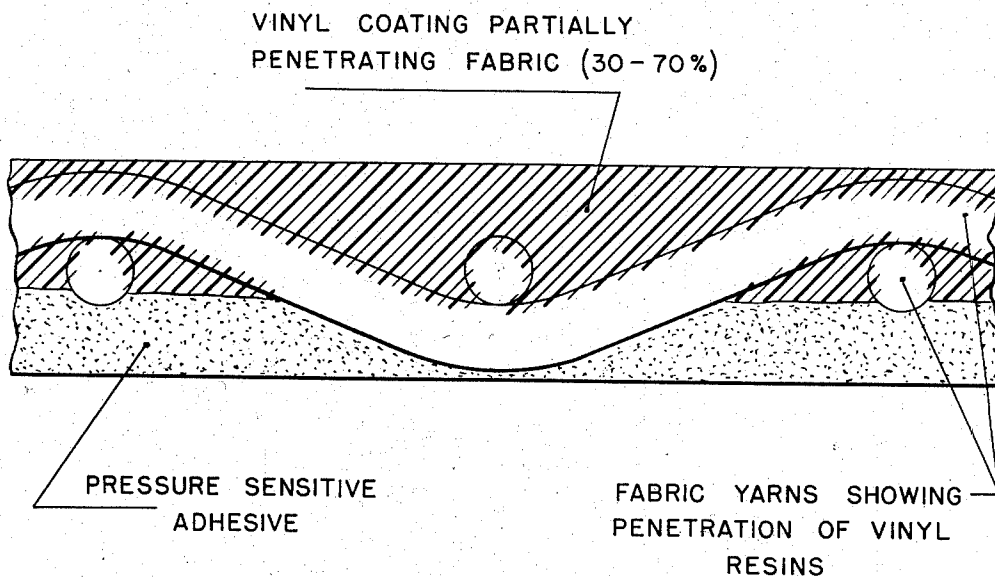


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ADHESIVE SHEET MATERIAL

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ADHESIVE SHEET MATERIAL

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This invention relates to adhesive sheet materials and more particularly to composite pressure-sensitive adhesive sheet materials of the nature of adhesive tape having a superior stability under ordinary and unusual conditions of storage and use, and in addition having improved water repellency, appearance, and color.

The invention further relates to the coating of textile fabrics, particularly cellulosic fabrics, with water-proof coatings and the use of the coated fabrics in the manufacture of pressure-sensitive adhesive tapes.

Cotton and other cellulosic fabrics are used at present to a large extent as the backing material in adhesive products such as industrial and surgical tapes. In making such tapes the adhesive mass is applied to the fabric backing either by solvent spreading or mass calendering. Cellulosic fabrics, however, have a number of shortcomings which adversely affect their use in adhesive tapes in certain instances. Such fabrics for example are relatively unstable to heat, display low resistance to acids and chemicals and to microbial attack, and have the further objectionable properties of high water absorption and easy soiling, and also have poor electrical properties.

Textile finishers and coaters in particular have tried to overcome these shortcomings either by impregnating and finishing the fabrics with suitable chemical agents or preferably by coating one side of the fabric with relatively impervious and resistant chemical coatings, in which case the other side of the fabric is left entirely free and uncontaminated for the suitable application of the adhesive mass. One well-known tape of the latter type is made by applying a nitrocellulose coating from a solvent solution which has been suitably plasticized and is applied on an ordinary solvent coating machine. Such tapes, although originally designed for surgical and hospital use, have been employed extensively for industrial purposes and have good water repellency and stability against outside influences, resistance to soiling, and are substantially impermeable to wound contaminants. However, the increase in industrial use of these pressure-sensitive tapes has emphasized the inadequacy of the nitrocellulose coating. Adhesive masses are being made with ever greater adhesive power with the result that the adhesive force exerted by the mass tends to exceed the anchorage of the coating or film to the fabric. As a result, on unwinding the tape from the roll, these masses tend to pull or strip the coating from the fabric. In addition to this drawback, solvent coating is relatively expensive and requires special machinery for coating and solvent recovery. Moreover, the coatings thus applied tend to lack thermal stability, and in addition display a low resistance to organic solvents and ready inflammability.

Most of the above drawbacks appear to exist in tapes having solution coatings, and in particular it appears that solvent-applied resins do not exhibit sufficient anchorage to the substrate fabric. The latter holds true for the relatively new type of coating compositions commonly known as the plastisols and organosols. It is believed that many of the disadvantages of these tapes, particularly with re-

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gard to the poor anchorage of the film to the fabric, are due to insufficient wetting of the fabric and low penetration of the large molecular aggregates which exist in all of these types of coatings.

It is accordingly a primary object of the present invention to prepare adhesive sheet material, particularly in the form of pressure-sensitive tape, which has a firmly adherent protective and decorative coating, which renders the tape not only highly water repellent and stable to heat but resistant to soiling and the action of chemicals and microbes.

It is a further object of the invention to provide adhesive sheet material, more specifically adhesive tape, with a coating which is sufficiently adherent to the backing to prevent its being stripped from the fabric by the adhesive mass on unwinding the material from the roll or core on which it is usually wound.

It is a further object of the invention to produce a pressure-sensitive adhesive tape having a coated fabric backing, in which both the adhesive layer and the coating layer are firmly adherent to the backing during extended storage or use and the composite tape is essentially free of delamination.

Further objects and advantages of the invention will become apparent from the following description and appended claims.

The drawing is a schematic representation of a cross-sectional view of a pressure-sensitive adhesive tape of this invention.

The sheet material or tape of the present invention is in general of the type having a fabric backing provided on one side with a layer of suitable adhesive material, and on the other side with a resinous coating which provides a protective and decorative outer surface when the tape is used in the customary manner. According to the invention the resin coating is applied to the backing in the form of resin latices, including specifically one or a mixture of such latices as the latices of polyvinyl chloride, copolymers of vinyl chloride and vinyl acetate in which the amount of vinyl chloride in the polymer is 88% or greater, copolymers of vinyl chloride and vinylidene chloride, copolymers of vinyl chloride and ethyl acrylate or octyl acrylate, copolymers of vinyl chloride and acrylonitrile, and a polymer latex resulting from the polymerization of vinyl chloride in an emulsion system in the presence of a butadiene-acrylonitrile copolymer.

Resin latices are of special advantage in preparing coated adhesive tapes of the type described for the following reasons. The resin particles in the latices are of extremely small size, and exist as dispersions with water as the continuous phase. On being applied on conventional coating machines, the water phase wets the fabric immediately and in addition causes the resin particles to penetrate not only the fabric structure, but also due to their small size even penetrate the yarn structure as well, and anchor themselves to the individual fibers.

Latex applications of vinyl resins are usually not film forming, as they are essentially deposits of individual particles. By heating the resins to raised temperatures such as 200 to 500° F., at which temperature they will flow and coalesce, continuous films are formed. Under these conditions, including the deep penetration and the intimate contact of the resin particles with the fabric substrate, films formed from resin latices are better anchored than the films deposited either from solvent solutions or from plastisol or organosol compounds.

The coating compositions employed in accordance with this invention are preferably plasticized with from 20-100% by weight of a polymeric plasticizer based on the weight of the resin, but in some instances a plasticizer mixture containing a small amount of liquid monomeric plasticizer, i.e., not more than about 8% by weight of

such liquid plasticizer on the weight of the resin, may be required. Low molecular weight plasticizers, such as the liquid monomeric plasticizers, are apt to migrate and cause deterioration of the adhesive mass adjacent to the coatings when the tape is in roll form. For this reason only small amounts of liquid monomeric plasticizer are used, and where possible polymeric type plasticizer are used entirely.

Suitable plasticizers of the polymeric type, include Glyptal 2557 and Glyptal 2559, which are modified alkyd resins made by the General Electric Company; certain of the Paraplex resins which in general are polyesters made by Rohm and Haas such as Paraplex G-25, which is essentially the condensation product of sebacic acid and 1-2-propylene glycol, and Paraplex G-40, which has a similar structure, a molecular weight of 6000 and a saponification number of 600; and Plastolein 9715 and 9720, which are polyesters made by Emery Industries, comprising the condensation product of azelaic acid and a dihydric alcohol. In addition to the above, Flexol R-2H may be used, which is a product of Carbide and Carbon Chemical Company, and is a linear polyester composed essentially of the condensation product of adipic acid and 2-ethyl-1-3-hexanediol having a molecular weight range of 2000 to 6000 and a viscosity of 300 poises.

Suitable liquid monomeric plasticizers, which may be used in small amounts along with the above polymeric plasticizers, include for example tricresyl phosphate, butyl phthalyl butyl glycolate, iso-octyl cetyl phthalate, di-2-ethylhexyl sebacate, N-ethyl, ortho, para-toluene sulfonamide and the like.

In order to avoid "strike through" of the applied coating, the composition containing the resin latex and the plasticizer is thickened by the addition of suitable thickening agents, namely, materials which in aqueous media exist as colloidal systems that have the property of increasing the viscosity of emulsions and dispersions. This class of materials includes for example methyl cellulose, carboxy methyl cellulose, and salts thereof, hydroxy ethyl cellulose, alginates and caseinates, alkali and ammonium salts of polyacrylic acid, and low molecular weight polyvinyl alcohol.

A thickener is added to the resin latex composition to permit accurate control of the quantity of coating material which penetrates the fabric and the extent to which such penetration takes place. The quantity required varies with the construction of the fabric as defined by the thread count and the size and type of yarn employed. Sufficient thickener is added to insure that penetration of the coating into the fabric takes place to the extent of 30-70% of its thickness. If less than about 30% penetration takes place, the coating does not adequately adhere to the fabric backing. If more than about 70% of penetration takes place, the coating prevents the adhesive mass applied to the other side of the fabric from anchoring itself adequately, and in either case, delamination tends to occur.

In many instances it is desired to have colored coatings in making the adhesive tapes according to this invention. In general it is necessary to use pigments for this purpose, but since certain pigments tend to migrate when the coating comes in contact with the adhesive mass, the type of pigment employed must be selected with this fact in mind. Generally, it is possible to use any of the inorganic pigments, including for example such pigments as titanium dioxide, the chrome yellows, iron oxides, chromium oxides, and lead pigments, such as lead molybdate and lead chromate. Opacifiers are preferably added along with these pigments, including such opacifiers as titanium dioxide, whiting, lithopone, barytes, and the like.

In order to obtain brilliant shades, it is frequently necessary to use organic pigments. However, some of these also are not suitable for the purposes of this invention, since they also migrate readily from the coating into the adhesive mass. Organic pigments which do not migrate

and can be used to advantage include carbon black, the phthalocyanines, such as phthalocyanine blue and phthalocyanine green, and the naphthol reds.

In preparing the coating compositions for application to the fabric backing, a simple mixing procedure can be used. Essentially all the required ingredients can be added to the latex, provided they do not disturb the established pH-conditions of the latex. Since plasticizers are not miscible with water-based latex, it is necessary to emulsify them prior to the addition to the compound. Emulsification of plasticizers proceeds smoothly through the addition of suitable emulsifiers, a small amount of ammonia to maintain correct pH-conditions and the addition of small amounts of water under vigorous stirring. However, in order to obtain coating compounds with high solids content, it is advisable to substitute latex for water in the emulsification of the plasticizers.

After proper emulsification of the plasticizer, the latex is usually added to this emulsion under mild stirring to insure uniform distribution, after which the pigments are added. They can be either dry and specially treated with surface active agents to insure rapid wetting or can be of the so-called "paste" or "stir-in" type, i.e. water dispersions of suitably treated pigments especially designed to be used with water-based vehicles.

After stirring sufficiently to provide complete and uniform distribution of the plasticizer-emulsion and pigments, a thickener is added to impart to the compound the desired viscosity for coating purposes. It is preferred to let the composition stand for at least 24 to 48 hours prior to usage in order to obtain optimum film properties of the coating. After this period an increase in viscosity, depending on the type of thickener used, will be noticed. After this aging period the latex composition is ready to be used for coating.

Various well-known procedures for applying the latex compositions to the fabric can be used, including knife coating, roller coating, reverse roller coating, and the like. One of the preferred methods which can be used to advantage is knife coating. In knife coating the web or fabric under tension passes under a knife of any suitable design and the compound is applied in front of the knife and continuously distributed by it uniformly across the width of the fabric. The coated material is then dried and fused on a tenter-frame. Fusing takes place after drying by exposing the fabric to temperatures of between 200° and 500° F., which causes the individual resin particles deposited from the latex compound to coalesce and form a continuous film.

A tenter-frame is preferably used for the drying, since water-based compositions tend to shrink textile fabrics, and the tenter-frame restores the original width of the fabric simultaneously with the drying.

In order to obtain the desired performance characteristics in the final coated tape, particularly with respect to water repellency and water vapor permeability, it is usually necessary to apply multiple coatings to the backing. In the case of multiple coatings applied in succession to the cloth, the fabric is merely dried, and not fused, in between the individual coatings, since fusing, and the film formed by it, will prohibit the wetting and uniform application of subsequent coatings. Finally, the accumulated coatings are fused into a single continuous film. If desired, the final coating may be embossed or smooth calendered by any suitable process.

A further understanding of the invention will be obtained from the following examples.

Example I

The following composition was applied to a scoured and bleached cotton cloth having 80 ends per inch as warp and 72 picks per inch as filling:

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Polyvinyl chloride latex (Geon Polyblend 552)	lbs.	100
Polymeric plasticizer (Glyptal 2557)	lbs.	9
Non-ionic emulsifier (Triton NE)	gms.	250
Ammonium hydroxide (28% aqueous solution)	cc.	20
Thickener (Acrysol GS)	lbs.	6-7

Triton NE is a 33⅓% water solution of the condensation product of an alkyl phenol with ethylene oxide made by the Rohm and Haas Company. Geon Polyblend 552 is the latex product of the polymerization of vinyl chloride in the presence of an acrylonitrile-butadiene copolymer. Acrysol GS is a 12½% aqueous solution of alkali polyacrylate made by the Rohm and Haas Company.

The above composition was prepared for application to the cloth in the following manner. Since plasticizers in general are immiscible with water-based latices, they were added to the latex after having been emulsified. This was readily achieved by the addition of the emulsifier and the ammonia to the plasticizer under vigorous agitation with a high-speed stirrer. The ensuing emulsion was added to the latex under gentle stirring with a slow-moving paddle stirrer. Then the thickener was added under gentle stirring which was continued for 30-40 minutes in order to obtain uniform distribution of all agents. The viscosity of this mixture was about 6000 cps., as measured with the Brookfield viscosimeter using spindle #4 at 20 r.p.m. The composition was allowed to age for 30 hours to obtain plasticizer equilibrium with the resin and thereby promote optimum film properties of the coating.

The coating composition prepared as described above was applied to the cloth on a regular textile high-speed tenter-frame which had been modified by the installation of a suitable knife-spreading assembly. The coated cloth was dried in the first half of the drier at a temperature of between 200° and 220° F. after which it entered the second half of the drier, where it was fused by exposure to a temperature of about 375° F. Leaving the drier, the cloth was led over a water-fed cooling drum in order to reduce its temperature. The coated cloth was then ready for the application of the adhesive mass, which was carried out in the usual manner.

Example II

The following composition was applied to a scoured 64/56 cotton print cloth:

Copolymer latex or vinyl chloride-vinylidene chloride	lbs.	100
Polymeric plasticizer (Glyptal 2557)	lbs.	25
Carbon black	lbs.	3.8
Non-ionic emulsifier (Triton NE)	gms.	250
Ammonium hydroxide (28% aqueous solution)	cc.	20
Methyl cellulose (15 cps.—10% solution)	lbs.	5

The compounding procedure in preparing the above mix for coating was carried out in the manner described in Example I with the exception that the carbon black in the dry state was ground into the plasticizer on a 3 roll paint mill prior to the emulsification.

Example III

The following composition was applied to a scoured and bleached 80/72 cotton print cloth:

Polyvinyl chloride latex	lbs.	100
Polymeric Plasticizer (Plastolein 9715)	lbs.	30
Titanium dioxide paste (42% solids)	lbs.	5.5
Naphthol red paste (30% solids)	lbs.	18.0
Non-ionic emulsifier (Triton NE)	gms.	250
Ammonium hydroxide (28% aqueous solution)	cc.	20
Thickener (Acrysol GS)	lbs.	6-7

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The above formulation, intended to produce a red coating, was prepared essentially in the manner described in Example I with the exception that after the addition of the pre-emulsified plasticizer, the pigment mixture was added to the latex under continuous slow stirring. The pigments employed in this case were of the so-called "paste" or "stir-in" type. After stirring for 30 minutes the thickener was added to the mixture and agitation continued for another 45 minutes to insure complete and uniform distribution of all ingredients. The coating composition was aged for at least 24 hours and then applied to the cloth in the manner described in Example I.

Example IV

The following composition was applied to a scoured 80/72 cotton print cloth:

Latex of high molecular wt. polyvinyl chloride	lbs.	100
Polymeric plasticizer (Paraplex G-40)	lbs.	16
Polymeric plasticizer (Glyptal 2557)	lbs.	20
Monomeric plasticizer (tricresyl phosphate)	lbs.	4
Carbon black	lbs.	3.8
Non-ionic emulsifier (Triton NE)	gms.	250
Ammonium hydroxide (28%)	cc.	20
Thickener (Acrysol GS)	lbs.	6-7

The compounding of the above composition was carried out in the same manner as described in Example II.

Any suitable rubber-resin type adhesive mass may be applied, for example by calender spreading, to the coated fabrics prepared as described above. A typical adhesive composition suitable for this purpose is compounded in the usual manner of the following materials:

	Parts by weight
Natural rubber	30
Reclaimed natural rubber	15
Polybutene	5
Disproportionated wood rosin	20
Hydrogenated ester gum	10
Zinc oxide	20
Mineral oil	2
Clay	6
2-6-ditertiary butyl-4 methyl phenol	2

In general the cloth backing is first provided with the coating, after which the adhesive mass is applied on the reverse side by calender spreading or other suitable process. Although reference has been made herein primarily to woven fabrics, it is possible to use unwoven fabrics, unsized paper and similar fibrous cellulosic material as the backing.

In addition to having the various advantages outlined above, the latex coatings of the present invention have the important advantage that they can be applied and formed without using conventional solvent coating machinery. Solvent coating is complicated, hazardous, and also expensive, in view of the necessity of recovering solvents. Since latex coating can be and is preferably carried out on regular textile equipment where tenter-frames are employed, these problems can be avoided.

What is claimed is:

1. A pressure sensitive adhesive tape comprising a backing of a coated water wettable fabric, said fabric having a synthetic resinous coating on only one side of said fabric, said coating consisting essentially of a vinyl latex resin, said resinous coating containing at least about 20% of a polymeric plasticizer, said resinous coating penetrating said fabric to an extent of about 30-70% of its thickness and resin particles of said latex resin penetrating individual yarns of said fabric, whereby said coating is anchored to said one side of the fabric, the yarns on the other side of said fabric being substantially bare and free of said resin, and a pressure sensitive rubber adhesive layer adherent to said other side of said fabric.

2. A pressure sensitive adhesive tape in accordance with claim 1 wherein said coating is a fused synthetic resinous coating.

3. A pressure sensitive adhesive tape in accordance with claim 1 wherein said synthetic resinous coating contains a thickener.

4. A pressure sensitive adhesive tape comprising a backing of a coated water wettable fabric, said fabric having a synthetic resinous coating on only one side of said fabric, said coating consisting essentially of a vinyl latex resin selected from the group consisting of aqueous emulsion polymerized vinyl chloride polymers and copolymers, said resinous coating containing at least about 20% of a polymeric plasticizer, said resinous coating penetrating said fabric to an extent of about 30 to 70% of its thickness and resin particles of said latex resin penetrating individual yarns of said fabric, whereby said coating is anchored to said one side of the fabric, the yarns on the other side of said fabric being substantially bare and free of said resin, and a pressure-sensitive rubber adhesive layer adherent to said other side of said fabric.

5. A pressure sensitive adhesive tape in accordance

with claim 4 wherein said coating is a fused synthetic latex resinous coating.

6. A pressure sensitive adhesive tape in accordance with claim 4 wherein the coating contains, in addition to the polymeric plasticizer, not more than about 8% by weight of a monomeric plasticizer based on the weight of the resin solids in said synthetic latex.

7. A pressure sensitive adhesive tape in accordance with claim 4 wherein said coating contains a thickener.

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