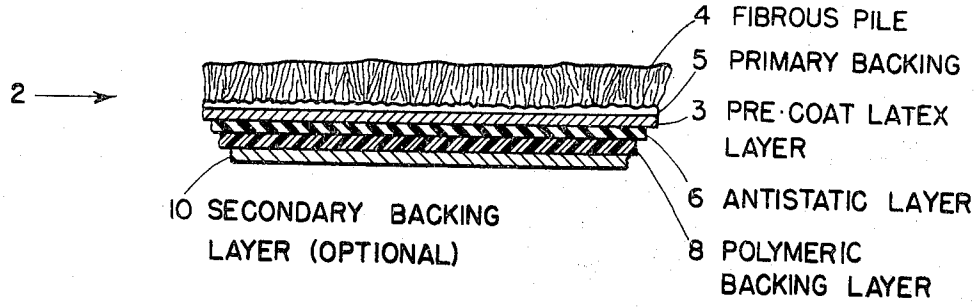
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ANTISTATIC FLOOR COVERING AND TEXTILE STRUCTURE

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ANTISTATIC FLOOR COVERING AND TEXTILE STRUCTURE

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U.S. Cl. 161—67 17 Claims

ABSTRACT OF THE DISCLOSURE

Antistatic floor covering and textile products of enhanced durability to cleaning and reduced migration tendency are produced by applying between two polymeric covering layers disposed beneath the textile or floor covering wear layer an antistatic composition consisting essentially of a mixture of

(a) an organic antistatic agent,

(b) a humectant which may be either a nonionic humectant, such as glycerin, or an ionic humectant such as calcium chloride, and

(c) when said humectant is a nonionic humectant, an electrolyte such as calcium chloride or sodium chloride and applying a polymeric backing coating over the antistatic layer, whereby the antistatic layer is disposed between the two polymeric covering layers.

BACKGROUND OF THE INVENTION

This invention is directed to antistatic textile products and floor coverings of textile and non-textile compositions. Most specifically the invention relates to an antistatic carpet structure which has a fibrous layer, a primary backing thereunder, a latex pre-coat layer thereover, an antistatic-conductive coating, and a polymeric backing.

Conventional floor coverings, especially carpet structures, are capable of generating and transferring substantial charges of static electricity. These charges of static electricity are created when persons in contact with the dielectric wear layer, such as the fibrous layer of the carpet move over said fibrous layer. The charge per se is created by the movement of dielectric shoe components which are in contact with the dielectric wear layer. These charges are then transferred to the wearer of the shoe. When the wearer subsequently becomes grounded, the accumulated charge discharges through that part of the individual's body which is in contact with the ground. This discharge procedure can result in severe discomfort to the individual. The above described problem can be eliminated if the charges of static electricity can be dispersed throughout the floor covering structure, and subsequently dissipated into the surrounding environment.

The prior art discloses antistatic compositions and carpet structures. For example, U.S. Pat. 2,302,003, Cadwell et al., teaches that accumulated charges may be dispersed via a plurality of conducting fibers which are positioned throughout the fibrous layer.

U.S. Pat. 3,510,386, Goins et al. teaches a carpet structure that must have an antistatic layer disposed directly beneath the wear layer, in that case, the fibrous pile primary backing. The patent teaches that it is mandatory that the antistatic layer be disposed directly beneath the primary backing so that the antistatic composition is operative to coat and contact the ends of the fibers, forming the pile in contact therewith. The patent teaches that

the antistatic composition must substantially penetrate the backing and part of the pile fibers in order to be effective. This presents problems in application, types of textile structures to which the antistatic composition may be applied and in its effective life span. An ancillary problem is also the fire hazard attendant to the flammability of the carpet structure due to migration of the antistatic composition up through the textile structure thus causing a stiffening of the pile with resultant stand-up to the flame; and the fact that said migration causes a loss in the effectiveness and durability of the product when such a treated carpet is washed.

In contrast thereto, the floor covering and textile structure of this invention disperses quickly and thoroughly, charges of static electricity without the need of specific conducting fibers. The structure of this invention bleeds off charges of static electricity.

The antistatic composition of this invention is incorporated between two polymeric backings in contrast to the vast majority of the prior art antistatic compositions which are not compatible nor effective for such a "sandwiching" and isolation between polymeric backings. Because of this incompatibility, carpets specifically, which are treated with these prior art antistatic compositions could not utilize most polymeric backings, and particularly the commonly used natural latex backing. In contrast, the antistatic coating of this composition as utilized herein is compatible with natural latex backings, adhesives and most other polymeric coating compounds.

The following description is directed to the most preferred embodiment of the instant invention, viz, carpet structure, however, it is to be understood that the term "floor covering" as used herein is intended to include linoleum petroleum product floorings, vinyl and asbestos sheet and tile floor covering, polyurethane and polyolefin floorings and the like and the invention is directed thereto as well.

SUMMARY OF THE INVENTION

It is an object of this invention to provide for an antistatic textile and floor covering product of enhanced durability to cleaning and having a low degree of migration tendency of the antistatic composition.

It is another object of the invention to provide for an antistatic flooring product having an antistatic composition interspersed between two polymeric layers, which in turn are disposed beneath the wear layer of said flooring product.

It is yet another object of the invention to provide for an antistatic carpet structure.

Other objects and advantages will become more apparent as the description proceeds.

Broadly speaking, the invention includes the provision of an antistatic textile and floor covering product comprising

(1) a wear layer, such as a fibrous textile layer,

(2) a latex pre-coat layer disposed beneath said wear layer,

(3) an antistatic coating composition layer disposed beneath said pre-coat layer, said antistatic layer consisting essentially of a mixture of

(a) an organic antistatic agent,

(b) a humectant selected from the group of ionic and monionic humectants, and

(c) when such humectant is a nonionic humectant, an electrolyte, and

(4) a polymeric backing layer covering said antistatic layer, said antistatic layer in turn, being disposed between said pre-coat layer and said polymeric backing layer.

DETAILED DESCRIPTION

The subject antistatic floor covering and textile structure is illustrated as a carpet in the single figure of the accompanying drawing. The structure, of the floor covering, such as a carpet **2** has a conventional wear layer, such as a fibrous layer **4** which can be woven, tufted, knitted, flocked or other structure usual in carpets. This fibrous layer can be composed of any of the usual textile fibers or blends or mixtures thereof employed in carpet manufacture, such as wool, polyamides (e.g. nylon *66* and nylon *6*), cotton, polyolefins (particularly polypropylene), acrylics, modacrylics, polyesters, etc. The fibrous layer **4** is woven in, tufted through, or in some other manner affixed to a backing layer **5**, usually a woven fabric of cotton or jute, although other fibers and types of construction can be employed for the backing thereof. The basic carpet structure may be any carpet manufacture, such as the well known tufted, Brussels, Wilton, Axminster, chenille, velvet, flocked, knit etc. In accordance with the present invention the underside of the fibrous or pile layer **4** with its primary backing **5** to which the fiber forming pile is affixed or through which it is tufted, etc. is coated with a pre-coat latex layer **3**, comprised of any of the conventional latices, this layer **3** is then coated with an antistatic coating **6** which provides a uniform continuous layer thereover. The antistatic coating **6** is effective without being in contact with the backing and the ends of the fibers forming the pile. The amount of material applied as such antistatic coating should be sufficient to substantially over the pre-coat layer **3**. Normally from .01 to 20 ounces per square yard and preferably from 2.0 to 10.0 ounces per square yard of the antistatic coating is applied.

The antistatic coating composition employed for the antistatic coating layer **6** ideally comprises a mixture of a textile antistatic agent and 10 to 50 parts by weight of humectant. There may also be employed from 0.1 to about 1 part by weight of a nonionic or cationic type wetting agent to assist the dispersing of the antistatic composition. It is also preferable to incorporate in the coating composition from about 0.1 to about 1 part by weight of an electrolyte particularly if the humectant employed is nonionic in character or is only weakly ionic, i.e. has a relatively low dissociation constant. The antistatic coating **6** is preferably applied in the form of an aqueous solution or dispersion, although other solvents or liquid dispersing mediums may be employed if desired and in the case of aqueous solutions or dispersions, volatile water-soluble solvents, such as lower aliphatic alcohols of 1 to 4 carbon atoms, acetone and the like, may be included to facilitate drying of the antistatic layer following its application.

Examples of satisfactory pre-coat latex layers **3** which may be applied to the underside of the primary backing **5** include filled or unfilled coatings of acrylic latexes, vinyl acetate latexes, styrene-butadiene latexes (preferably carboxylated), natural latex, vinyl chloride and vinylidene chloride interpolymers and the like with plasticizing monomers, such as butyl acrylate and including ethylene-vinyl chloride copolymers and the like. Satisfactory adhesive coats include all of the above, but in general styrene-butadiene latexes are preferred.

After the antistatic coating **6** has been applied to the pre-coat layer **3**, a polymeric backing layer **8** is then applied to the carpet and forms an essential element of the carpet structure of this application. This polymeric backing layer is preferably applied in the form of an aqueous dispersion (latex) and is preferably a known compound natural rubber latex or compounded carboxylated butadiene-styrene rubber-latex, commonly employed as latex backing for carpetings, although other polymeric coatings, such as polystyrene, vinylidene chloride, polyacrylates, butadiene-styrene rubbers and the like may be employed both herein and as the pre-coat layer **3**. As examples of known natural compounded rubber latices which are commercially available may be mentioned: Lotol GX–3180, U.S. Rubber Company, compounded carboxylated styrene-butadiene rubber latices such as Lotol GX–1076, U.S. Rubber Company.

While the exact reasons for the antistatic properties of the carpet structure of the present invention are not fully understood, it appears that the two polymeric coatings **3** and **8** serve the function of holding the antistatic coating layer **6** in place yet without interferring with electric charge dissipation. Charges of static electricity built up in the pile **4** are dispersed throughout the entire carpet area by antistatic layer **6** and subsequently bled off into the ground or atmosphere. In order to assist bleeding such charges to the ground, the polymeric coating **3** and **8** may have incorporated therein a material such as as carbon black or any agent which will lower the dielectric properties of the polymeric layers.

A number of preferred compositions for the antistatic coating layer **6** of the carpet structure of the present invention are disclosed in U.S. Pat. 3,519,561 of Andrew J. Kelly and Robert C. Britt entitled "Antistatic Composition and Process." Particularly preferred are those antistatic compositions disclosed in said patent in which potassium formate is employed as humectant since it has been found that not only is potassium formate particularly effective as a humectant in such coating compositions, but compositions containing the same are compatible with the latex backing and specifically overcomes premature coagulation or gelling of latex backing based on natural compounded rubber, thus not interfering with good bonding of the latex coated with the carpet backing. On the other hand, the antistatic coatings containing calcium chloride are incompatible with certain known latex coatings which have been used as carpet backings in that they cause premature coagulation or gelling of the latex with resultant poor adhesion of the latex to the carpet backing so that in the case of loosely woven or tufted carpets the latex does not function satisfactorily to hold the tufts in place.

While antistatic layers based on the antistatic compositions of the above mentioned patent are particularly preferred, it will be understood that one may employ any antistatic layer based on any known antistatic material suitable for textiles which will disperse charges of static electricity. Such agents are normally nitrogen containing or carboxylic containing organic antistatic agents and as examples thereof may be mentioned the following compounds:

Bukester R1499—lauric acid polyethylene glycol ester.

Amine oxides or quaternar ammonium salts of vinyl pyrrolidone dimethylamino-ethylmethacrylate copolymers.

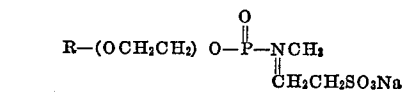
Vinyl pyrrolidone acrylamine copolymers—such as a copolymer of 75% vinyl pyrrolidone and 25% acrylamide.

Zelec DP—lauryl alcohol phosphate.

Catanac SN—stearylamidopropyl dimethyl-β-hydroxyethyl ammonium nitrate.

Ethoquad C/12—polyoxyethylated quaternary ammonium salt.

Phosphonamide sulfonate of an alcohol ethoxylate, i.e., a product of the formula



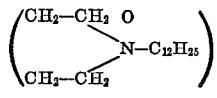
wherein R represents the hydrocarbon residue of an

alkanol (such as Alfol 1412) and *n* represents an integer of 8 to 20.

Partial esters of the copolymer of vinyl methyl ether and maleic anhydride with nonionic surface active agents—described in French Pat. No. 1,360,209.

Esters of phosphoric acid and ethoxylated aliphatic alcohol such as the phosphate esters of lauryl alcohol condensed with 4 moles of ethylene oxide or of dodecyl alcohol condensed with about 2 moles of ethylene oxide

Polyglycol 4000
Sucrose octa-acetate
Polyethoxy amides of stearic and oleic acid
Methyl diethanolamine ethoxylate
Ethoxylated 2,3,7,9-tetramethyl-5-decyne-4,7-diol
Polyoxyethylenemono-oleate
Lauryl trimethyl ammonium chloride
Undecylimidazolone
Lauryl dimethylbenzyl ammonium chloride
Polyoxyethyl stearyl ammonium chloride
Oleic-monoisoproparol amide
Vinyl acetate/styrene/acrylic acid polymers
Ethoxylated diamines
Long chain amine oxides



Hydroxybutyramides
Quaternized polymers of vinylpyridine
Quaternized copolymers of vinylpyridine and vinylpyrrolidone

Phosphate esters of the type described in U.S. Pats. 3,004,056 and 3,004,057 and Belgian Pat. 641,097.

The phosphate esters of the type referred to in said patents may be prepared by reacting one mole of P_2O_5 with 2 to 4.5 moles of a nonionic surface active agent having the molecular configuration of a condensation product of at least one mole of ethylene oxide with one mole of a compound containing at least 6 carbon atoms and a reactive hydrogen atom under substantially anhydrous conditions and at a temperature below about 110° C. The process does not require the use of an excess of the hydroxylic organic compound (in this instance the defined nonionic surface active agent), in order to bring the P_2O_5 into solution. Substantially no tertiary phosphate ester is formed and little or no P_2O_5 remains in the composition. Depending upon the particular ratio of P_2O_5 to the nonionic surface active agent employed, and the nature of such nonionic, the product may in some instances contain some unreacted nonionic surface active agent which for certain uses is actually advantageous.

For similar reasons, the proportions of secondary phosphate ester:primary ester:free nonionic in the products thereof will in general fall within the range of about 20 to 45% secondary ester:30–80% primary ester:0–40% nonionic, by weight.

Lighter colored or substantially colorless products are obtained when the phosphation reaction is carried out in the presence of a small or catalytic amount of a phosphorus-containing compound selected from the group consisting of hypophosphorous acid, salts of hypophosphorous acid, phosphorous acid, and salts and esters of phosphorous acid. The process comprises reacting one mole of P_2O_5 with 2 to 4.5 moles of a nonionic surface active agent having the molecular configuration of a condensation product of at least one mole of ethylene oxide with one mole of a compound containing at least 6 carbon atoms and a reactive hydrogen atom, under substantially anhydrous conditions and at a temperature below about 110° C. in the presence of a small amount of one or a mixture of the aforementioned hypophosphorous or phosphorous acid compounds.

By the use of such compounds in the described phosphation reaction, it has been found that an unexpected and substantial improvement in the (absence of) color of the products and the resistance of such products to discoloration in storage is obtained. Products resulting from the use thereof generally have VCS (varnish color scale, Gardner scale, standards of 1933) values of at least one less than products of the same process carried out in the absence of the hypophosphorous or phosphorous acid compound. Products having a VCS color of about 1 or less are thus made possible, as compared with VCS colors of from about 2 to 7 or more for products produced without the aid of the present invention. Further, the products have been found to resist discolorations or darkening even after storage for three to six months.

The nonionic surface active agents employed as reactants are well known in the art and are disclosed along with suitable methods for their preparation in numerous patents and other publications. In general, they may be obtained by condensing a polyglycol ether containing the required number of alkenoxy groups or an alkylene oxide such as propylene oxide, butylene oxide, or preferably ethylene oxide, with an organic compound containing at least 6 carbon atoms and a reactive hydrogen atom. As such compounds containing a reactive hydrogen atom there may be mentioned alcohols, phenols, thiols, primary and secondary amines, and carboxylic and sulfonic acids, and their amides. The amount of alkylene oxide or equivalent condensed with the reactive chain, will depend primarily upon the particular compound with which it is condensed. As a convenient rule of thumb, an amount of alkylene oxide or equivalent should be employed which will result in a condensation product containing about 20 to 85% by weight of combined alkylene oxide. However, the optimum amount of alkylene oxide for attainment of the desired by hydrophobic hydrophilic balance may be readily determined in any particular case by preliminary test and routine experimentation.

In general, the nonionic surface active agents, having the molecular configuration of a condensation product of at least one mole of an alkylene oxide, preferably ethylene oxide, with one mole of a compound containing at least 6 carbon atoms and a reactive hydrogen atom are preferably polyoxyalkylene derivatives of alkylated and polyalkylated phenols, multi-branched chain primary aliphatic alcohols having the molecular configuration of an alcohol produced by the Oxo process from a polyolefin of at least 7 carbon atoms, and straight chain aliphatic alcohols of at least 10 carbon atoms. Examples of these derivatives and other suitable nonionic surface active agents which may be phosphated in accordance with the present invention are included below. In this list, "E.O." means "ethylene oxide" and the number preceding same refers to the number of moles thereof reacted with one mole of the given reactive hydrogen-containing compound.

Nonylphenol+9–11 E.O.
Nonylphenol+2 E.O.
Dinonylphenol+7 E.O.
Dodecylphenol+18 E.O.
Castor oil+20 E.O.
Tall oil+18 E.O.
Oleyl alcohol+20 E.O.
Lauryl alcohol+4 E.O.
Lauryl alcohol+15 E.O.

Hexadecyl alcohol+12 E.O.
Hexadecyl alcohol+20 E.O.
Octadecyl alcohol+20 E.O.
Oxo tridecyl alcohol:
(From tetrapropylene)+7 E.O.
(From tetrapropylene)+10 E.O.
(From tetrapropylene)+15 E.O.

Dodecyl mercaptan+9 E.O.
Soya bean oil amine+10 E.O.
Rosin amine+32 E.O.
Coconut fatty acid amine+7 E.O.
Cocoa fatty acid+10 E.O.
Dodecylbenzene sulfonamide+10 E.O.
Decyl sulfonamide+6 E.O.
Oleic acid+5 E.O.
Polypropylene glycol (30 oxypropylene units),+10 E.O.

In carrying out the phosphation reaction the P_2O_5 is preferably added gradually, with vigorous agitation to the nonionic surface active agent in liquid form. If the latter agent is a solid at room temperature, it should be heated to above its melting point. Addition of the nonionic surface active agent to the P_2O_5 is inadvisable since this has been found to result in the formation of tar and the like and to prevent the reaction from proceeding to completion. The reaction is exothermic and in some cases cooling is necessary to prevent the temperature from going above 110° C. since this tends to produce discolored and darkened products. The reaction proceeds continuously during addition of the P_2O_5 and solution thereof in the nonionic surface active agent, and is substantially 90% complete or more by the time all of the P_2O_5 has been added. The few particles of solid P_2O_5 remaining in the reaction medium may be removed at this point if time is of the essence, but it is preferred in the interests of economy to allow the reaction to proceed for an additional period of time which may range from ½ to 5 hours or more at ambient temperatures up to about 110° C. until all of the P_2O_5 has dissolved indicating complete reaction between the reactants involved. Vigorous agitation during the reaction is highly desirable to facilitate and expedite completion of the reaction.

It is an advantageous feature that the P_2O_5 may be employed in dry, solid form as a granular powder or other finely divided or particulate form, for reaction with the above defined nonionic surface active agents. However, if desired, the P_2O_5 may first be dispersed in an inert organic diluent such as benzene, xylene, ether, pentane, or low and high boiling hydrocarbon fractions.

After completion of the reaction, the reaction mixture may be cooled and discharged. If carried out under rigid anhydrous conditions the product should consist of a mixture of the primary and secondary phosphate esters of the nonionic surface active agent combined, depending upon the proportions of reactants, in some instances with a small proportion of unreacted nonionic surface active agent. Any small amount of water present in the reaction mixture will result protanto in the formation of some phosphoric acid in the product. The degree of esterification in the product may be determined by potentiometric titration or by titration with alkali to methyl orange and then to phenolphthalein.

The products may be supplied in free unneutralized form, or in the form of the partially or completely neutralized salts containing as cations alkali metals, alkaline earth metals, metals, ammonium and organic amines. It is to be understood that such salts are to be regarded as the equivalent of the present products in heir free form. As examples of suitable cations, there may be mentioned sodium, potassium, lithium, calcium, strontium, barium, magnesium, iron, tin, cadmium, aluminum, antimony, chromium, manganese, mercury, nickel, silver, zinc, ammonium and aliphatic, alicyclic, aromatic and heterocyclic organic amines such as the mono-, di- and tri-methylamines, ethylamines, propylamines, laurylamines, stearylamines, ethanolamines, propanolamines, butanolamines, hexanolamines, cyclohexylamines, phenylamines, pyridylamines, morpholinylamines, and the like.

Where desired, the above products may be modified by the addition to the reaction medium of a small amount of hypophosphorous or phosphorous acid compound. Generally, about 0.01 to 5% and preferably about 0.1 to 2% of such compound, based on the weight of the nonionic surface active agent being phosphated is sufficient to provide the desired improvements with respect to prevention of color degradation of the products and improvement in resistance of the products to color degradation in storage. Hypophosphorous acid and its alkali metal salts, e.g. sodium and potassium salts are generally preferred although any metal, alkaline earth metal, ammonium or amine salt of hypophosphorous acid or phosphorous acid may be employed, in addition to phosphorous acid per se. When hypophosphorous acid is employed, it is preferred to use a 30 to 50% aqueous solution thereof although aqueous solutions of this acid and other of the water soluble hypophosphorous and phosphorous acid compounds may be employed in the form of aqueous solutions ranging in concentration from less than 5 up to 70% or more. It should be borne in mind that the reaction should be carried out under substantially anhydrous conditions and accordingly the water introduced in such solutions should be held to a minimum.

The salts of hypophosphorous acid and phosphorous acid employed herein may be in their hydrated or dehydrated form. As examples of such salts, there may be mentioned aluminum, cadmium, sodium, potassium, lithium, calcium, strontium, barium, magnesium, ammonium, mono-, di- and tri-methylamine, -ethylamine, -propylamine, -ethanolamine, and -propanolamine, pyridinyl, and morpholinyl phosphites and hypophosphites.

Esters of phosphorous acid may also be employed. These esters may be described as mono-, di-, and tri-alkyl, -aryl, and -cycloalkyl phosphites. It will be understood that mixed esters are included. As some specific examples of such esters in which the esterifying group generally contains from about 1 to 20 carbon atoms, there may be mentioned ethyl phosphite, lauryl phosphite, Oxo tridecyl phosphite (the esterifying alcohol having the molecular configuration of an alcohol produced from tetrapropylene or triisobutylene by the Oxo process), stearyl phosphite, phenyl phosphite, cyclohexyl phosphite, the corresponding di- and tri-substituted phosphites, ethyl phenyl phosphite, ethyl diphenyl phosphite, lauryl cyclohexyl phosphite, dipropyl phenyl phosphite, and the like.

The hypophosphorous or phosphorous acid compound is preferably admixed with the non-ionic surface active agent prior to its addition to the nonionic surface active agent. It will accordingly be understood that the hypophosphorous or phosphorous acid compound or mixture thereof may be added at the start of the reaction or continuously or intermittently as the reaction proceeds.

The examples in the following table are only illustrative. In each of these examples, the nonionic surface active agent is first charged to a reactor equipped with an agitator. If the charge is solid at room temperature, it is heated to melt the same. The additive referred to in the table is then added to and dissolved in the nonionic surface active agent with vigorous agitation. The solid granular P_2O_5 is then charged to the reactor with vigorous agitation over a period ranging from about 5 minutes to about 1 hour and usually about 15 minutes. After the initial exothermic reaction subsides, the reaction mixture is heated to 100° C. and held at this temperature for about 5 hours after which the mixture is cooled and discharged. A sample of the reaction mixture is titrated with alkali to methyl orange and then to phenolphthalein as a control on the esterification. The VCS color readings are measured in the prescribed manner. A reading of one is the lowest color reading measurable by this method, the highest being 18. Products prepared with the use of the additives referred to in the table sustained no change in color after 3 to 6 months' storage.

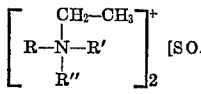
Preferred are the monoesters, the diesters and the mixtures of same.

TABLE A

Example	Nonionic agent	Nonionic parts	P_2O_5 parts	Parts	Additive where employed	VCS color
1	Nonylphenol + 2 E.O. $C_9H_{19}C_6H_4(OC_2H_4)_2OH$	2,888	284	Control		2
2	do	2,288	284	3.4	Hypophosphorous acid (50%)	<1
3	Nonylphenol + 4 E.O. $C_9H_{19}C_6H_4(OC_2H_4)_4OH$	2,855	213	Control		4
4	do	2,855	213	4.2	Hypophosphorous acid (50%)	<1
5	Nonylphenol + 6 E.O. $C_9H_{19}C_6H_4(OC_2H_4)_6OH$	484	47.3	Control		4
6	do	484	47.3	1.0	Hypophosphorous acid (50%)	<1
7	do	484	47.3	0.5	Sodium hypophosphite	<1
8	do	484	47.3	2.0	Triphenyl phosphite	2
9	Nonylphenol + 10 E.O. $C_9H_{19}C_6H_4(OC_2H_4)_{10}OH$	1,821	108	Control		4
10	do	1,821	108	7.0	Hypophosphorous acid (30%)	<1
11	Nonylphenol + 100 E.O. $C_9H_{19}C_6H_4(OC_2H_4)_{100}OH$	605	11.9	Control		2
12	do	605	11.9	1.2	Hypophosphorous acid (50%)	1
13	Dinonylphenol + 7 E.O. $C_{18}H_{38}C_6H_4(OC_2H_4)_7OH$	327	23.6	Control		5
14	do	327	23.6	1.0	Hypophosphorous acid (30%)	<1
15	Dodecylphenol + 6 E.O. $C_{12}H_{25}C_6H_3(OC_2H_4)_6OH$	1,052	94.4	Control		4
16	do	1,052	94.4	3.0	Hypophosphorous acid (50%)	<1
17	Oxo tridecyl alcohol [1] + 3 E.O. $C_{13}H_{27}(OC_2H_4)_3OH$	166	23.7	Control		7
18	do	166	23.7	1.0	Hypophxophorous acid (50%)	2
19	do	166	23.7	1.0	Phosphorous acid	2
20	Lauryl alcohol + 4 E.O. $C_{12}H_{25}(OC_2H_4)_4OH$	724	71	Control		7
21	do	724	71	1.8	Hypophosphorous acid (50%)	1

[1] From tetrapropylene by the Oxo process.

A suitable quaternary ammonium compound, may be represented by the following structural formula:



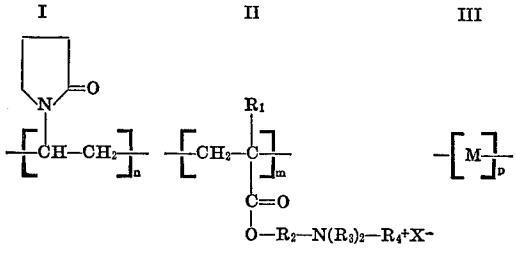
wherein R=—$(CHY)_n$—CH_3 and n=6 to 26; R″ and R′=—$(CHY)_n$—CH_3 and n=0 to 6. The alkyl moiety may be branched or straight chain, y being hydrogen or an alkyl group as defined above. R″ and R′ need not be the same.

The quaternary ammonium compounds may be made in ways known in the art, such as for example by dissolving in isopropyl alcohol one mole of dimethyl stearyl amine; then from a separatory funnel add thereto ½ mole of diethyl sulfate keeping temperature below 50° C.; after the last of the diethyl sulfate is added and the exotherm is stopped, reflux for one hour and cool. Evaporate the alcohol.

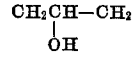
Preferred quaternary ammonium compounds include: compounds where R′ and R″ are lower alkyl particularly preferred is wherein R′ and R″ are methyl. R may be C_{12-16}, saturated or unsaturated, i.e., cocoa, stearic, oleic and the like.

The quaternized copolymers referred to may be those that are compounds which are first copolymerized and thereafter quaternized or those wherein the monomers are first quaternized and then copolymerized. Procedures known in the art for carrying out the above processes may be employed.

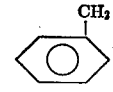
The quaternary copolymers employed are those which have Unit I and either Units II or III, or all three Units.



wherein n represents 40–90 mole percent, m is 10–60 mole percent, p is from 10–60 mole percent and $n+m$ or p or $n+m+p$=100; R_1 is H or CH_3; R_2 is



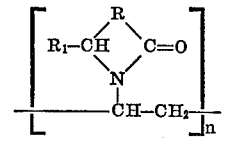
or C_xH_{2x} where x=2–18; R_3 is CH_3 or C_2H_5; R_4 is CH_3, C_2H_5,



X is Cl, Br, I, SO_4, HSO_4, CH_3SO_3; and M is a monomeric unit resulting from the heteropolymerization employing a mono vinyl monomer different from and copolymerizable with n. M may be 5 to 40 where p is 0 to 50; the latter occurring where n, m and p are all employed.

As indicated from the above formula, such quaternary copolymers are prepared by the copolymerization of an N-vinyl lactam, such as N-vinyl pyrrolidone and di-loweralkylaminoalkyl (or hydroxy alkyl) acrylate or methacrylate, and optionally a further mono vinyl different from and copolymerizable with n. The monomers are copolymerized in accordance with the present invention so that based upon 100 mole percent, the vinyl pyrrolidone units are present in an amount of 40–90 mole percent, the units derived from the di-loweralkylaminoalkyl (or hydroxy alkyl) acrylate or methacrylate constitute from 10 to 60 mole percent, and the units derived from said further copolymerizable vinyl monomer also constitute from 10 to 60 mole percent.

Suitable heterocyclic N-vinyl lactams have the formula:



wherein R represents an alkylene bridge group of 2 to 4 carbon atoms necessary to complete a 5, 6 or 7-membered heterocyclic ring system, and R_1 represents either hydrogen or a lower alkyl group, and n is an integer of at least 3.

All of the specific polymeric materials characterized by the foregoing general formula are commercially available and are called polymeric N-vinyl lactams. They are obtained by polymerizing organic 5, 6 or 7 membered ring compounds containing in their rings the —NH—CO— group, such as, for example,

N-vinyl-2-pyrrolidone,
N-vinyl-2-piperidone,
N-vinyl-2-caprolactam,
N-vinyl-3-methyl-2-pyrrolidone,
N-vinyl-3-methyl-2-piperidone, or
N-vinyl-3-methyl-2-caprolactam,
N-vinyl-4-methyl-2-pyrrolidone,
N-vinyl-4-methyl-2-piperidone or
N-vinyl-4-methyl-2-caprolactam,
N-vinyl-5-methyl-2-pyrrolidone,
N-vinyl-5-methyl-2-piperidone,
N-vinyl-3-ethyl-2-pyrrolidone,

N-vinyl-4,5-dimethyl-2-pyrrolidone,
N-vinyl-5,5-dimethyl-2-pyrrolidone,
N-vinyl-3,3,5-trimethyl-2-pyrrolidone,
N-vinyl-5-methyl-5-ethyl-2-pyrrolidone,
N-vinyl-3,4,5-trimethyl-3-ethyl-2-pyrrolidone,
N-vinyl-6-methyl-2-piperidone,
N-vinyl-6-methyl-2-piperidone,
N-vinyl-3,5-dimethyl-2-piperidone,
N-vinyl-4,4-dimethyl-2-piperidone,
N-vinyl-7-methyl-2-caprolactam,
N-vinyl-7-ethyl-2-caprolactam,
N-vinyl-3,5-dimethyl-2-caprolactam,
N-vinyl-4,6-dimethyl-2-caprolactam and
N-vinyl-3,5,7-trimethyl-2-caprolactam.

Of these several compounds, N-vinyl-2-pyrrolidone is most preferred as it is readily available and provides products having excellent properties.

Exemplary di-loweralkylaminoalkyl (or hydroxy alkyl) acrylates or methacrylates suitably employed include such materials as:

dimethylaminomethyl acrylate
dimethylaminomethyl methacrylate
diethylaminomethyl acrylate
diethylaminomethyl methacrylate
dimethylaminoethyl acrylate
dimethylaminoethyl methacrylate
dimethylamino-2-hydroxy propyl acrylate
dimethylamino-2-hydroxy propyl methacrylate
diethylamino-2-hydroxy ethyl acrylate
diethylamino-2-hydroxy ethyl methacrylate
dimethylaminobutyl acrylate
dimethylaminobutyl methacrylate
dimethylaminoamyl methacrylate
diethylaminoamyl methacrylate
dimethylaminohexyl acrylate
diethylaminohexyl methacrylate
dimethylaminooctyl acrylate
diethylaminooctyl methacrylate
diethylaminooctyl acrylate
diethylaminooctyl methacrylate
dimethylaminodecyl methacrylate
dimethylaminododecyl methacrylate
diethylaminolauryl acrylate
diethylaminolauryl methacrylate
dimethylaminostearyl acrylate
dimethylaminostearyl methacrylate
diethylaminostearyl acrylate
diethylaminostearyl methacrylate

etc., the non-hydroxy alkyl units being preferred.

The mono vinyl or vinylidene monomer represented by M in the above structural formula can comprise any conventional vinyl monomer copolymerizable with N-vinyl pyrrolidone. Thus, for example, suitable conventional vinyl monomers include the alkyl vinyl ethers, e.g., methyl vinyl ether, ethyl vinyl ether, octyl vinyl ether, etc.; acrylic and methacrylic acid and esters thereof, e.g., methacrylate, methyl methacrylate, etc.; vinyl aromatic monomers, e.g., styrene, α-methyl styrene, etc.; vinyl acetate; vinyl alcohol; vinylidene chloride; acrylonitrile and substituted derivatives thereof; methacrylonitrile and substituted derivatives thereof; acrylamide and methacrylamide and N-substituted derivatives thereof; vinyl chloride, crotonic acid and esters thereof; etc. Again, it is noted that such copolymerizable vinyl monomer can comprise any conventional vinyl monomer copolymerizable with N-vinyl pyrrolidone and where a terpolymer is formed, copolymerizable with both units *n* and *m*, and being different from both.

Accordingly, preferred quaternized copolymers employed in the present invention can be characterized as having a repeating structural unit derived from

(A) 40–90 mole percent of vinyl lactam;
(B) 10–60 mole percent of a di-loweralkylaminoalkyl acrylate or methacrylate of a di-loweralkylaminohydroxylalkyl acrylate or methacrylate; or
(C) 10–60 mole percent of a vinyl monomer different from and copolymerizable with A and B.

Such copolymers are conveniently prepared by subjecting a solution of vinyl lactam and the amino acrylate or amino methacrylate monomer with or without an optional copolymerizable vinyl monomer to conditions conducive to vinyl polymerization through the double bond. Thus, for example, polymerization may suitably be initiated by the action of free radicals, the polymerization proceeding exothermically once initiated. Suitable free radical catalysts conveniently employed and suitably utilized in accordance with the production of the copolymers include organic and inorganic peroxides, e.g., hydrogen peroxide, t-butyl peroxide, etc., aliphatic azo compounds, e.g., azobisisobutyronitrile as well as other free radical forming catalysts well known in the polymerization art.

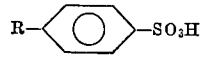
The polymerization is preferably carried out in solution at temperatures varying from about 50° C. to 100° C. or more; however, to avoid run away conditions and to obtain a copolymer of a desirable molecular weight it is sometimes preferred to carry out the copolymerization at a temperature of from about 75 to about 85° C. The copolymerization reaction is preferably carried out in the absence of free-oxygen, conveniently under a blanket of an inert gas, such as, nitrogen, argon or the like, or at atmospheric pressure.

As indicated previously the copolymers are in the form of their quaternary salts. Accordingly, after completion of the polymerization reaction the polymer is submitted to a treatment conducive to quaternization of the tertiary amino group, utilizing a conventional quaternizing agent. Thus, noting the above structural formula for the copolymers, suitable quaternizing agents include, such as, dialkyl sulfates, e.g., dimethyl sulfate, diethyl sulfate, etc.; alkyl sulfonic acid, e.g., methyl sulfonic acid, ethyl sulfonic acid, etc.; benzyl halides, e.g., benzyl chloride, benzyl bromide, benzyl iodide, etc.; alkyl halide, etc. Accordingly, any conventional quaternizing agent can be advantageously employed in the production of the quaternary N-vinyl pyrrolidone copolymers used in the compositions of the present invention.

The molecular weight of the quaternized copolymers should be between 800 and 5,000.

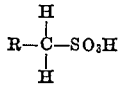
Operative group IA, IIA and IIB metal sulfonates and sulfates may be represented by the following generic formulae:

1. Alkylaryl Sulfonates (i.e. Naccanol 402B)
2. Alkylbenzene Sulfonates



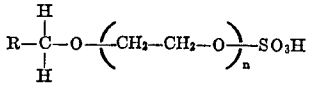
R is $CH_3-(CH_2)_n-$
n is 0–200

3. Linear Sulfonates



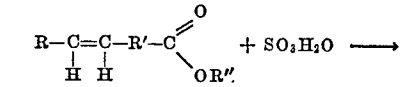
(i.e. Nansa HS–55 viz. Sodium Lauryl Sulfate)
R is $CH_3-(CH_2)_n-$

4. Ethoxylated Alcohol Sulfates (i.e. Alipals)

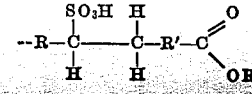


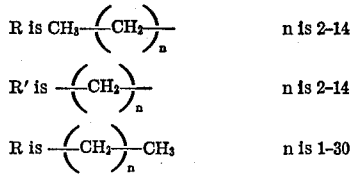
n is 1–1000

5. Sulfonated Esters

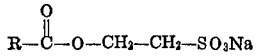


or

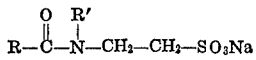




6. Alkyl Naphthalene Sulfonates (i.e., Nekal BA–75)
7. Igepon A's



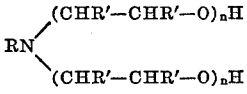
8. Igepon T's



(R, R' and R'' are alkyl or aromatic groups)

It is to be understood that any one of the above components may be used in place of the alkoxylated tertiary amine, however, the humectant (and where needed, the electrolyte) must still be employed in conjunction therewith.

Particularly preferred antistatic layers based on alkoxylated tertiary amines represented by the following general formula:



wherein R represents an aliphatic hydrocarbon radical of from about 8 to about 22 carbon atoms, each R' represents hydrogen or methyl and *n* represents an average integer of at least 1, preferably 1 to about 30, although higher alkoxylated derivatives, i.e., the products obtained by condensing 1 molar proportion of a primary aliphatic (saturated or unsaturated) amine with up to 50 molar proportions of an alkylene oxide, usually ethylene oxide, may be employed if desired. Such alkoxylated amines are well known in the art and are prepared by condensing the primary saturated or unsaturated aliphatic amine of from 8 to 22 carbon atoms, with an alkylene oxide, usually ethylene oxide, although propylene oxide and butylene oxide may be employed if desired, until glycol groups of desired chain length are obtained. Such products have been disclosed, for example in U.S. Pats. 1,970,578, 2,174,762, 2,510,284 and 2,593,466.

As a humectant in the composition of the present invention there may be used various deliquescent salts of metals of the Groups I and II, Periodic Table, particularly of the alkali metal and alkaline earth metals. Specific deliquescent salts which I prefer to employ as humectant, include the alkali metal salts of lower aliphatic carboxylic acids, such as sodium formate, potassium formate, lithium formate, cesium formate, sodium and potassium acetate, potassium butyrate and mineral acid salts like calcium chloride. There may also be used such organic humectants as glycerol, urea, ethylene glycol, sorbitol, ethoxylated sorbitol, lauric acid esters and mixtures of the same.

It will be apparent that where a deliquescent salt is employed as the humectant, it may also function as an electrolyte. However, where glycerine or other nonionic humectants are employed, they should be combined with an electrolyte. Also in the case of deliquescent salts, such as sodium and potassium formate which have a relatively low dissociation constant, it is preferable to incorporate a small amount of a salt of a strong base and strong acid having a high dissociation constant, such as sodium chloride, potassium chloride or calcium chloride. Salts which are not sufficiently deliquescent such as sodium chloride, sodium sulfate, potassium nitrate, so that they do not function wholly satisfactorily as both humectant and electrolyte, can be employed in combination with a nonionic humectant, such as glycerine or urea or in combination with a more highly deliquescent salt, such as potassium formate or calcium chloride. Thus in the composition of the present invention, the humectant and electrolyte may be either a single compound or a mixture of compounds.

If desired a further backing, such as a jute backing, illustrated as **10** in the drawings, may be applied over the latex coating, but is not an essential element of the carpet structure of this invention.

The details of the present invention will be apparent from consideration of the following specific examples and claims, in which all parts, proportions and percentages are by weight unless specified otherwise.

EXAMPLES 1–17

In these examples the antistatic composition was prepared by adding the base and organic acid to water to form the humectant in situ. The alkoxylated amine employed was stearyl amine which had been ethoxylated with 20 moles of ethylene oxide per mole of amine. The thus prepared antistatic composition may, if desired, be modified by thickening with any known thickener, such as sodium polyacrylate, methyl cellulose or the like. A pH adjustment up to about 7–13 may also be desirable in certain instances were reduced susceptibility to migration and enhanced flame retardency are desired. A wetting agent where employed, may be tridecyl alcohol which had been ethoxylated with 6 moles of ethylene oxide per mole of alcohol.

In all cases the antistatic coating was applied to the underside of the latex pre-coat layer, the latter having been applied to the back of a tufted carpet having a primary loosely wooven jute backing, and the type of fibers employed in the tufted pile are given in Table I as well as the amount of antistatic composition applied to the underside of the pre-coat layer. After application of the antistatic coating the carpet was dried to remove excess moisture. A latex coating was then applied over the antistatic coating.

The testing procerure used in these examples was the AATC 134–1969 Test.

TABLE I

Example number	Humectant: Basic compound	Humectant: Parts	Humectant: Organic acid	Humectant: Parts	Parts amine	Parts wetting agent	Electrolyte	Parts	Parts water	pH adjustment acid or base	pH	Carpet fiber	Coating wt. in ozs. per sq. yard
1	NaOH	40	Formic	56	20	2	NaCl	2	210	Acetic	6.5	Acrylic	5
2	NaOH	40	do	56	20	2	NaCl	2	210	do	6.5	Polyester	5
3	NaOH	40	do	56	20	2	NaCl	2	210	Formic	6.5	Polypropylene	5
4	NaOH	40	Acetic	60	20	2	NaCl	2	210	do	9	Nylon	5
5	NaOH	40	do	60	20	2	NaCl	2	210	do	6.5	Wool	5
6	KOH	56	Formic	46	20	2	NaIC	2	180	do	9	Nylon	4
7	KOH	56	do	46	20	2	NaCl	2	180	Acetic	6.5	Wool	5
8	NaOH	20	do	23	10	1	KCl	1	150	do	6.5	Nylon	5
9	NaOH	20	do	23	10	1	KCl	1	150	Formic	6.5	Wool	4
10	KOH	56	Acetic	60	20	1	NaCl	2	200	do	6.5	Nylon	6
11	KOH	56	do	60	20	1	NaCl	2	200	do	6.5	Wool	4
12	KOH	56	do	74	25	1	NaCl	3	500	do	6.5	Nylon	5
13	KOH	56	do	74	25	1	NaCo	3	500	do	6.5	Wool	5
14	KOH	69	Formic	56	25	2	NaCl	2.5	245	do	6.5	Nylon	5
15	KOH	69	do	56	25	2	NaCl	2.5	245	do	6.5	Polyester	5
16 [1]												Acrylic	5
17 [1]												Polypropulene	5

[1] Untreated control.

TABLE II.—STATIC RESULTS ACCORDING TO AATC 134-1969

Ex.	Before cleaning, volts: Chrome leather	Before cleaning, volts: Neolite	After steam cleaning, volts: Chrome leather	After steam cleaning, volts: Neolite	Control—No treatment, volts: Chrome leather	Control—No treatment, volts: Neolite
1	+100	−100	+450	+500	+10-11,000	−4-5,000
2	−250	−250	+400	+600	+7,000	+2,500
3	−100	−100	+200	−150	+6,500	−2,000
4	−800	−400	−2,200	−600	9,000	7,000
5	−100	+200	−400	−600	−12,000	−8,000
6	−500	−800	−1,000	−1,200		
7	400	600	500	−400		
8	300	500	800	1,000		
9	200	300	600	800		
10	800	1,000	1,400	900		
11	600	700	800	600		
12	200	800	600	800		
13	400	1,200	1,400	1,100		
14	600	400	810	950		
15	800	600	800	500		

EXAMPLES 18–33

In these examples the samples treated were nylon and wool tufted carpet structures. In all cases the antistatic coating was applied over a latex pre-coat layer and dried. A latex coating was then applied over the antistatic coating.

In these examples the humectant was formed in situ by the reaction of a basic component with an acidic component. The testing procedure was the same as in the preceding examples.

The composition of the antistatic coating, as well as the test results and other pertinent information for these examples are given in Table III.

TABLE IV.—STATIC RESULTS ACCORDING TO AATC 134-1969

Example	Before cleaning: Chrome leather	Before cleaning: Neolite	After steam cleaning: Chrome leather	After steam cleaning: Neolite
18	−2,000	−1,300	1,500	−1,400
19	−2,000	−1,300	1,500	−1,400
20	−500	−500	300	200
21	−1,300	−1,400	−1,100	1,200
22	−1,000	−1,100	500	800
23	−1,700	−1,300	1,500	1,100
24	−1,300	−1,200	1,200	1,300
25	−1,300	−1,200	7,000	1,000
26	−1,700	−900	1,500	1,100
27	−1,700	−1,800	1,600	1,900
28	−1,200	−1,200	800	900
29	−1,800	−1,300	1,500	1,200
30	−700	−1,100	900	1,200
31	−1,100	−1,200	800	950
32	−1,200	−900	1,100	850
33	−7,000	−4,200	11,000	5,200
34	−17,000	−5,400	9,000	6,200

EXAMPLES 35–49

In these examples the samples treated were nylon and wool tufted carpet structures. In all cases the antistatic coating was applied in the same manner as in the preceding examples.

In these examples the humectant was not formed in situ, but instead was added directly to the antistatic composition. In Examples 41–44 the calcium chloride functioned as both a humectant and electrolyte.

The composition of the antistatic coating, as well as the test results and other pertinent information for these examples are given in Table V.

TABLE III

Example number	Humectant: Basic compound	Humectant: Parts	Humectant: Organic acid	Humectant: Parts	Humectant: Parts amine	Parts wetting agent	Electrolyte	Parts	Parts water	pH adjustment acid or base	pH	Carpet fiber	Coating wt. in ozs. per sq. yard
18	NaOH	40	Acetic	60	20	2	NaCl	2	210	Acetic	6.5	Nylon	4
19	NaOH	40	do	60	20	2	NaCl	2	210	do	6.5	Wool	4
20	KOH	56	Formic	46	20	2	NaCl	2	180	Formic	6.5	Nylon	4
21	KOH	56	do	46	20	2	NaCl	2	180	do	6.5	Wool	4
22	NaOH	20	do	23	10	1	KCl	1	150	Triethanolamine	9	Nylon	6
23	NaOH	20	do	23	10	1	KCl	1	150	do	9	Wool	6
24	KOH	56	Acetic	60	20	2	NaCl	1	200	Acetic	6.5	Nylon	4
25	KOH	56	do	60	20	2	NaCl	1	200	do	6.5	Wool	4
26	KOH	56	Propionic	74	25	2	NaCl	3	500	Formic	6.5	Nylon	4
27	KOH	56	do	74	25	2	NaCl	3	500	do	6.5	Wool	4
28	KOH	69	Formic	56	25	3	NaCl	2.5	245	Morpholene	9	Nylon	6
29	KOH	69	do	56	25	3	NaCl	2.5	245	do	9	Wool	6
30	29% NH_4OH	121	Acetic	60	20	2	NaCl	2	200	NH_4OH	9	Nylon	6
31	29% NH_4OH	121	Formic	46	20	2	NaCl	2	200	NH_4OH	9	do	6
32	29% NH_4OH	121	Propionic	74	20	2	NaCl	2	400	NH_4OH	6.5	do	4
33 [1]												do	
34 [1]												Wool	

[1] Untreated control.

TABLE V

Example number	Humectant	Parts	Parts amine	Parts wetting agent	Electrolyte	Parts	Parts water	pH adjustment acid or base	pH	Carpet fiber	Coating wt. in ozs. per sq. yard
35	Sorbitol ester [1]	10	20	1	NaCl	1	70	Acetic	6.5	Nylon	5
36	$CaCl_2$	20	20	2		(2)	100	do	6.5	do	5
37	$CaCl_2$	20	20	2		(2)	100	do	6.5	do	5
38	$CaCl_2$	20	20	2		(2)	100	do	6.5	Wool	5
39	$CaCl_2$	30	20	2		(2)	110	do	6.5	Nylon	5
40	$CaCl_2$	30	20	2		(2)	110	do	6.5	do	5
41	$CaCl_2$	30	20	2		(2)	110	do	6.5	Wool	5
42	$CaCl_2$	40	20	2		(2)	120	do	6.5	Nylon	5
43	$CaCl_2$	40	20	2		(2)	120	do	6.5	do	5
44	$CaCl_2$	40	20	2		(2)	120	do	6.5	Wool	5
45	Urea	10	10	1	$CaCl_2$	10	100	Formic	6.5	Nylon	5
46	Urea	30	[3] 10	1	NaCl	1	110	do	6.5	do	5
47	$CaCl_2$	30	[4] 10	2		(2)	100	Acetic	6.5	do	5
48 [5]										do	
49 [5]										Wool	

[1] Ethoxylated sorbitol lauric acid ester.
[2] Humectant was electrolyte.
[3] N-octyl, N-ethyl morpholinium ethosulfate.
[4] Quaternary diethyl sulfate imidazoline.
[5] Untreated control.

TABLE VI.—STATIC RESULTS ACCORDING TO AATC 134-1969

Example	Before cleaning		After steam cleaning	
	Chrome leather	Neolite	Chrome leather	Neolite
35	1,700	2,200	1,800	2,100
36	1,800	2,100	1,600	1,900
37	2,600	3,200	2,800	3,300
38	2,700	2,810	2,900	3,200
39	2,500	2,600	2,600	2,400
40	2,900	3,300	3,200	2,800
41	3,100	2,900	3,400	3,200
42	3,400	3,400	3,200	3,600
43	2,800	2,700	2,400	2,800
44	3,200	2,600	3,300	2,800
45	3,100	3,200	2,900	3,500
46	2,500	2,600	2,800	1,600
47	3,300	3,500	3,400	3,200
48	2,800	2,200	2,500	3,000
49	11,000	6,500	12,200	6,700
50	9,500	5,500	9,200	5,400

EXAMPLES 50–78

In these examples the samples tested were conventional woven and nonwoven fabrics. In all cases the antistatic coating was applied and dried to remove the excess moisture.

In these examples the humectant was formed in situ by the reaction of a basic component as in Examples 1–18. The procedure for these examples was as follows:

The samples were cut and coated first with a latex backing and then with the antistatic coating. In these examples, the coating weight was based on the weight of the fabric in question. A polymeric backing was then applied to the fabric and dried at a temperature of from about 200 to 325° F. for a period of time of from about 10 to 30 minutes. The dried fabric was then conditioned for at least 6 hours at a temperature of 70±5° F., and 35 to 40% relative humidity. The coated material was then tested on an Atlab Tester, as developed by the Atlas Chemical Co., Wilmington, Del. The test procedure consists essentially of a means of controlled rubbing of a strip of fabric across a pair of static-generating (Teflon) bars and across a stainless steel bar which transfers the friction generated charge to an electrostatic voltmeter for measurement. This testing was conducted at 77° F.±2° F., and at a constant relative humidity of 35 to 40%.

The composition of the antistatic coating, as well as the test results and other pertinent information for these examples, are given in Table VII.

EXAMPLES 79–111

In these examples the samples treated were conventionally woven and nonwoven fabrics of the type and fibers shown in Table VII. In all cases the antistatic coating was applied in the same manner to the back of the precoat latex and the textile sample dried to remove excess moisture. A polymeric backing was then applied to the fabric and cured at a temperature of from 200°–325° F. for from 10–30 minutes. The coated material was then tested on an Atlab Tester in the manner described above in connection with Examples 77–78. In these examples the humectant was not formed in situ, but instead was added directly to the antistatic composition.

The composition of the antistatic coating as well as test results and other pertinent data for these examples are given in Table VIII.

TABLE VII

Example number	Humectant: Basic compound	Humectant: Parts	Humectant: Organic acid	Humectant: Parts	Parts amine	Electrolyte	Parts	Parts water	pH adjustment acid or base	pH	Nylon textile	Percent coating weight	Charge build-up in kv.
50	NaOH	40	Acetic	60	20	NaCl	2	210	Acetic	6.5	Taffeta	2	1.2
51	NaOH	40	do	60	20	NaCl	2	210	do	6.5	do	5	.5
52	NaOH	40	do	60	20	NaCl	2	210	do	9.0	Upholstery	2	1.0
53	NaOH	40	do	60	20	NaCl	2	210	do	6.5	do	5	.2
54	KOH	56	Formic	46	20	NaCl	2	180	Formic	6.5	Taffeta	2	.5
55	KOH	56	do	46	20	NaCl	2	180	do	6.5	do	5	.1
56	KOH	56	do	46	20	NaCl	2	180	do	6.5	Upholstery	2	0.5
57	KOH	56	do	46	20	NaCl	2	180	do	6.5	do	5	.0
58	NaOH	20	do	23	10	KCl	1	150	do	6.5	Taffeta	2	.5
59	NaOH	20	do	23	10	KCl	1	150	do	6.5	do	5	.2
60	NaOH	20	do	23	10	KCl	1	150	do	6.5	Upholstery	2	.6
61	NaOH	20	do	23	10	KCl	1	150	do	6.5	do	5	.4
62	KOH	56	Acetic	60	20	NaCl	2	200	Acetic	6.5	Taffeta	2	.2
63	KOH	56	do	60	20	NaCl	2	200	do	6.5	do	5	.1
64	KOH	56	do	60	20	NaCl	2	200	do	9.0	Upholstery	2	.6
65	KOH	56	do	60	20	NaCl	2	200	do	6.5	do	5	.2
66	KOH	56	do	74	25	NaCl	3	500	Formic	6.5	Taffeta	2	1.6
67	KOH	56	do	74	25	NaCl	3	500	do	6.5	do	5	1
68	KOH	56	do	74	25	NaCl	3	500	do	5.5	Upholstery	2	1.7
69	KOH	56	do	74	25	NaCl	3	500	do	5.5	do	5	.8
70	KOH	69	Formic	56	25	NaCl	25	245	do	5.5	Taffeta	2	.4
71	KOH	69	do	56	25	NaCl	25	245	do	5.5	do	5	.2
72	KOH	69	do	56	25	NaCl	25	245	do	5.5	Upholstery	2	.6
73	KOH	69	do	56	25	NaCl	25	245	do	5.5	do	5	.2
74	29% NH OH	121	Acetic	60	20	NaCl	2	200	do	8.0	Taffeta	2	0–1
75	29% NH OH	121	Formic	46	20	NaCo	2	200	do	8.0	do	2	0–1
76	29% NH OH	121	Acetic	74	20	NaCl	2	200	do	8.0	do	2	1
77 [1]											Upholstery		8
78 [1]											Taffeta		12

[1] Untreated.

TABLE VIII

Ex. No.	Humectant	Parts	Amine parts	Wetting agent parts	Electrolyte	Parts	Parts water	pH adjustment acid	pH	Textile	Percent coating weight	Charge build-up in kv.
79	Sorbitol ester.[3]	10	10	1	NaCl	1	70	Acetic	5.5–6.5	Taffeta	2	1
80	do	10	10	1	NaCl	1	70	do	5.5–6.5	do	5	0
81	do	10	10	1	NaCl	1	70	do	5.5–6.5	do	10	0
82	do	10	10	1	NaCl	1	70	do	5.5–6.5	Nylon rayon filled upholstery.	2	1
83	do	10	10	1	NaCl	1	70	do	5.5–6.5	do	5	5
84	do	10	10	1	NaCl	1	70	do	5.5–6.5	do	10	0
85	Glycerol	20	20	0	$CaCl_2$	5	75	do	6.0–6.5	Taffeta	2	1
86	do	20	20	0	$CaCl_2$	5	75	do	6.0–6.5	do	5	0
87	do	20	20	0	$CaCl_2$	5	75	do	6.0–6.6	do	10	0
88	do	20	20	0	$CaCl_2$	5	75	do	6.0–6.5	Upholstery	2	1
89	do	20	20	0	$CaCl_2$	5	75	do	6.0–6.5	do	5	0

See footnotes at end of table.

TABLE VIII—Continued

Ex. No.	Humectant	Parts	Amine parts	Wetting agent parts	Electrolyte	Parts	Parts water	pH adjustment acid	pH	Textile	Percent coating weight	Charge build-up in kv.
90	Glycerol	20	20	0	$CaCl_2$	5	75	Acetic	6.0-6.5	Upholstery	10	0
91	$CaCl_2$	20	20	01 (5)		0	100	do	5.5-6.5	Taffeta	3	0
92	$CaCl_2$	20	20	01 (5)		0	100	do	5.5-6.5	do	5	0
93	$CaCl_2$	20	20	01 (5)		0	100	do	5.5-6.5	do	10	0
94	$CaCl_2$	20	20	01 (5)		0	100	do	5.5-6.5	Upholstery	3	0
95	$CaCl_2$	20	20	01 (5)		0	100	do	5.5-6.5	do	5	0
96	$CaCl_2$	20	20	01 (5)		0	100	do	5.5-6.5	do	10	0
97	$CaCl_2$	30	20	01 (5)		0	110	do	5.0-5.5	Taffeta	3	0
98	$CaCl_2$	30	20	01 (5)		0	110	do	5.0-5.5	do	5	0
99	$CaCl_2$	30	20	01 (5)		0	110	do	5.0-5.5	do	10	0
100	$CaCl_2$	30	20	01 (5)		0	110	do	5.0-5.5	Upholstery	3	0
101	$CaCl_2$	30	20	01 (5)		0	110	do	5.0-5.5	do	5	0
102	$CaCl_2$	30	20	01 (5)		0	110	do	5.0-5.5	do	10	0
103	$CaCl_2$	40	20	01 (5)		0	120	do	5.0-5.5	Taffeta	3	0
104	$CaCl_2$	40	20	01 (5)		0	120	do	5.0-5.5	do	5	0
105	$CaCl_2$	40	20	01 (5)		0	120	do	5.0-5.5	do	10	0
106	$CaCl_2$	40	20	01 (5)		0	120	do	5.0-5.5	Upholstery	3	0
107	$CaCl_2$	40	20	01 (5)		0	120	do	5.0-5.5	do	5	0
108	$CaCl_2$	40	20	01 (5)		0	120	do	5.0-5.5	do	10	0
109	Urea	30	[1] 10	1	NaCl	1	110	Formic	5.0-5.5	Taffeta	2.5	0-1
110	do	30	[1] 10	1	NaCl	1	110	do	5.0-5.5	Nylon ray filled upholstery.	5	0-1
111	do	30	[1] 10	1	NaCl	1	110	do	5.0-5.5	Nylon rayon non-woven	5	.5

[1] N-octyl, N-ethyl morpholinium ethyl sulfate.
[2] Condensate of tridecyl alcohol with 6 moles of ethylene oxide.
[3] Ethoxylated sorbitol lauric acid ester.
[4] Nylon-unless otherwise specified.
[5] Humectant was electrolyte.

EXAMPLES 112-121

In these examples the sample floor covering was treated in accordance with the components as given in Table IX. The antistatic coating was applied in "sandwich" form to the underside of the flooring product in accordance with the procedure as outlined earlier. Electrostatic test results are given in Table X.

TABLE IX

Ex. No.	Basic component	Parts	Organic acid	Parts	Conductor parts on solids bases	Parts	Electrolyte	Parts	Parts water	pH adjustment	pH	Ozs. per sq. yard
112	KOH	56	Formic	46	Naccanol-40 lb	20	NaCl	2	180	KOH	8.5	4
113	KOH	56	do	46	Nansa HS-55	20	NaCl	2	180	KOH	8.5	4
114	KOH	56	do	46	Sodium lauryl sulfate	20	NaCl	2	180	KOH	8.5	4
115	KOH	56	do	46	Alipal CO-433	20	NaCl	2	180	KOH	8.5	4
116	KOH	56	do	46	Gaftex 288	20	NaCl	2	180	KOH	8.5	4
117	KOH	56	do	46	Nekal BA-75	20	NaCl	2	180	KOH	8.5	4
118	KOH	56	do	46	Igepon AP-78	20	NaCl	2	180	KOH	8.5	4
119	KOH	56	do	46	Igepon T-33	20	NaCl	2	180	KOH	8.5	4
120	KOH	56	do	46	Aerosol OT	20	NaCl	2	180	KOH	8.5	4
121	KOH	56	do	46	Triethanol amine lauryl sulfate	20	NaCl	2	180	KOH	8.5	4

[1] See tests Table X.

TABLE X

[Test AATC, 123, 1969 (all readings in electrostatic volts)]

Example number	Chrome leather	Neolite	After steam cleaning: Chrome leather	After steam cleaning: Neolite
112	+1,200	−900	+1,700	−1,000
113	+1,500	−1,000	+1,600	−900
114	+1,700	−1,200	+1,800	−1,500
115	+1,100	−1,400	+1,500	−1,200
116	+1,500	−900	+1,200	−1,400
117	+1,900	−1,700	+2,000	−1,900
118	+1,800	−2,000	+1,770	−2,100
119	+1,600	−1,800	+1,500	−2,000
120	+1,100	−900	+1,200	−1,100

It is obvious that numerous changes and modifications can be made in the above described details without departing from the spirit and nature of the invention. Therefore, it is to be understood that any such changes and modifications are included within the scope of the invention and that the invention is not to be limited except as set forth in the appended claims.

I claim:

1. An antistatic textile and floor covering product comprising

(1) a wear layer,

(2) a latex pre-coat layer disposed on at least one surface of said layer,

(3) an antistatic coating composition layer disposed on said pre-coat layer, said antistatic layer consisting essentially of a mixture of

(a) an organic antistatic agent,

(b) a humectant selected from the group of ionic and nonionic humectants, and

(c) when such humectant is a nonionic humectant, an electrolyte, and

(4) a polymeric backing layer covering said antistatic layer, said antistatic layer being disposed between said pre-coat layer and said polymeric backing layer.

2. An antistatic product as defined in claim 1 wherein said wear layer is a fibrous textile material.

3. An antistatic product as defined in claim 2 wherein said fibrous textile layer is of the pile type.

4. An antistatic product as defined in claim 3, wherein said fibrous textile layer is a tufted carpet structure having pile fibers tufted through a woven backing.

5. An antistatic product as defined in claim 4, wherein said organic antistatic agent is an alkoxylated tertiary amine.

6. An antistatic product as defined in claim 3, wherein said antistatic coating composition is applied at a concentration of from about 2.0 to 10 oz. per sq. yd.

7. An anistatic product as defined in claim 6, wherein said organic antistatic agent is an alkoxylated tertiary amine.

8. An antistatic product as defined in claim 3 wherein said fibrous pile is secured to a primary backing layer.

9. An antistatic product as defined in claim 2, wherein said organic antistatic agent is an alkoxylated tertiary amine.

10. An antistatic product as defined in claim 1 wherein said floor covering is selected from the group consisting of vinyl homopolymeric and copolymeric sheet and tile products, asbestos-composition sheet and tile products, polyurethane and polyolefin flooring products and linoleum-petroleum products.

11. An antistatic product as defined in claim 1, wherein said antistatic coating composition is applied at a concentration of from about 0.1 to 20 oz. per sq. yd.

12. An antistatic product as defined in claim 11, wherein said organic antistatic agent is an alkoxylated tertiary amine.

13. An antistatic product as defined in claim 1, wherein said organic antistatic agent is an alkoxylated tertiary amine.

14. An antistatic product as defined in claim 1, wherein said organic antistatic agent is a quaternary ammonium compound.

15. An antistatic product as defined in claim 1, wherein said humectant is an ethoxylated sorbitol lauric acid ester.

16. An antistatic product as defined in claim 1, wherein said organic antistatic agent includes as amine, N-octyl-N-ethyl morpholinium ethylsulfate.

17. An antistatic product as defined in claim 1, wherein said organic antistatic agent is a phosphate ester.

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