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(54) CARPET PRODUCT AND PROCESS FOR THE MANUFACTURING OF A CARPET PRODUCT

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Description

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority benefit of U.S. provisional patent application number 61/895,149, filed 24 October 2013, the entirety of which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to a carpet product and a process for manufacturing it.

BACKGROUND OF THE INVENTION

[0003] Carpets typically include a primary backing material to which carpet fibers are attached to form a carpet pile on the face side, and a primary coating layer on the back side of the primary backing material to fix the carpet fibers to the primary backing. To improve dimensional stability, a secondary backing material is often fixed to the primary backing material by means of a secondary coating layer.

[0004] The primary and secondary coating layers are typically formed from aqueous polymer dispersions, for example aqueous vinyl acetate ethylene copolymer dispersions and lattices of carboxylated styrene butadiene copolymers.

[0005] U.S. patent 3,779,799 describes the use of an aqueous latex of carboxylated styrene butadiene copolymers, or alternatively of an aqueous dispersion of vinyl acetate ethylene copolymer, as the primary coating for the tufted primary backing material of carpets.

[0006] U.S. patents 4,735,986 and 5,084,503 describe carpet backing adhesives employing vinyl acetate ethylene dispersions stabilized with a mixture of polyvinyl alcohols. A high tuft lock is said to be obtained with such dispersions. It is also mentioned that such vinyl acetate ethylene dispersions are compatible with most styrene butadiene emulsions. The use of different types of coating materials for the primary and secondary coating layers is not disclosed.

[0007] U.S. patent application 2001/0046581 discloses a carpet comprising a primary backing with a yarn attached with an adhesive, with a woven secondary backing attached to the back side of the primary backing with the same adhesive. The second side of the secondary backing is coated with a thermoplastic polymer layer by melt bonding.

[0008] WO 2012/020321 A2 discloses carpet products with coating layers formed from vinyl ester ethylene copolymer dispersions. The vinyl ester ethylene copolymer dispersions have a particle size of 50 to 500 nm, and the dispersions are used to coat the primary backing material as well as for laminating the secondary backing material. Styrene-based emulsions are described as prior art binders for coating compositions for carpet materials, but these are said to be more expensive and have worse washability and are not used in the invention.

[0009] U.S. patent application 2008/0113146 describes a method for manufacturing carpets from recycled materials wherein EVA hotmelt, vinyl acetate ethylene emulsion, carboxylated styrene butadiene latex, styrene butadiene latex, acrylic latex, polyolefin hotmelt, polyolefin dispersion, or butadiene acrylate copolymers are described as adhesive backing materials for coating the primary backing materials.

[0010] WO 2010/129945 discloses a method for manufacturing carpets from recycled materials, using filler obtained from recycling of waste carpets. EVA hotmelt, vinyl acetate ethylene emulsion, carboxylated styrene butadiene latex, styrene butadiene latex, acrylic latex, polyolefin hotmelt, polyolefin dispersion, or butadiene acrylate copolymers are described as coating agents for coating the primary backing materials.

[0011] U.S. patent application 2013/0209726 describes a latex coating composition comprising a blend of a vinyl ester ethylene copolymer and a styrene butadiene copolymer. The blend may be used as a precoat binder, a skipcoat binder, or both.

[0012] U.S. patent application 2013/0149487 describes coating compositions for the scrim coat and for the skip coat which comprise an aqueous dispersion of vinyl acetate ethylene copolymers which have cross-linking silane comonomer units, or which have non-silicon multi-functional cross-linking comonomer units.

[0013] Japanese parent application JP 59-214633 discloses coating a polypropylene woven fabric coated with an ethylenic copolymer emulsion, e.g., a vinyl acetate ethylene copolymer emulsion (VAE), followed by drying. Pile yarns are then interwoven with the dry VAE-coated base fabric. A styrene butadiene rubber latex (SBR) is then applied to the dried VAE layer and the loops of pile yarn emerging from it. Then, a secondary base fabric of expanded polypropylene woven cloth bearing a wet coating of an ethylenic copolymer emulsion, e.g., a VAE, is laid upon the wet SBR latex coating with the VAE and SBR coatings in contact, and bonded by heating and drying the VAE emulsion and SBR latex. In some embodiments, the VAE emulsion on the secondary base fabric is omitted.

[0014] Despite these advances, improved methods and materials would be beneficial for providing carpet having high tuft lock and high delamination resistance, yet easily processable at the elevated temperatures encountered on carpet coating lines.

SUMMARY OF THE INVENTION

[0015] In one aspect, the invention provides a carpet product comprising in sequence

a) a primary backing material having a back side and a face side, with carpet fibers extending from the face side to form a carpet pile and also passing through the primary backing material and forming loops on the back side;
b) a primary coating layer on the loops, comprising a vinyl acetate ethylene copolymer as the only binder, wherein the vinyl acetate ethylene copolymer comprises no comonomers other than vinyl acetate and ethylene, and present at from 542 to 1085 g/m^2 (16 to 32 oz./yd^2) on a dry solids basis;
c) a secondary coating layer on the primary coating layer, comprising a styrene-butadiene copolymer as the only binder; and
d) a secondary backing material on the secondary coating layer and adhered thereby to the primary coating layer.

[0016] In another aspect, the invention provides a process for making a carpet product, comprising in sequence

a) providing a primary backing material having a back side and a face side, with carpet fibers extending from the face side to form a carpet pile and also passing through the primary backing material and forming loops on the back side;
b) coating the loops with an aqueous primary coating composition comprising a vinyl acetate ethylene copolymer as the only binder, wherein the vinyl acetate ethylene copolymer comprises no comonomers other than vinyl acetate and ethylene, to form a wet primary coating layer providing from 542 to 1085 g/m^2 (16 to 32 oz./yd^2) of coating on a dry solids basis;
c) coating a secondary backing material with an aqueous secondary coating composition comprising a styrene butadiene copolymer as the only binder to form a wet secondary coating layer;
d) pressing the product of step c) against the product of step b) to contact the wet primary coating layer with the wet secondary coating layer; and
e) drying the product of step d).

DETAILED DESCRIPTION OF THE INVENTION

[0017] Surprisingly, the inventors have found that a specific combination of primary coating layer and secondary coating layer makes possible the production of carpet having high tuft lock and high delamination resistance, yet easily processable at the elevated temperatures encountered on carpet coating lines.

Structural carpet components

[0018] The primary backing material typically comprises any material recognized in the art for use as a carpet backing. Specific examples typically include woven or nonwoven fabrics made from one or more of natural or synthetic fibers or yarns including jute, wool, polypropylene, polyethylene, polyamide, polyesters, rayon, or various copolymers.

[0019] The primary backing has a face side and a back side. Carpet fibers (yarn) are attached to the primary backing, extending from the face side to form the carpet face. The fibers can be made with uncut yarn loops, cut yarn loops (a pile of single yarns), or a combination of cut and uncut yarns. The fibers can be made from wool, cotton, nylon, acrylic resin, polyester, polypropylene and blends thereof. As the fiber material is not critical, other fiber material would be readily apparent to one of skill in the art, i.e., any material recognized in the art for use as a carpet fiber. A tufting method can be used to fix fibers to the primary backing material. In a typical case, carpet fibers extend from the face side to form a carpet pile and pass through the primary backing material to form loops on the back side. Typically, the primary backing will have a basis weight in a range from 102 to 339 g/m^2 (3 to 10 oz./yd^2), more typically in a range from 136 to 237 g/m^2 (4 to 7 oz./yd^2). The combination of primary backing and carpet fibers (yarn) will typically have a basis weight in a range from 339 to 1017 g/m^2 (10 to 30 oz./yd^2).

[0020] The secondary backing side is oriented toward and attached to the back side of the primary backing, with the primary and secondary coating layers interposed. The secondary backing can be made of a variety of materials. Typically, it will be made of one or more of the materials mentioned above for making the primary backing. In most cases the secondary backing will not have carpet pile fibers passing through it, and will not have carpet pile fibers directly adhered or otherwise directly attached to it. Here the term "directly" means without any intervening woven or nonwoven fabric layer(s). Typically, the secondary backing will have a basis weight in a range from 33.9 to 203 g/m^2 (1 to 6 oz./yd^2). More typically, the range will be in a range from 102 to 170 g/m^2 (3 to 5 oz./yd^2).

[0021] The primary coating layer will typically be present at a loading level in a range from 542 to 1085 g/m^2 (16 to 32 oz./yd^2) on a dry solids basis. More typically, the amount will be in a range from 610 to 881 g/m^2 (18 to 26 oz./yd^2). The secondary coating layer will typically be present at a loading level in a range from 203 to 305 g/m^2 (6 to 9 oz./yd^2) on a dry solids basis. More typically, the amount will be in a range from 237 to 271 g/m^2 (7 to 8 oz./yd^2).

[0022] Generally, the primary backing material, the secondary backing material, the primary coating layer and the secondary coating layer are each independently coextensive with one or more of the others. Most typically, they are all mutually coextensive.

Vinyl acetate ethylene copolymer dispersion

[0023] The vinyl acetate ethylene copolymer comprises vinyl acetate units in an amount of 70 to 98 wt%, based on the total weight of comonomers. Preferably the vinyl acetate content is in the range of 75 to 95 wt%, most preferred the vinyl acetate content is in the range of 80 to 95 wt%, in each case based on the total weight of comonomers.

[0024] The copolymer comprises ethylene in an amount of 2 to 30 wt%, based on the total weight of comonomers. The amount is preferably 5 to 15 wt%, most preferred 10 to 12 wt%, in each case based on the total weight of comonomers.

[0025] The monomers are preferably selected so as to give copolymers with a glass transition temperature Tg of -30°C to +30°C, preferably -5°C to 20°C, and most preferred 0°C to 18°C. The glass transition temperature Tg of the copolymers may be determined in a known manner by means of differential scanning calorimetry (DSC) according to ASTM D3418-03.

[0026] The Tg may also be calculated approximately in advance by means of the Fox equation. According to Fox T.G., Bull. Am. Physics Soc. 1, 3, page 123 (1956), it holds that: $1/Tg = x_1/Tg_1 + x_2/Tg_2 + ... + x_n/Tg_n$, where x_n is the mass fraction (wt%/100) of the monomer n and Tg_n is the glass transition temperature, in kelvins, of the homopolymer of the monomer n. Tg values for homopolymers are listed in the Polymer Handbook, 2nd Edition, J. Wiley & Sons, New York (1975).

[0027] The vinyl acetate ethylene copolymer can be prepared by an aqueous emulsion polymerization using conventional emulsion polymerization procedure. Preferably at a temperature in a range from 40°C to 150°C, more preferred 50°C to 120°C and most preferred 60°C to 100°C. The polymerization pressure is generally between 40 and 100 bar absolute, preferably between 45 and 90 bar absolute, and most preferred between 45 and 85 bar absolute, depending on the ethylene feed.

[0028] Polymerization may be initiated using a redox initiator combination such as is customary for an aqueous emulsion polymerization. Examples of suitable oxidation initiators are hydrogen peroxide, tert-butyl peroxide, tert-butyl hydroperoxide, potassium peroxodiphosphate, tert-butyl peroxopivalate, cumene hydroperoxide, isopropylbenzene monohydroperoxide, azobisisobutyronitrile, and the sodium, potassium, and ammonium salts of peroxodisulfuric acid. Preference is given to the sodium, potassium, and ammonium salts of peroxodisulfuric acid and to hydrogen peroxide. The stated initiators are used in general in an amount of 0.01 wt% to 2.0 wt%, based on the total weight of the comonomers.

[0029] The stated oxidizing agents, more particularly hydrogen peroxide or the salts of peroxodisulfuric acid, may also be used on their own as thermal initiators.

[0030] Suitable reducing agents are ammonium or alkali metal sulfites and bisulfites, as for example sodium sulfite, the derivatives of sulfoxylic acid such as zinc sulfoxylates or alkali metal formaldehyde sulfoxylates, such as sodium hydroxymethanesulfinate (Brüggolit). It is preferred to use a non-formaldehyde generating redox initiation system. In general, suitable non-formaldehyde generating reducing agents for redox pairs include, as non-limiting examples, those based on ascorbic acid or its salts, or erythorbate (iso-ascorbic acid) or its salts, or tartaric acid or its salts, or bisulfite salts particularly sodium bisulfite, as known in the art, or disodium glycolic acid sulfonate hydrate, which is available as a commercial reducing agent known as BRUGGOLITE® FF6M manufactured by Brueggeman Chemical of Heilbronn, Germany. It is preferred to use disodium glycolic acid sulfonate hydrate, or sodium sulfite, or ascorbic acid or its salts, or erythorbic acid (iso-ascorbic acid) or its salts. The amount of reducing agent is preferably 0.01 wt% to 3 wt%, based on the total weight of the comonomers.

[0031] Regulating substances may be used during the polymerization to control the molecular weight of the copolymer. In a preferred embodiment no regulating substances are used. If regulators are used, they are employed typically in amounts between 0.01 wt% to 5.0 wt%, based on the total weight of the monomers to be polymerized, and are metered separately or else as a premix with reaction components. Examples of such substances are n-dodecyl mercaptan, tert-dodecyl mercaptan, mercaptopropionic acid, methyl mercaptopropionate, isopropanol, and acetaldehyde.

[0032] One or more emulsifiers and/or one or more protective colloids are used to stabilize the aqueous dispersion of the vinyl acetate ethylene copolymers.

[0033] Suitable emulsifiers are nonionic, anionic or cationic emulsifiers. Preferably nonionic or anionic emulsifiers are used, or mixtures of nonionic and anionic emulsifiers. The amount of emulsifier is preferably 0.5 to 10 wt%, more preferably 1 to 5 wt%, in each case based on the total amount of comonomers.

[0034] Suitable nonionic emulsifiers are, for example, acyl, alkyl, and oleyl ethoxylates. These products are available commercially, for example, under the name GENAPOL® or LUTENSOL®. Suitable nonionic emulsifiers also include ethoxylated branched or unbranched fatty alcohols (aliphatic alcohols), preferably having a degree of ethoxylation of 3 to 80 ethylene oxide units and C_6 to C_{36} alkyl radicals. Other suitable nonionic emulsifiers include C_{13}-C_{15} oxo-process alcohol ethoxylates having a degree of ethoxylation of 3 to 30 ethylene oxide units, C_{16}-C_{18} fatty alcohol ethoxylates having a degree of ethoxylation of 11 to 80 ethylene oxide units, C_{10} oxo-process alcohol ethoxylates having a degree of ethoxylation of 3 to 11 ethylene oxide units, C_{13} oxo-process alcohol ethoxylates having a degree of ethoxylation of 3 to 20 ethylene oxide units, polyoxyethylenesorbitan monooleate having 20 ethylene oxide groups, copolymers of ethylene oxide and propylene oxide with a minimum content of at least 10 wt% of ethylene oxide, and polyethylene oxide ethers of oleyl alcohol having a degree of ethoxylation of 4 to 20 ethylene oxide units.

[0035] Preferred are ethoxylated branched or unbranched aliphatic alcohols, particularly having a degree of ethoxylation of 3 to 80 ethylene oxide units and C_8 to C_{36} alkyl radicals. Preferred nonionic emulsifiers are also C_{13}-C_{15} oxo-process alcohol ethoxylates having a degree of ethoxylation of 3 to 30 ethylene oxide units, and C_{16}-C_{18} aliphatic alcohol ethoxylates having a degree of ethoxylation of 11 to 80 ethylene oxide units. Particularly preferred are C_{12}-C_{14} aliphatic alcohol ethoxylates having a degree of ethoxylation of 3 to 20 ethylene oxide units. Preferably the copolymer dispersion is free of alkylphenol ethoxylates and esters thereof.

[0036] Examples of suitable anionic emulsifiers are sodium, potassium, and ammonium salts of straight-chain aliphatic carboxylic acids having 12 to 20 C atoms; sodium hydroxyoctadecanesulfonate; sodium, potassium, and ammonium salts of hydroxyl-fatty acids having 12 to 20 C atoms and the sulfonation and/or acetylation products thereof; sodium, potassium, and ammonium salts of alkyl sulfates, also as triethanolamine salts, and sodium, potassium, and ammonium salts of alkylsulfonates having in each case 10 to 20 C atoms and of alkylarylsulfonates having 12 to 20 C atoms; dimethyldialkylammonium chlorides having 8 to 18 C atoms and its sulfonation products; sodium, potassium, and ammonium salts of sulfosuccinic esters with aliphatic saturated moriohydric alcohols having 4 to 16 C atoms, and sulfosuccinic 4-esters with polyethylene glycol ethers of monohydric aliphatic alcohols having 10 to 12 C atoms, more particularly their disodium salts, and of biscyclohexyl sulfosuccinate, more particularly its sodium salt; ligninsulfonic acid and also its calcium, magnesium, sodium, and ammonium salts; and resin acids or hydrogenated or dehydrogenated resin acids, and alkali metal salts of any of these.

[0037] The most preferred anionic emulsifiers are the sodium, potassium, and ammonium salts of alkyl sulfates and of alkylsulfonates having in each case 10 to 20 C atoms, and also of alkylarylsulfonates having 12 to 20 C atoms, and of sulfosuccinic esters with aliphatic saturated monohydric alcohols having 4 to 16 C atoms.

[0038] Suitable protective colloids include polyvinyl alcohols; polyvinyl acetals; polyvinylpyrrolidones; polysaccharides in water-soluble form such as starches (amylase and amylopectin), celluloses and their carboxymethyl, methyl, hydroxyethyl, hydroxypropyl derivatives; proteins such as casein or caseinate, soya protein, gelatine; lignosulfonates, synthetic polymers such as poly(meth)acrylic acid, copolymers of (meth)acrylates with carboxyl-functional comonomer units, poly(meth)-acrylamide, polyvinylsulfonic acids, and the water-soluble copolymers thereof; melamine-formaldehyde sulfonates, naphthalene-formaldehyde sulfonates, styrene-maleic acid copolymers, and vinyl ether-maleic acid copolymers.

[0039] Preference is given to using partially hydrolyzed (degree of hydrolysis: 80 to 95 mol%) and/or fully hydrolyzed (degree of hydrolysis: 98 to 100 mol%) polyvinyl alcohols. Preferred partially hydrolyzed polyvinyl alcohols have a degree of hydrolysis of 80 to 95 mol% and a Höppler viscosity, in 4% strength aqueous solution, of 1 to 30 mPas (method of Höppler at 20°C, DIN 53015). Most preferred are polyvinyl alcohols having a degree of hydrolysis of 85 to 94 mol% and a Höppler viscosity, in 4% strength aqueous solution, of 3 to 25 mPas (method of Höppler at 20°C, DIN 53015). As used herein, the "degree of hydrolysis" of a polyvinyl alcohol means the degree to which vinyl acetate monomer units have been hydrolyzed to alcohols.

[0040] Other preferred embodiments employ a mixture of one or more partially hydrolyzed polyvinyl alcohol(s) and one or more fully hydrolyzed polyvinyl alcohol(s). Preferred fully hydrolyzed polyvinyl alcohols have a degree of hydrolysis of 98 to 99.95 mol% and a Hoeppler viscosity of 13 to 30 mPa•s (method of Höppler at 20°C, DIN 53015).

[0041] Both partially hydrolyzed and fully hydrolyzed polyvinyl alcohols may be hydrophobically modified, e.g., they may comprise hydrophobic comonomers, one example of which is ethylene.

[0042] The total amount of the protective colloid is preferably 1 to 5 wt%, based on the total weight of comonomers.

[0043] It is also a preferred embodiment to use a mixture of at least one emulsifier and at least one protective colloid.

[0044] The emulsifiers and protective colloids discussed above are all commercially available or obtainable by processes known to the skilled person.

Preparation of aqueous vinyl acetate ethylene copolymer dispersions

[0045] In preparing the aqueous vinyl acetate ethylene copolymer dispersion, all of the protective colloid or all of the emulsifier may form an initial charge, or all of the protective colloid or all of the emulsifier may form a feed, or portions of the protective colloid or of the emulsifier may form an initial charge and the remainder may form a feed after the polymerization has been initiated. The feeds may be separate (spatially and chronologically), or all or some of the components may be fed after pre-emulsification. In a preferred embodiment all of the protective colloid and optionally all of the emulsifier are charged initially to the reactor.

[0046] All of the monomers may form an initial charge, or all of the monomers may form a feed, or portions of the monomers may form an initial charge and the remainder may form a feed after the polymerization has been initiated. The feeds may be separate (spatially and chronologically), or all or some of the components may be fed after pre-emulsification. In a preferred embodiment at least a part of the monomers, preferably 70 to 85 wt%, is added in the initial charge.

[0047] Once the polymerization process has ended, post-polymerization may be carried out using known methods to remove residual monomer, for example using post-polymerization initiated by a redox catalyst. Volatile residual monomers may also be removed by distillation, preferably at subatmospheric pressure, and, where appropriate, by passing inert entraining gases, such as air, nitrogen, or water vapor, through or over the material.

[0048] The solids content of suitable aqueous vinyl acetate ethylene copolymer dispersions is typically in a range from 45 wt% to 75 wt%. The particle size distribution may be monomodal or multimodal, and the mean particle diameter may range in size from 0.15 μm to 10 μm as measured by laser diffraction.

Styrene butadiene dispersions

[0049] The styrene butadiene copolymers comprise 20 to 79.9 wt%, preferably 50 to 65 wt% styrene and 20 to 79.9 wt%, preferably 35 to 50 wt% butadiene, based on the total amount of comonomers. Optionally 0.1 to 15 wt% of further auxiliary comonomers may be present, in each case based on the total weight of comonomers. Preferred auxiliary comonomers are ethylenically unsaturated mono-carboxylic acids, and/or di-carboxylic acids, their anhydrides, and their salts, and mixtures thereof, particularly acrylic acid, methacrylic acid, itaconic acid and/or maleic acid and/or fumaric acid.

[0050] Additional suitable auxiliary comonomers are for example, alkyl esters of (meth)acrylic acid, such as, for example, methyl methacrylate, ethylenically unsaturated carboxamides and carbonitriles, such as, for example, (meth)acrylonitrile; diesters of fumaric acid or maleic acid; hydroxy alkyl (meth)acrylates; sulfur acid monomers, phosphorus acid monomers, crosslinking comonomers, such as, for example, divinyl benzene or divinyl adipates; postcrosslinking comonomers, such as acrylamidoglycolic acid (AGA), allyl methacrylates or allyl N-methylol carbamates; epoxy-functional comonomers, such as glycidyl (meth)acrylates; and silicon-functional comonomers, such as alkoxysilane containing (meth)acrylates or vinyl monomers.

[0051] While some applications may favor the inclusion of additional monomers in the styrene butadiene copolymer, for example such as those listed above, it may nonetheless in some cases be advantageous to exclude certain monomers, depending on the specific needs of a given application. In other cases, these monomers may be included up to a limit of 1.0 wt% of the styrene butadiene copolymer.

[0052] The styrene butadiene copolymers can be prepared by aqueous emulsion or suspension polymerization, preferably emulsion polymerization, in conventional manner, employing conventional polymerization temperatures, preferably from 40°C to 120°C, and pressures, preferably with diene comonomer pressures up to 10 bar absolute.

[0053] The polymerization may be initiated using conventional amounts of one or more conventional water-soluble initiators such as sodium persulphate, or oil (monomer) soluble initiator, such as tert-butyl peroxide and cumene hydroperoxide, or a redox initiator combination, using a reducing agent such as sulfites and bisulfites. To control the molecular weight, conventional regulator substances or chain transfer agents, such as mercaptans, alkanols, and dimeric alpha methylstyrene can be used during the polymerization in conventional manner in conventional amounts of from 0.01 to 5.0 percent by weight, or, preferably, up to 3 percent by weight, based on the comonomer to be polymerized. The polymerization process preferably takes place in known manner in the presence of conventional amounts of one or more conventional emulsifier and/or protective colloid. Suitable emulsifiers and protective colloids are the same as described for preparing the vinyl acetate ethylene dispersion.

[0054] The solids content of the styrene butadiene copolymer dispersion is typically in a range from 45 wt% to 75 wt%.

Coating compositions

[0055] To obtain the primary or secondary coating composition, the vinyl acetate ethylene copolymer dispersion or the styrene butadiene copolymer dispersion is combined with one or more fillers and one or more thickeners, and optionally further additives.

[0056] Any filler suitable for use in carpet manufacture may be used. Examples include mineral fillers or pigments including those known in the art, such as calcium carbonate, ground glass, clay, kaolin, talc, barites, feldspar, titanium dioxide, calcium aluminum pigments, satin white, synthetic polymer pigment, zinc oxide, barium sulphate, gypsum, silica, alumina trihydrate, mica, hollow polymer pigments, and diatomaceous earth. Mixtures of fillers can also be employed.

[0057] The amount of filler in the composition can vary depending upon the density of the filler and the coating properties desired. Typically, it will be from about 50 to about 800 dry weight parts filler, more typically from about 100 to about 600 dry weight parts, and most typically from about 250 to about 600 dry weight parts, in each case per 100 dry weight parts of copolymer solids.

[0058] One or more polymeric thickeners is typically included in the composition to provide sufficient viscosity for application according to conventional methods. Any polymeric thickener known in the carpet coating art may be used, for example hydroxyethyl cellulose and sodium polyacrylate. Although any amount of polymeric thickener may be used, the inventors have found that typically no more than 6 wt% of thickener is needed, relative to the amount of aqueous dispersion of the copolymer, and thus in some embodiments of the invention no more than 6 wt% is used, relative to the amount of aqueous dispersion of the copolymer. In some embodiments, at most 5 wt% or at most 4 wt% is used, relative to the amount of aqueous dispersion of the copolymer. Typically, at least 1 wt% of thickener, or at least 2 wt%, is used, relative to the amount of aqueous dispersion of the copolymer.

[0059] The Brookfield RV viscosity of the resulting coating composition should be in a range from 7000 to 15000 mPas, measured with a Brookfield RV viscometer using spindle No. 5 at 25°C and 20 rpm.

[0060] Further conventional additives in carpet coating compositions are flame retardants or biocides or antioxidants. If a foamed coating is desired blowing agents can be added to the coating compositions.

Making the carpet product

[0061] The primary and secondary aqueous coating compositions can be applied in various ways. For example the coating compositions can be applied directly, such as with a roll over roll applicator, or with a doctor blade. Alternatively, they can be applied indirectly, such as with a pan applicator. Preferably a roll over roller applicator is used. The primary coating coats at least the loops on the back side of the primary backing, and may also coat some or all of the back side of the backing itself.

[0062] The primary and secondary backing materials are brought together to bring the still-wet primary and secondary coating compositions into contact, typically with application of pressure, and heat is then applied to evaporate the water from the coatings. This may be done by passing the product through an oven, typically set at a temperature between about 100°C and 150°C. Upon cooling, the final product is obtained.

[0063] A significant advantage of carpet products obtained according to the invention is better delamination resistance compared with carpet products according to the state of the art.

EXAMPLES

[0064] The following polymer dispersions were used to prepare the carpet products. Vinyl acetate-ethylene copolymer dispersion (VAE):

An aqueous dispersion of a vinyl acetate ethylene copolymer with a solids content of about 60 wt% was used. The dispersion was costabilized with a protective colloid and a non-ionic surfactant. The copolymer composition was about 85 wt% vinyl acetate and about 15 wt% ethylene, with a glass transition temperature Tg of about 2°C.

Styrene butadiene copolymer dispersion (SBR):

[0065] An aqueous dispersion of a styrene butadiene copolymer with a solids content of about 55 wt% was used. The dispersion was stabilized with an anionic surfactant. The copolymer composition was about 65 wt% of styrene and about 35 wt% of butadiene, with a glass transition temperature Tg of about 11°C.

Carpet coating compositions:

Filler:

[0066] Filler used was calcium carbonate (CARMEUSE™ MW 101 manufactured by Carmeuse Lime and Stone, Chatsworth, Georgia).

Froth Aid:

[0067] Froth aid used was ammonium lauryl sulphate (STANFAX® 238 manufactured by Royal Adhesives, Dalton, Georgia).

Thickener:

[0068] Thickener used was a sodium polyacrylate (PARAGUM® 277 manufactured by Royal Adhesives, Dalton, Georgia).

[0069] General recipe for the carpet coating compositions used as primary coating composition or secondary coating composition in testing:

Material	Dry weight [grams]
Dispersion	100
Filler	450
Froth Aid	0.33
Thickener	*
Water	*

* Thickener and water were admixed in amounts needed to obtain a carpet coating composition having a total solids content of about 81.5 wt% and a Brookfield viscosity (spindle No. 5, 20 rpm) of 6000 to 7000 cps.

[0070] The uncoated backing materials used in the test were:
A nylon carpet greige goods (i.e., a backing with pile yarn tufted in but without a binder) with a 678 g/m^2 (20 oz./yd^2) face weight level loop nylon with a straight stitch commercial style tufting construction was used as primary backing.

[0071] A polypropylene 5 pick woven material with an average weight of 68 g/m^2 (2 oz./yd^2) was used as secondary backing.

Preparation of samples for testing:

[0072] The primary and secondary coating compositions were admixed according to the general recipe with a Lighting mixer. Thickener and water were admixed in an amount necessary for obtaining a total solids content of about 81.5 wt% and a Brookfield viscosity (spindle No. 5, 20 rpm) of 6000 to 7000 cps.

[0073] The primary coating composition was applied with a spatula having a 25.4 cm (10 in) blade to the backside of the nylon carpet material at a rate of 949 g/m^2 (28 oz./yd^2) of primary coating solids.

[0074] The secondary backing was coated with the secondary coating composition with a draw-down bar at a 762 μm (30 mil) wet film thickness, resulting in about 237 g/m^2 (7 oz./yd^2) of secondary coating solids. The wet coated secondary backing was pressed against the wet coating layer on the primary backing with a large stainless steel roller. The assembly was dried at 132°C (270°F) in a convection air oven for 20 minutes, and the resulting carpet product was allowed to stand at ambient temperature and humidity for at least two hours before testing.

Test Methods

Determination of Tg according to ASTM D3418-03:

[0075] Glass transition temperatures of copolymers were measured calorimetrically using a TA instruments Q20-1002 differential scanning calorimeter (DSC). The samples were prepared by casting a wet film of 254 μm (10 mil) thickness and drying the film at 105°C. Discs were cut from this dried film and 10 to 15 mg of the sample were loaded into an aluminium DSC pan. The pan was loaded into the calorimeter and heated to 105°C for 5 minutes to ensure that the sample is dry. The samples were then cooled to -60°C and equilibrated there for 2 minutes. The temperature was then increased at a rate of 20°C per minute to 100°C. The run conditions were consistent with section 10.2 of ASTM D3418. The onset Tg is the value reported.

[0076] Carpet Tuft Bind values were determined according to ASTM D1335-05. This procedure is a method to calculate the force required to pull a loop or cut pile from a piece of carpet.

Equipment:

[0077] Instron Model 2519-105 (1000 N capacity) equipped with 7.62 cm (3 inch) jaw clamps, desiccator for conditioning carpet samples, 3.8 mm cylindrical specimen holder and loop hook.

Test Procedure:

Treatment of samples for testing Dry Tuft Bind:

[0078] All samples for testing were cut into 17.15 x 17.15 cm (6.75 x 6.75 in) squares and placed in the desiccator with 25 to 35% humidity and 22 to 24°C for a minimum of 12 hours.

Additional treatment of samples for testing Wet Tuft Bind:

[0079] Samples for wet tuft bind are prepared one at a time according to the following procedure:
After dry tuft binds are determined, the 17.15 x 17.15 cm (6.75 x 6.75 in) square is placed into a one gallon (3.8 liter) container that has been filled with cold tap water. The carpet sample is submerged into the water and allowed to soak for 10 minutes. After 10 minutes the sample is removed and placed on a paper towel for 30 seconds to soak up excess water. The carpet is then taken to be tested for tuft bind values as previously described.

Determination of Dry Tuft Bind and of Wet Tuft Bind:

[0080] Samples were mounted over the 3.8 mm holder with rows or loops in line with the long axis of the holder. The carpet and cylinder (specimen holder) were then placed into the jaws of the Instron. Only loops with a minimum of 2.54 cm (1 inch) from the sample edge were tested.

[0081] The loop hook was inserted in the loop to be pulled. By visual inspection it was insured that only one loop was hooked for testing.

[0082] The tuft was pulled at a speed of 304.8 cm (12 in) per minute. The pull was continued until the tuft was separated from the primary backing.

[0083] The maximum force needed to pull tuft was measured in pounds. A total of ten pulls were made, averaged, and are reported in Table 1.

Testing of Delamination Resistance:

[0084] Carpet Delamination resistance was determined according to ASTM D3936-05. This procedure is a method to calculate the force required to separate the secondary backing material from the primary backing material.

Equipment:

[0085] Instron Model 2519-105 (1000 N capacity) equipped with 7.62 cm (3.00 in) jaw clamps

Desiccator for conditioning carpet samples

Test Procedure:

Treatment of samples for testing Dry Delamination:

[0086] All samples for testing were cut into strips 7.62 cm (3.00 in) wide in the warp direction and 30.48 cm (12.00 in) long in the machine direction and kept in the desiccator at 25 % to 35 % humidity and 22°C to 24°C for a minimum of 12 hours.

Additional treatment of samples for testing Wet Delamination:

[0087] Samples for wet delamination were prepared one at a time according to the following procedure:
An untested strip of the dimensions described above was placed in a 3.8 liter (one gallon) container that had been filled with cold tap water. The carpet sample was submerged into the water and allowed to soak for 10 minutes. After 10 minutes the sample was removed and placed on a paper towel for 30 seconds to soak up excess water. The sample was then tested for delamination values as described below.

Determination of Dry Delamination and of Wet Delamination:

[0088] The secondary backing was separated from the primary backing approximately 3.8 cm (1½ in) in the long (machine) direction on each sample. The primary backing/pile was placed in the bottom jaw as straight as possible, and the secondary backing was placed in the top jaw for a 180° peel configuration as straight as possible. The two layers were pulled apart at a speed of 30.5 cm (12 in) per minute for a total of 17.8 cm (7 in) of jaw travel.

[0089] No data were taken during the first and last inches of jaw travel, and the highest value obtained in each of the five central one-inch segments was recorded. The average of these five values was divided by 3 (the width of the sample in inches) to provide delamination strength in lb./in. Each such run was performed in triplicate, and the average of these for each type of carpet is reported in Table 1. The "% Retain" figures are the wet values as a percentage of dry.

Table 1:

Primary Coating Layer	VAE	VAE
Secondary Coating Layer	VAE	SBR
Dry Tuft Bind N(lb.)	34.9(7.84)	33.1(7.45)
Wet Tuft Bind N(lb.)	13.9(3.13)	14.8(3.33)
% Retain Tuft Bind	39.9	44.7
Dry Delamination N/cm(lb./in)	10.1(5.74)	12.6(7.22)
Wet Delamination N/cm(lb./in)	2.8(1.60)	3.6(2.03)
% Retain Delamination	27.9	28.1

[0090] As seen in Table 1, the combination of VAE on the primary backing and SBR on the secondary backing according to the invention provided a 26% increase in Dry Delamination strength and a 27% increase in Wet Delamination strength, compared with the use of VAE on both backings.

Claims

1. A carpet product comprising in sequence

   a) a primary backing material having a back side and a face side, with carpet fibers extending from the face side to form a carpet pile and also passing through the primary backing material and forming loops on the back side;
   b) a primary coating layer on the loops, comprising a vinyl acetate ethylene copolymer as the only binder, wherein the vinyl acetate ethylene copolymer comprises no comonomers other than vinyl acetate and ethylene, and present at from 542 to 1085 g/m^2 (16 to 32 oz./yd^2) on a dry solids basis;
   c) a secondary coating layer on the primary coating layer, comprising a styrene-butadiene copolymer as the only binder; and
   d) a secondary backing material on the secondary coating layer and adhered thereby to the primary coating layer.

2. The carpet product of claim 1, wherein the vinyl acetate ethylene copolymer comprises vinyl acetate units in an amount of 70 to 98 wt%, based on the total weight of comonomers.

3. The carpet product of claim 1, wherein the vinyl acetate ethylene copolymer comprises vinyl acetate units in an amount of 75 to 95 wt%, based on the total weight of comonomers.

4. The carpet product of claim 1, wherein the vinyl acetate ethylene copolymer comprises vinyl acetate units in an amount of 80 to 95 wt%, based on the total weight of comonomers.

5. The carpet product of any preceding claim, wherein the vinyl acetate ethylene copolymer comprises ethylene in an amount of 2 to 30 wt%, based on the total weight of comonomers.

6. The carpet product of any preceding claim, wherein the vinyl acetate ethylene copolymer comprises ethylene in an amount of 5 to 15 wt%, based on the total weight of comonomers.

7. The carpet product of any preceding claim, wherein the vinyl acetate ethylene copolymer comprises ethylene in an amount of 10 to 12 wt%, based on the total weight of comonomers.

8. The carpet product of any one of claims 1 to 7, wherein the vinyl acetate ethylene copolymer in the primary coating layer is derived from a vinyl acetate ethylene copolymer dispersion stabilized only by one or more emulsifiers and one or more protective colloids.

9. The carpet product of any one of claims 1 to 7, wherein the vinyl acetate ethylene copolymer in the primary coating layer is derived from a vinyl acetate ethylene copolymer dispersion stabilized only by one or more emulsifiers.

10. The carpet product of any one of claims 1 to 7, wherein the vinyl acetate ethylene copolymer in the primary coating layer is derived from a vinyl acetate ethylene copolymer dispersion stabilized only by one or more protective colloids.

11. The carpet product of claim 10, wherein the one or more protective colloids consist of one or more polyvinyl alcohols.

12. The carpet product of claim 11, wherein the one or more polyvinyl alcohols comprise at least one partially hydrolyzed polyvinyl alcohol and at least one polyvinyl alcohol having a degree of hydrolysis of 98 to 100 mol%.

13. The carpet product of any preceding claim, wherein the styrene butadiene copolymer comprises 20 to 79.9 wt%, preferably 50 to 65 wt% styrene and 20 to 79.9 wt%, preferably 35 to 50 wt% butadiene, based on the total amount of comonomers.

14. The carpet product of any preceding claim, wherein the styrene butadiene copolymer comprises 0.1 to 15 wt% in total of auxiliary comonomers, based on the total weight of comonomers.

15. The carpet product of claim 14, wherein the auxiliary comonomers are selected from the group consisting of ethylenically unsaturated mono-carboxylic acids, ethylenically unsaturated di-carboxylic acids, the anhydrides or salts of either of these, and combinations of any of the foregoing.

16. A process for manufacturing the carpet product according to claim 1, comprising in sequence

a) providing a primary backing material having a back side and a face side, with carpet fibers extending from the face side to form a carpet pile and also passing through the primary backing material and forming loops on the back side;
b) coating the loops with an aqueous primary coating composition comprising a vinyl acetate ethylene copolymer as the only binder, wherein the vinyl acetate ethylene copolymer comprises no comonomers other than vinyl acetate and ethylene, to form a wet primary coating layer providing from 542 to 1085 g/m^2 (16 to 32 oz./yd^2) of coating on a dry solids basis;
c) coating a secondary backing material with an aqueous secondary coating composition comprising a styrene butadiene copolymer as the only binder to form a wet secondary coating layer;
d) pressing the product of step c) against the product of step b) to contact the wet primary coating layer with the wet secondary coating layer, and
e) drying the product of step d).

Patentansprüche

1. Teppichprodukt, sequentiell umfassend:

a) ein primäres Trägermaterial mit einer Rückseite und einer Vorderseite, wobei sich Teppichfasern von der Vorderseite erstrecken, um einen Teppichstapel zu bilden, und auch durch das primäre Trägermaterial hindurchgehen und Schlaufen auf der Rückseite bilden;
b) eine primäre Deckschicht auf den Schlaufen, umfassend ein Vinylacetat-Ethylen-Copolymer als einziges Bindemittel, wobei das Vinylacetat-Ethylen-Copolymer keine anderen Comonomere umfasst als Vinylacetat und Ethylen, und mit von 542 bis 1085 g/m^2 (16 bis 32 oz/yd^2) auf einer Trockenfeststoff-Basis vorhanden ist;
c) eine sekundäre Deckschicht auf der primären Deckschicht, umfassend ein Styrol-Butadien-Copolymer als einziges Bindemittel; und
d) ein sekundäres Trägermaterial auf der zweiten Deckschicht und dadurch haftend auf der primären Deckschicht aufgebracht.

2. Teppichprodukt nach Anspruch 1,
wobei das Vinylacetat-Ethylen-Copolymer Vinylacetat-Einheiten in einer Menge von 70 bis 98 Gew.-%, bezogen auf das Gesamtgewicht von Comonomeren, umfasst.

3. Teppichprodukt nach Anspruch 1,

wobei das Vinylacetat-Ethylen-Copolymer Vinylacetat-Einheiten in einer Menge von 75 bis 95 Gew.-%, bezogen auf das Gesamtgewicht von Comonomeren, umfasst.

4. Teppichprodukt nach Anspruch 1,
wobei das Vinylacetat-Ethylen-Copolymer Vinylacetat-Einheiten in einer Menge von 80 bis 95 Gew.-%, bezogen auf das Gesamtgewicht von Comonomeren, umfasst.

5. Teppichprodukt nach einem vorhergehenden Anspruch,
wobei das Vinylacetat-Ethylen-Copolymer Ethylen in einer Menge von 2 bis 30 Ges.-%, bezogen auf das Gesamtgewicht von Comonomeren, umfasst.

6. Teppichprodukt nach einem vorhergehenden Anspruch,
wobei das Vinylacetat-Ethylen-Copolymer Ethylen in einer Menge von 5 bis 15 Gew.-%, bezogen auf das Gesamtgewicht von Comonomeren, umfasst.

7. Teppichprodukt nach einem vorhergehenden Anspruch,
wobei das Vinylacetat-Ethylen-Copolymer Ethylen in einer Menge von 10 bis 12 Gew.-%, bezogen auf das Gesamtgewicht von Comonomeren, umfasst.

8. Teppichprodukt nach einem der Ansprüche 1 bis 7, wobei das Vinylacetat-Ethylen-Copolymer in der primären Deckschicht von einer Vinylacetat-Ethylen-Copolymer-Dispersion abgeleitet ist, die nur durch einen oder mehrere Emulgatoren und ein oder mehrere Schutzkolloide stabilisiert ist.

9. Teppichprodukt nach einem der Ansprüche 1 bis 7,
wobei das Vinylacetat-Ethylen-Copolymer in der primären Deckschicht von einer Vinylacetat-Ethylen-Copolymer-Dispersion abgeleitet ist, die nur durch einen oder mehrere Emulgatoren stabilisiert ist.

10. Teppichprodukt nach einem der Ansprüche 1 bis 7,
wobei das Vinylacetat-Ethylen-Copolymer in der primären Deckschicht von einer Vinylacetat-Ethylen-Copolymer-Dispersion abgeleitet ist, die nur durch ein oder mehrere Schutzkolloide stabilisiert ist.

11. Teppichprodukt nach Anspruch 10,
wobei das eine oder die mehreren Schutzkolloide aus einem oder mehreren Polyvinylalkoholen bestehen.

12. Teppichprodukt nach Anspruch 11,
wobei der eine oder die mehreren Polyvinylalkohole mindestens einen teilweise hydrolysierten Polyvinylalkohol und mindestens einen Polyvinylalkohol mit einem Hydrolysegrad von 98 bis 100 Mol-% umfassen.

13. Teppichprodukt nach einem vorhergehenden Anspruch, wobei das Styrol-Butadien-Copolymer 20 bis 79,9 Gew.-%, vorzugsweise 50 bis 65 Gew.-%, Styrol und 20 bis 79,9 Gew.-%, vorzugsweise 35 bis 50 Gew.-%, Butadien, bezogen auf die Gesamtmenge an Comonomeren, umfasst.

14. Teppichprodukt nach einem vorhergehenden Anspruch,
wobei das Styrol-Butadien-Copolymer insgesamt 0,1 bis 15 Gew.-% Hilfs-Comonomere, bezogen auf das Gesamtgewicht von Comonomeren, umfasst.

15. Teppichprodukt nach Anspruch 14,
wobei die Hilfs-Comonomere ausgewählt sind aus der Gruppe bestehend aus ethylenisch ungesättigten Monocarbonsäuren, ethylenisch ungesättigten Dicarbonsäuren, den Anhydriden oder Salzen irgendeiner von diesen und Kombinationen irgendeines der vorhergehenden.

16. Verfahren zur Herstellung des Teppichprodukts nach Anspruch 1, sequentiell umfassend:

a) Bereitstellen eines primären Trägermaterials mit einer Rückseite und einer Vorderseite, wobei sich Teppichfasern von der Vorderseite erstrecken, um einen Teppichstapel zu bilden, und auch durch das primäre Trägermaterial hindurchgehen und Schlaufen auf der Rückseite bilden;
b) Beschichten der Schlaufen mit einer wässrigen primären Beschichtungszusammensetzung, umfassend ein Vinylacetat-Ethylen-Copolymer als einziges Bindemittel, wobei das Vinylacetat-Ethylen-Copolymer keine an-

deren Comonomere umfasst als Vinylacetat und Ethylen, um eine nasse primäre Beschichtungsschicht zu bilden, die von 542 bis 1085 g/m^2 (16 bis 32 oz/yd^2) Beschichtung auf einer Trockenfeststoff-Basis ergibt;
c) Beschichten eines sekundären Trägermaterials mit einer wässrigen sekundären Beschichtungszusammensetzung, umfassend ein Styrol-Butadien-Copolymer als einziges Bindemittel, um eine nasse sekundäre Beschichtungsschicht zu bilden;
d) Pressen des Produkts aus Schritt c) gegen das Produkt aus Schritt b), um die nasse primäre Beschichtungsschicht mit der nassen sekundären Beschichtungsschicht in Kontakt zu bringen; und
e) Trocknen des Produkts aus Schritt d).

Revendications

1. Tapis comprenant, dans l'ordre :

a) un matériau d'endos primaire comportant un côté postérieur et un côté face, des fibres de tapis s'étendant à partir du côté face pour former des poils de tapis et traversant également le matériau d'endos primaire et formant des boucles sur le côté postérieur ;
b) une couche de revêtement primaire sur les boucles, comprenant un copolymère d'éthylène-acétate de vinyle comme seul liant, le copolymère d'éthylène-acétate de vinyle ne comprenant aucun comonomère autre que l'acétate de vinyle et l'éthylène, et étant présent dans une quantité de 542 à 1 085 g/m^2 (16 à 32 onces/yard carré) sur la base des solides secs ;
c) une couche de revêtement secondaire sur la couche de revêtement primaire, comprenant un copolymère de styrène-butadiène comme seul liant ; et
d) un matériau d'endos secondaire sur la couche de revêtement secondaire et adhérant ainsi à la couche de revêtement primaire.

2. Tapis selon la revendication 1, dans lequel le copolymère d'éthylène-acétate de vinyle comprend des unités d'acétate de vinyle dans une quantité de 70 à 98 % en poids, relativement au poids total des comonomères.

3. Tapis selon la revendication 1, dans lequel le copolymère d'éthylène-acétate de vinyle comprend des unités d'acétate de vinyle dans une quantité de 75 à 95 % en poids, relativement au poids total des comonomères.

4. Tapis selon la revendication 1, dans lequel le copolymère d'éthylène-acétate de vinyle comprend des unités d'acétate de vinyle dans une quantité de 80 à 95 % en poids, relativement au poids total des comonomères.

5. Tapis selon l'une quelconque des revendications précédentes, dans lequel le copolymère d'éthylène-acétate de vinyle comprend de l'éthylène dans une quantité de 2 à 30 % en poids, relativement au poids total des comonomères.

6. Tapis selon l'une quelconque des revendications précédentes, dans lequel le copolymère d'éthylène-acétate de vinyle comprend de l'éthylène dans une quantité de 5 à 15 % en poids, relativement au poids total des comonomères.

7. Tapis selon l'une quelconque des revendications précédentes, dans lequel le copolymère d'éthylène-acétate de vinyle comprend de l'éthylène dans une quantité de 10 à 12 % en poids, relativement au poids total des comonomères.

8. Tapis selon l'une quelconque des revendications 1 à 7, dans lequel le copolymère d'éthylène-acétate de vinyle dans la couche de revêtement primaire est dérivé d'une dispersion de copolymère d'éthylène-acétate de vinyle stabilisée seulement par un ou plusieurs émulsifiants et un ou plusieurs colloïdes protecteurs.

9. Tapis selon l'une quelconque des revendications 1 à 7, dans lequel le copolymère d'éthylène-acétate de vinyle dans la couche de revêtement primaire est dérivé d'une dispersion de copolymère d'éthylène-acétate de vinyle stabilisée seulement par un ou plusieurs émulsifiants.

10. Tapis selon l'une quelconque des revendications 1 à 7, dans lequel le copolymère d'éthylène-acétate de vinyle dans la couche de revêtement primaire est dérivé d'une dispersion de copolymère d'éthylène-acétate de vinyle stabilisée seulement par un ou plusieurs colloïdes protecteurs.

11. Tapis selon la revendication 10, dans lequel lesdits un ou plusieurs colloïdes protecteurs se composent d'un ou plusieurs alcools polyvinyliques.

12. Tapis selon la revendication 11, dans lequel lesdits un ou plusieurs alcools polyvinyliques comprennent au moins un alcool polyvinylique partiellement hydrolysé et au moins un alcool polyvinylique ayant un degré d'hydrolyse de 98 à 100 %mol.

13. Tapis selon l'une quelconque des revendications précédentes, dans lequel le copolymère de styrène-butadiène comprend 20 à 79,9 % en poids, préférablement 50 à 65 % en poids de styrène et 20 à 79,9 % en poids, préférablement 35 à 50 % en poids de butadiène, relativement à la quantité totale de comonomères.

14. Tapis selon l'une quelconque des revendications précédentes, dans lequel le copolymère de styrène-butadiène comprend 0,1 à 15 % en poids au total de comonomères auxiliaires, relativement au poids total des comonomères.

15. Tapis selon la revendication 14, dans lequel les comonomères auxiliaires sont sélectionnés dans le groupe constitué d'acides monocarboxyliques à insaturation éthylénique, d'acides dicarboxyliques à insaturation éthylénique, d'anhydrides ou de sels des uns ou des autres de ceux-ci, et de combinaisons de n'importe lesquels des composés susmentionnés.

16. Procédé de fabrication du tapis selon la revendication 1, comprenant, dans l'ordre :

a) la fourniture d'un matériau d'endos primaire comportant un côté postérieur et un côté face, des fibres de tapis s'étendant à partir du côté face pour former des poils de tapis et traversant également le matériau d'endos primaire et formant des boucles sur le côté postérieur ;
b) le revêtement des boucles avec une composition aqueuse de revêtement primaire comprenant un copolymère d'éthylène-acétate de vinyle comme seul liant, le copolymère d'éthylène-acétate de vinyle ne comprenant pas de comonomères autres que l'acétate de vinyle et l'éthylène, pour former une couche de revêtement primaire humide apportant de 542 à 1 085 g/m^2 (16 à 32 onces/yard carré) de revêtement sur la base des solides secs ;
c) le revêtement d'un matériau d'endos secondaire avec une composition aqueuse de revêtement secondaire comprenant un copolymère de styrène-butadiène comme seul liant pour former une couche de revêtement secondaire humide ;
d) le fait de presser le produit de l'étape c) contre le produit de l'étape b) pour mettre la couche de revêtement primaire humide en contact avec la couche de revêtement secondaire humide, et
e) le séchage du produit de l'étape d).

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