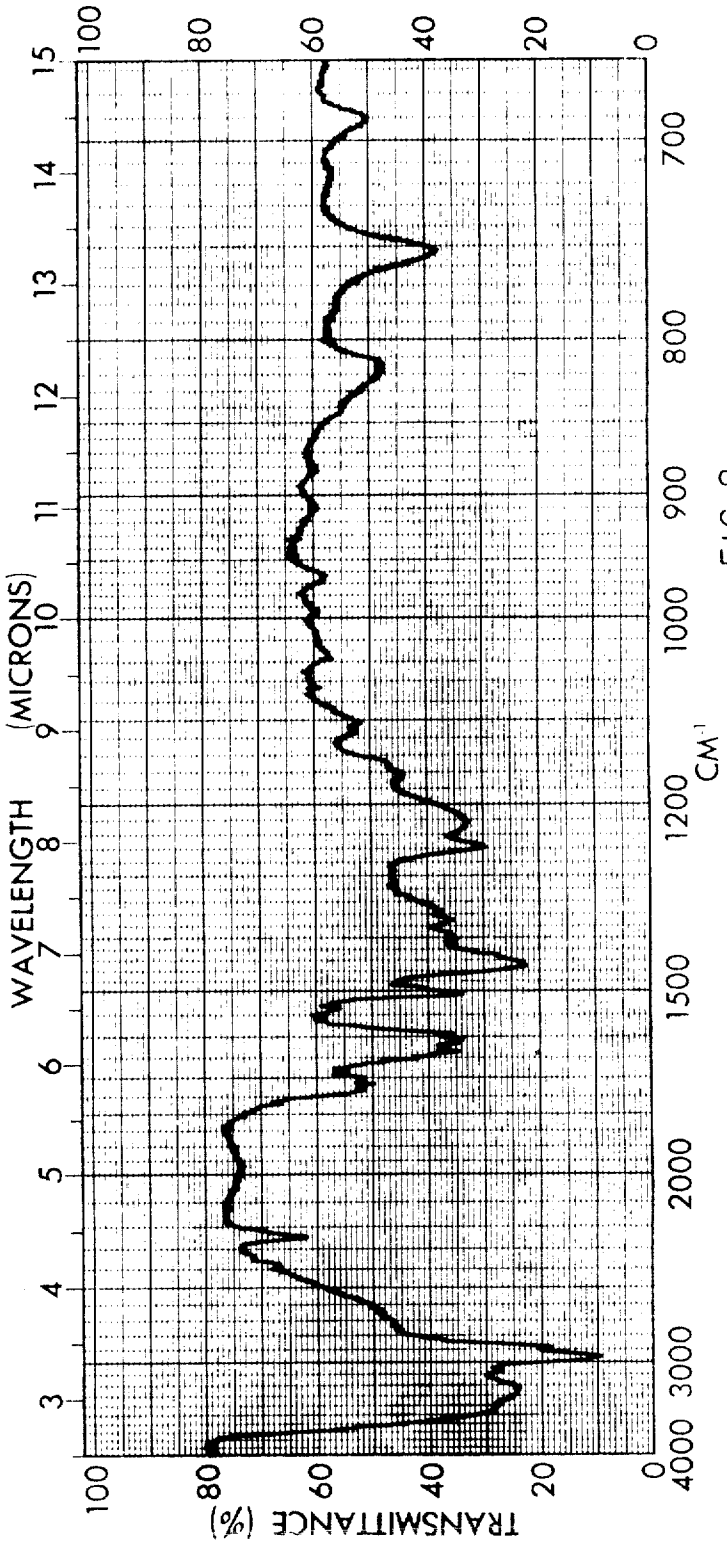



FIG. 2

United States Patent Office 3,594,206 Patented July 20, 1971



3,594,206

# LATEX RECOATING PROCESS

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Filed June 4, 1968, Ser. No. 734,363
Int. Cl. B44d 1/16
U.S. Cl. 117—2 12 Claims

## ABSTRACT OF THE DISCLOSURE

Latex-backed fabrics can be effectively recoated with latex by first applying to the original, glazed latex backing a precoating composition comprising acrylonitrile-conjugated diene copolymer, a curable condensation resin and a solvent.

This invention relates to latex backed fabrics which are to be subjected to laundering, or similar cleaning or dry-cleaning.

In many office buildings, schools, hospitals, homes, factories, machine shops, warehouses, and the like, a problem arises due to the carrying of moisture, dust, filings, and other debris on the shoes of persons going from one area to other areas. Dust mats of various kinds have been employed with varying success, but tend to become unsightly and unsanitary. In recent times, a mat that has good washability has been developed. These mats are made preferably from cellulosic and cotton duck backing and yarn by the familiar tufting technique. After the tufting, the loops are anchored to the duck backing to prevent raveling by coating with a rubber latex which is then dried and vulcanized or cured. The curing step is carried out at elevated temperatures conventionally employed but at temperatures below that at which the cotton fiber is damaged. This not only serves to fix the loops in place during washing and use, but provides an anti-skid surface which keeps the mat from sliding when walked upon.

The pile of the mat is provided with a dust collecting oil which is used in an amount tending to absorb or hold dust and other debris from the shoes of a person who walks across it, or who wipes his shoes thereon before entering the area which it is desired to protect.

The dust collecting oil is a high-boiling petroleum oil having a high flash point and other properties as set forth later herein. The proportions used are such that it does not stain the shoes, yet tends to retain the dirt, usually being in the range of about 0.075 to about 1.0 ounce per square foot. This will vary with the fabric, but should be such that excessive tracking off of the oil does not occur. Optimum oil content will be such that there is little or no noticeable track off.

After a period of service which will depend upon the amount of traffic over it, as well as the amount of dirt collected, the mat is laundered in any type of industrial laundry wheel. Being made of cellulosics, preferably of cotton, the mats are readily laundered by familiar techniques which need not be described in great detail. They are washed at 140° F.–200° F. water temperature, using soaps or detergents, alkalies, water softeners, etc. They are then rinsed and dried, for example, in high temperature gas driers, steam driers or electric driers.

The mats are usually provided on a rental basis by a service company which replaces dirty mats with clean ones and launders and reconditions the dirty mats. In the course of lanudering, the dust collecting oil is removed along with the soil, and must be replaced before the mat is returned to service. This treatment can be effected either after rinsing or after drying of the laundered mat.

Particularly useful examples of such dust collecting mats are described and claimed in U.S. Pat. No. 3,306,-



808, the disclosure of which is incorporated herein by reference.

The exposure of the latex to sunlight causes glazing and hardening of the latex coating thereby significantly reducing the skid resistance of the mats. In addition, there is an increased tendency for the hardened latex backing to crack and peel off during the laundering and treating cycles. This failure of the latex coating occurs at a time when the primary fabric surface is still in usable condition. Thus, the glazing of the latex coating, and not the normal wearing characteristics, limit the useful life of the mats.

Many different techniques have been tried in an attempt to recoat the mats but these have proved generally unsatisfactory. The obvious method is to merely apply a latex of the same type initially on the mat and to then cure the mat in the usual manner. This, however, proved to be unsatisfactory. The new latex coating would not adequately adhere to the prior latex coating with the result that the new coating would peel off after only a few laundering cycles. Where the original latex coating was severly cracked, some mechanical locking of the new coating to the old coating resulted, but even this was not sufficient for commerical usage.

Tests were conducted to determine whether latex swelling solvents, e.g., some of the lower molecular weight ketones and toluene, could be used to treat the old latex to provide a "tooth" in the surface to which the new latex might adhere. While some improvement resulted in that the new coating would survive more laundering cycles than in the cases where no swelling solvent was employed, the improvement was not sufficient for commercial application.

A number of adhesive compositions were tried as intermediate coating between the old latex coating and the new. These also proved generally unacceptable.

It has now been found that a particular sequence of steps using a particular precoating composition can be employed in the repair of the latex coating of latex coated mats. This new procedure permits continued use of the mats until the mat fails or becomes unsatisfactory due to normal wear. Unless otherwise indicated, percentages given throughout the specification and claims are all by weight. As broadly contemplated, the present process comprises:

(A) applying to a hardened latex surface of a latex-backed mat a precoating of a composition comprising:
  (1) a major amount of a volatile solvent which is a swelling agent for butadiene-acrylonitrile copolymers,
  (2) an acrylonitrile-conjugated diene polymer in which the conjugated diene has from 4 to 6 carbon atoms per molecule of diene monomer and containing from about 20 to 60% acrylonitrile and from about 40 to 80% conjugated diene; and
  (3) a solvent-soluble condensation resin which is curable at 250° F.;
(B) applying to said precoating an acrylonitrile-butadiene latex of the desired composition; and
(C) curing the resulting composition to wash fastness.

Suitable solvents for use in the precoating compositions include lower alkyl ketones such as, methylethyl ketone and methylisobutyl ketone, lower alkyl esters such as butyl acetate, as well as aromatic solvents such as toluene. In general, it is preferred that toluene not be used as the sole solvent but be used in admixture with a major amount of a ketone. Typically, a mixture of 80% methylethyl ketone and 20% toluene is useful. As noted, a major amount of solvent is to be contained in the precoating composition. Typically, the amount of solvent may comprise between 65 and 75% of the precoating composition. The

final determination of the amount of solvent will generally be based on the fluidity desired in the final precoating composition to insure ease of application.

The acrylonitrile-conjugated diene polymer particularly useful for the purposes of the present invention, is a copolymer of acrylonitrile and butadiene containing from about 20 to 60% acrylonitrile and from about 40 to 80% butadiene. The copolymer may conveniently be the same as that contained in the final coating but this is not a requirement for operability. In general, the acrylonitrile-diene polymer will comprise from about 5 to about 25% of the precoating composition and will usually be less than about 15%.

The condensation resins which are useful in the practice of the present invention include the phenol-aldehyde condensation resins and more particularly, the phenol-formaldehyde condensation resins, provided that such resins are moderately soluble in the solvent employed and with the further proviso that the resin be capable of being cured at 250° F. The condensation resin will comprise from 2 to about 10%, preferably from about 3 to 7% of the precoating composition and will generally be on the order of about 5%.

The precoating composition preferably contains up to 18% of a vinyl polymer. Typical of these are polyvinyl chloride, polyvinyl acetate, polyvinyl butrate, and the polyacrylates as well as mixtures of these and copolymers of the corresponding monomers. In general, it is preferred to employ vinyl polymers substantially free of oxygen bonds and therefore polyvinyl chloride is particularly suitable for the purposes of the present invention. The preferred range of vinyl polymer in the precoating composition is 10% to 18%.

The precoating composition can be applied to the mat being treated by simple brushing or rolling operations. Other techniques including the use of doctor blades and the like may similarly be employed, if desired.

Before applying the final latex coating to the precoated mat it is desirable to permit a substantial portion of the volatile solvent to evaporate. For consistently reproduceable results, the final coating should be applied while the precoating composition is still tacky, i.e. while the precoating is still sticky to the touch. In the most satisfactory practice of the present process, the final coating composition should not be applied until the precoating composition has lost its wet gloss but while the precoating composition still retains a solvent odor.

The final coating is applied as an aqueous latex of the acrylonitrile conjugated diene copolymer. Any of the latex compositions disclosed in the aforementioned U.S. Pat. No. 3,306,808 are useful for this purpose. The final coating may additionally contain any of the well-known fillers for rubber such as silica flour and carbon black. A very significant improvement in the adhesion of the final coating to the mat is obtained, however, when the aqueous latex contains from about 0.3 to 1% by weight (based on the aqueous latex) of carbon black. In general, the carbon black may be added in the form of an aqueous dispersion.

The precoated and coated mat should be cured at an elevated temperature generally of at least 250° F. A 20-minute cure at 250° F. has generally been found satisfactory. Higher temperatures, of course, reduce the time necessary for cure. Thus, 15 minutes at 290° F. has similarly been found suitable.

## EXAMPLE I

A latex-backed mat of the type described was found to have lost its skid resistance. Examination of the mat shows that the latex backing had a glazed, hardened, embrittled surface. A precoating composition of the type and composition described previously herein (containing butadiene-acrylonitrile copolymer, solvent-soluble- phenol formaldehyde resin curable at 250 °F., and a major amount of a toluene-butylacetate mixed solvent) was diluted with methyl ethyl ketone to suitable consistency and applied by roller-coating to the glazed latex backing. Before the precoating had dried, i.e., while it was still tacky, an aqueous butadiene-acrylonitrile copolymer latex of 53% solids-content was applied by roller-coating. The precoating and final coating were cured by heating the mat at 250° F. for 25 minutes. The cured mat was then subjected to 20 launderings and oil-treating cycles. At the end of these tests, over 90% of the latex was retained on the mat in good condition.



## EXAMPLE II

Following the general procedure of Example I, the backing on latex-backed mats of the type described can be recoated by applying thereto a precoating composition comprising about 25% acrylonitrile-butadiene copolymer, about 5% of a solvent-soluble phenol formaldehyde resin curable at 250° F., and about 70% methyl ethyl ketone. The precoated-and-latex coated mats, after curing, exhibit good latex retention after 20 laundering and oil-treating cycles.

## EXAMPLE III

Following the general procedure of Example I, the backing on latex-backed mats of the type described can be recoated by applying thereto a precoating composition comprising about 15% acrylonitrile-butadiene copolymer, about 10% polyvinyl chloride, about 5% phenol formaldehyde resin (solvent-soluble and curable at 250° F.), and about 70% methyl ethyl ketone. The precoated-and-latex coated mats, after curing, exhibit good latex retention after 20 laundering and oil-treating cycles.

## EXAMPLE IV

Following the general procedure of Example I, the backing on latex-backed mats of the type described can be recoated by applying thereto a precoating composition comprising about 5% acrylonitrile-butadiene copolymer, about 10% polyvinyl chloride, about 7% of a phenol formaldehyde resin (solvent-soluble and curable at 250° F.) and about 70% methyl ethyl ketone. The precoated-and-latex coated mats, after curing, exhibit good latex retention after 20 laundering and oil-treating cycles.

## EXAMPLE V

The inclusion of from about 0.3 to about 1% (based on latex) of carbon black into the final latex coating composition greatly improves the adhesion of the latex to the precoating and thus to the mat. This may be shown by a series of tests on latex-backed mats on which the latex has hardened and cracked. All of the mats are given the same precoating in accordance with the practice of the present invention. The mats are separated into groups with each group given a final latex coating of different carbon content. In a typical test, the carbon black is introduced as a 37% aqueous dispersion into, for example, a 53% solids latex. The addition of one part of such dispersion to 100 parts of the latex corresponds to a carbon black dosage of about 0.3 weight percent. Following this procedure, with control tests in which the latex contained no carbon black, it was found that carbon black, in the ranges specified, very significantly improves the adhesion of the final latex to the precoated mat. A carbon dosage of about 0.8% was found to provide optimum results. Twice as many of the mats containing carbon black in the latex retained 90% or more of the latex backing as did the mats without carbon in the latex under equivalent washing and treating conditions. The number of failures, i.e. those tests in which 50% or less of the latex was retained after equivalent wash-treat cycles, were about the same. Less than 20% of the mats failed in each test series.

It is good practice to launder the mats to be recoated prior to application of the precoating composition. It has been found that a significant improvement in latex adhesion is obtained if the mats are treated with aqueous

ammonia prior to the precoating step. This may be accomplished by incorporating up to about 3% by weight of ammonia in the washing step. When used in a washing cycle which involves a series of washes, the ammonia is preferably incorporated in the last high temperature wash, or, if all washes are at about the same temperature, in the last wash. In general, about 1% to 2% of ammonia is effective. Preferably, the ammonia treatment is conducted during the rinsing cycle. If a plurality of water rinses are used, the ammonia treatment is more effective if incorporated in the second or subsequent rinses than in the first rinse. As will be recognized, the concentration of ammonia in the rinse can be significantly lower than in the wash for effectiveness. In a typical example of this treatment, about 5 lbs. of 27–28% aqueous ammonia and 800 lbs. of water per 100 lbs. of mats can be employed as a second rinse following a water rinse. The ammonia rinse is suitably conducted at 160°–170° for 10 minutes.

From the foregoing it will be recognized that particularly outstanding adhesion is obtained in the recoating of latex-backed fabrics by the combination of:

(a) Washing the fabrics to be recoated and treating the fabrics with aqueous ammonia prior to final drying of the fabrics;

(b) Applying a precoating composition to the latex-backed side of the dried fabric which precoating composition comprises (1) 5% to 15% of a 20%–60% acrylonitrile/80%–40% butadiene copolymer, (2) up to 18%, and preferably at least 10%, of polyvinyl chloride, (3) 3% to 7% of a solvent-soluble phenol formaldehyde resin curable at 250° F., and (4) 65% to 75% of a volatile solvent which is a swelling agent for acrylonitrile-butadiene copolymers;

(c) Volatilizing solvent from the precoating of step (b) until the composition has lost its wet gloss but is still tacky and retains the solvent odor;

(d) Applying to the precoating an aqueous latex of a polymer capable of curing to form a continuous, durable film, preferably an acrylonitrile-butadiene copolymer of the type described, said latex containing from about 0.3 to 1% of carbon black; and

(e) Curing the precoated and latex coated fabric at a non-destructive temperature of at least about 250° F.

This series of treatments can be easily and economically effected and is eminently suited to commercial operation. The final latex coating is strongly adherent providing significantly extended life for the coated fabrics throughout numerous washing-oil treating cycles until the fabric itself becomes unsuitable for continued use.

One precoating composition which meets the requirements of the present invention and is commercially available is Thixon 81238 (a product manufactured by Dayton Chemical Product Laboratories, Inc.). FIG. 1 is a characteristic infrared scan of a film formed by applying a coating of Thixon 81238 to glass and volatilizing the solvent. FIG. 2 is the characteristic infrared scan on the pyrolysate of Thixon 81238. This precoating composition is further characterized by its black color, easy curing, and ability to cure to a flexible film. It is readily diluted by ketones such as methyl ethyl ketone or by toluol, or other lacquer thinners. The composition comprises acrylonitrile-butadiene copolymer, phenol formaldehyde resin, polyvinyl chloride and solvent of the characteristics and in the proportions specified herein for the practice of the invention. It dries tack free in 5 to 10 minutes at normal conditions. Thus, if longer than this period of time will elapse between application of the precoating composition and the final latex coating, the precoating composition should be diluted to insure that the precoating will be tacky at the time of the final coating. Ketonic solvents can be employed for the dilution of this material. The material can be applied to the latex backing to be treated in the same manner as its materials disclosed in the examples.

In addition to the foregoing techniques, the precoating composition can be applied by spraying techniques provided the consistency is suitable for that purpose. Premature volatilization of the solvent during spraying leads to the formation of fine threads of the composition; a problem commonly referred to as "spider webbing." Accordingly, if the composition is to be sprayed onto the glazed latex backing, it is recommended that the solvent be one which is not excessively volatile under the spray conditions. Toluene, butyl acetate and methyl-isobutyl ketone are suitable for this purpose. Methyl ethyl ketone can be employed if mixed with one of the above-mentioned solvents in proportions sufficient to reduce the volatilibility for spraying. A commercial preparation meeting the requirements of the present invention and found particularly useful for spray application is Thixon XO–678 (a product manufactured by Dayton Chemical Product Laboratories, Inc.). With this preparation it has been found desirable to add a substantial portion of one of the above-identified volatility-reducing solvents in order to avoid significant spider webbing.

What is claimed is:

**1.** A process for the recoating of latex-backed fabrics which comprises the steps of

(A) applying to the latex surface of said fabric a precoating of a composition comprising

(1) a major amount of a volatile solvent which is a swelling agent for butadiene-acrylonitrile copolymers,

(2) 5% to 25% of an acrylonitrile-conjugated diene copolymer in which the conjugated diene has from 4 to 6 carbon atoms per molecule of diene monomers and containing from about 20 to 60% acrylonitrile and from about 40 to 80% conjugated diene; and

(3) 2% to 10% of a phenol aldehyde condensation resin which is soluble in said solvent;

(B) applying to said precoating an acrylonitrile-conjugated diene copolymer curable to a continuous, durable film; and

(C) curing the resulting coating to wash fastness.

**2.** A process in accordance with claim **1**, wherein said precoating composition additionally contains up to about 18% of vinyl polymer.

**3.** A process in accordance with claim **1**, wherein said condensation resin is a phenol formaldehyde resin.

**4.** A process in accordance with claim **1**, wherein said latex-backed fabric is washed and treated with aqueous ammonia and dried prior to application of said precoating composition.

**5.** A process in accordance with claim **1** including additionally applying in step B from about 0.3% to 1% by weight of carbon black.

**6.** A process for the recoating of latex-backed fabrics which comprises the steps of

(A) applying to the latex surface of said fabric a precoating of a composition comprising

(1) 5% to 15% of a 20%–60% acrylonitrile/80%–40% butadiene copolymer,

(2) up to 18% of vinyl polymer,

(3) 65% to 75% of a volatile solvent which is a swelling agent for acrylonitrile-butadiene copolymers, and

(4) 3% to 7% of a phenol formaldehyde resin which is soluble in said solvent and curable at 250° F.,

(B) applying to said precoating an acrylonitrile-conjugated diene copolymer curable to a continuous, durable film; and

(C) curing the resulting coating to wash fastness.

**7.** A process in accordance with claim **6** wherein, following step A, the solvent is volatilized from the applied precoating composition until the composition loses its wet gloss but remains tacky and retains solvent odor.

**8.** A process in accordance with claim **6** wherein said precoating composition contains at least 10% of polyvinyl chloride.

9. A process in accordance with claim 6 wherein said precoating composition contains about 5% phenol formaldehyde resin.

10. A process in accordance with claim 6 wherein said latex-backed fabric is washed and treated with aqueous ammonia and dried prior to application of said precoating composition.

11. A process in accordance with claim 6 including additionally applying in step B from about 0.3% to 1% by weight of carbon black.

12. A process for the recoating of latex-backed fabrics which comprises the steps of

(A) washing the fabrics to be recoated and treating the fabrics with aqueous ammonia;

(B) drying the fabrics;

(C) applying a precoating composition to the latex-backed side of the dried fabrics which precoating composition comprises

(1) 5% to 15% of a 20%–60% acrylonitrile/80%–40% butadiene copolymer,

(2) 10 to 18% of polyvinyl chloride,

(3) 65% to 75% of a volatile solvent which is a swelling agent for acrylonitrile-butadiene copolymers, and

(4) 3% to 7% of a phenol formaldehyde resin which is soluble in said solvent and curable at 250° F.;



(D) volatilizing solvent from the applied precoating composition of step B until the composition loses its wet gloss but remains tacky and retains solvent odor;

(E) applying to the precoating an aqueous latex of an acrylonitrile-butadiene copolymer, said latex containing from about 0.3 to 1% of carbon black; and

(F) curing the precoated and latex coated fabric at a non-destructive temperature of at least 250° F.

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U.S. Cl. X.R.

117—47, 76, 143; 161—66, 67; 264—36