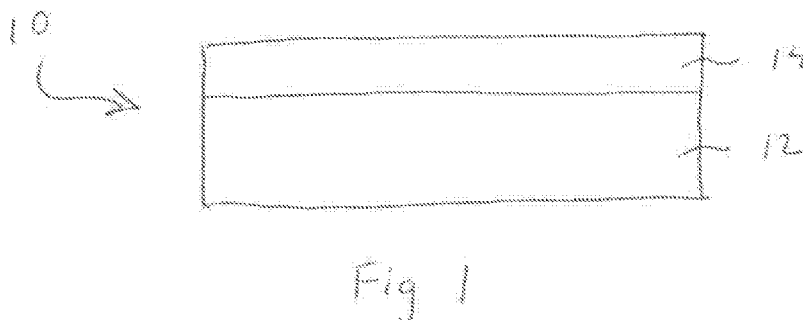




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Declarations under Rule 4.17:— *of inventorship (Rule 4.17(iv))***Published:**— *with international search report (Art. 21(3))*(54) **Title:** TEMPERATURE-RELEASABLE FLOOR COATING SYSTEM

(57) **Abstract:** A temperature-releasable coating on a flooring substrate comprises a temperature-release non-SCC polymer and a film-forming non-SCC polymer which can comprise acrylic polymer, polyurethane, etc. The temperature-release polymer provides the coating system with heat-release or cool-release property, avoiding chemical stripping. Also disclosed are non-SCC coating formulations for making the coatings, and processes for applying and removing the coating.



Temperature-Releasable Floor Coating System

Background

[0001] The present application claims the benefit of U.S. Provisional Patent Application No. 62/211,324, entitled “Temperature-Releasable Floor Coating System,” in the name of Wofford et al, filed August 28, 2015, the contents of which are hereby incorporated by reference in their entirety. The present application also claims the benefit of U.S. Provisional Patent Application No. 62/211,274, entitled “Compositions, Systems, and Apparatus Utilizing Crystallizable Polymers,” filed August 28, 2015, the contents of which are hereby incorporated by reference in their entirety, and to corresponding International Publication No. _____, also entitled “Compositions, Systems, and Apparatus Utilizing Crystallizable Polymers,” filed as a PCT application on August 26, 2016, the contents of which are hereby incorporated by reference in their entirety.

[0002] Surface coating systems protect and enhance the appearance of substrates, such as floors, counter tops, and other areas subjected to traffic or other heavy use. Substrates are prone to wear and deterioration with traffic, such as pedestrian and vehicular traffic.

[0003] Sealers can be applied to porous substrates and absorb into the substrate and solidify within the substrate in order to reduce the permeability of the substrate and thereby enhance the durability and appearance of the substrate. Coatings are applied to porous and nonporous substrates to protect against abrasion, scratching, staining, chemical damage, and other adverse effects. Coatings can also be designed to significantly enhance the appearance of the substrate by improving cleanliness, smoothness, reflection, and gloss. Polymer-based floor coatings, in the form of aqueous emulsion or solvent solution, are typically applied to floors with mops or other applicators, and allowed to dry to a hard protective film.

[0004] Polymer-based floor coatings are generally maintained with the use of cleaners and tools, which can include various buffing and burnishing machines. Although floor maintenance programs can be effective, they are expensive. Moreover, as the surface becomes worn or otherwise acquires an unsatisfactory appearance over time, it becomes necessary to entirely remove the

coating. Stripping can be carried out with chemical strippers and/or mechanical abrasion. Stripping is time-consuming, labor-intensive, potentially hazardous, and can damage the substrate itself, particularly after multiple stripping cycles. Abrasion leaves the floor scoured, reducing the longevity of the flooring substrate.

[0005] Traditional floor finishes, including coatings such as acrylic polymer and/or polyurethane, have been applied to floors. Recent trends in protective floor coatings are to move away from traditional finishes and move toward durable coatings (also referred to as “architectural coatings” because of their permanence and their difficulty of removal) including highly cross-linked coatings, such as those including uv-cured polymers such as uv-cured polyurethane, uv-cured acrylic polymer, crosslinked polyurethane, crosslinked polyurea, crosslinked acrylic polymer, crosslinked epoxy polymer, and polysiloxane. Although these coatings can provide enhanced durability relative to traditional floor finishes, they too eventually have to be removed from the floor due to scratching, scuffs, stains, etc. The highly cross-linked structure of these coatings makes them difficult, if not impossible, to remove by any means other than physical abrasion.

[0006] The establishment and maintenance of floor coatings in commercial buildings subject to public traffic presents challenges. It is undesirable to close part or all of the building during normal operating hours for the stripping of a floor coating, and/or for floor coating installation and maintenance. Moreover, the installation of a floor coating system overnight, i.e., during closed hours, must be done in a manner such that when the building opens up for public traffic the next day, the freshly installed floor coating system is safe and durable.

[0007] For some time there has been an ongoing search for a floor coating that can be removed without the use of chemical strippers and without the generation of a large amount of dust from abrasion. While it is known that architectural paints and maintenance coatings can be softened and removed with heat to enable mechanical removal, such methods require high energy and high temperatures, and risk damage to the flooring substrate.

Summary

[0008] It has been found that by providing the floor coating with a heat-release polymer having a melting point above the floor temperature, the addition of relatively

low levels of heat energy to the floor can cause the heat-release polymer to melt and thereby allow agitation of the heated coating to release the coating from the floor. Similarly, providing the floor coating with a cool-release polymer having a freezing point below the floor temperature can allow relatively low levels of cooling to freeze the cool-release polymer and thereby allow agitation of the cooled coating to release the coating from the floor. The polymers referred to herein are non-side chain crystalline polymers or non-side chain crystallizable polymers (non-SCC polymer). Side chain crystalline polymers for use as a temperature-release polymer are disclosed in a separately filed application, i.e., US Serial No. 62/211274, filed 28 August 2015, to Bitler et al. Accordingly, all references to “polymer” and “coating” herein are understood to be a “non-side chain crystalline polymer” and “non-SCC coating” respectively. For clarity, the terms “non-SCC polymer” and “polymer” disclosed and claimed herein are used interchangeably to mean “non-SCC polymer.” The terms “non-SCC coating” and “coating” disclosed and claimed herein are used interchangeably to mean “non-SCC coating.”

[0009] A temperature-release polymer can be a heat-release polymer or a cool-release polymer. The temperature-release polymer (TRP) can be: (i) in a primer layer between the flooring substrate and a wear layer, and/or (ii) in a base layer between the flooring substrate and a wear layer, and/or (iii) in a wear layer which contains additional polymer which provides the coating with durability, gloss, transparency, etc., and/or (iv) in a temperature-release layer between the flooring substrate and the wear layer.

[0010] The TRP can be tailored so that it provides the coating with heat-release properties or cool-release properties. Heating can be used to cause a heat-release polymer to melt (i.e. liquefy) and release the coating containing the heat-release polymer, together with additional components in the heat-release layer as well as the release of additional coating layers above the layer containing the heat-release polymer. Cooling can be used to cause a cool-release polymer to freeze and release the coating containing the cool-release polymer, together with additional components in the cool-release layer as well the release of additional coating layers above the layer containing the cool-release polymer. The use of the TRP in a release layer or as a release component enables the release of even the highly

durable architectural coatings, which are otherwise not feasibly stripped with chemical strippers and which are difficult and time consuming to grind off. The use of heat-release polymer or cool-release polymer allows non-architectural coatings to be removed by either the use of heating or cooling, or (ii) through the use of chemical strippers, if desired.

[0011] A first aspect is directed to a coated floor comprising a flooring substrate having a heat-releasable multilayer coating thereon. The heat-releasable multilayer coating comprises a heat-releasable layer and a wear layer. The heat-releasable layer comprises a heat-release polymer having an onset of melting temperature, T_o , of at least 27°C. The wear layer comprises a film-forming polymer comprising at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polystyrene, polyether, polyaldehyde, polyketone, and polycarbonate. The heat-releasable layer is between the flooring substrate and the wear layer.

[0012] A second aspect is directed to a multilayer floor coating system comprising a heat-release layer composition and a wear layer composition. The heat-release layer composition comprises a heat-release polymer having an onset of melting temperature, T_o , of at least 27°C. The wear layer composition comprises a film-forming polymer comprising at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate.

[0013] A third aspect is directed to a process for applying and removing a floor coating. The process comprises (A) applying a heat-release coating composition to a flooring substrate, (B) drying the heat-release coating composition to form a heat-release layer over the flooring substrate, (C) applying a wear layer coating composition over the heat-releasable layer, (D) drying the wear layer coating composition to form a wear layer over the heat-releasable layer to produce a heat-releasable multilayer floor coating over the flooring substrate, (E) trafficking the floor in a manner causing the floor to undergo a degradation of appearance, (F) heating the heat-releasable multilayer floor coating until the heat-releasable layer reaches a temperature of at least 27°C; and (G) agitating the wear layer while the heat-

releasable layer is at a temperature of at least 27°C, to disintegrate the wear layer and separate the wear layer from the flooring substrate. The heat-release coating composition comprises a heat-release polymer having an onset of melting temperature, T_o , of at least 27°C. The wear layer coating composition comprises a film-forming polymer comprising at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate.

[0014] A fourth aspect is directed to a coated floor, comprising a flooring substrate and a heat-releasable wear layer over the flooring substrate. The heat-releasable wear layer comprises (i) a heat-release polymer having an onset of melting temperature, T_o , of at least 27°C, and (ii) a film-forming polymer comprising at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate. In an embodiment, the process can be carried-out using the system according to the second aspect. In an embodiment, the process can be carried-out to produce a coated floor in accordance with the first aspect.

[0015] A fifth aspect is directed to a floor coating system comprising a heat-release wear layer composition comprising a heat-release polymer and a film forming polymer. The heat-release polymer has an onset of melting temperature, T_o , of at least 27°C. The film-forming polymer comprises at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate.

[0016] A sixth aspect is directed to a process for applying and removing a floor coating, comprising: (a) applying a heat-release wear layer coating composition to a flooring substrate, (b) drying the heat-release wear layer composition to form a heat-releasable wear layer over the flooring substrate, (c) trafficking the floor in a manner causing the floor to undergo a degradation of appearance; (d) heating the heat-releasable wear layer to a temperature of at least 27°C, and (e) agitating the heat-releasable wear layer while the heat-releasable wear layer is at a temperature of at

least 27°C, to disintegrate the heat-releasable wear layer and separate it from the flooring substrate. The heat-release wear layer coating composition comprises (i) a heat-release polymer having an onset of melting temperature, T_o , of at least 27°C, and (ii) a film-forming polymer comprising at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate. In an embodiment, the process can be carried-out using the system according to the fifth aspect. In an embodiment, the process can be carried-out to produce a coated floor in accordance with the fourth aspect.

[0017] A seventh aspect is directed to a coated floor comprising a flooring substrate and a cool-releasable coating thereon. The cool-releasable coating comprises (a) cool-release polymer having a freezing temperature T_f of less than 15°C and a peak melt temperature T_p of greater than 25°C, and (b) a film-forming polymer comprising at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate.

[0018] An eighth aspect is directed to a floor coating system including a cool-release coating composition comprising a cool-release polymer and a film-forming polymer. The cool-release polymer has a freezing temperature T_f of less than 15°C and a peak melt temperature T_p of greater than 25°C. The film-forming polymer comprises at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate.

[0019] A ninth aspect is directed to a process for applying and removing a floor coating, comprising: (a) applying a cool-release coating composition to a flooring substrate, (b) drying the cool-release coating composition to form a cool-releasable layer over the flooring substrate, (c) applying a wear layer coating composition over the cool-releasable layer, (d) drying the wear layer coating composition to form a wear layer over the cool-releasable layer and provide a cool-releasable multilayer floor coating over the flooring substrate; (e) trafficking the floor in a manner causing

the floor to undergo a degradation of appearance; (f) cooling the cool-releasable multilayer floor coating to a temperature of less than 15°C; and (g) agitating the cool-releasable multilayer floor coating while the cool-releasable multilayer floor coating is at a temperature of less than 15°C, to disintegrate the wear layer and separate the wear layer from the flooring substrate. The cool-release coating composition comprises a cool-release polymer having a freezing temperature T_f of less than 15°C and a peak melt temperature T_p of greater than 25°C. The wear layer coating composition comprising a film-forming polymer comprising at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate.

[0020] A tenth aspect is directed to a process for applying and removing a floor coating, comprising: (a) applying a cool-release wear layer composition to a flooring substrate, (b) drying the cool-release composition to form a cool-releasable wear layer over the flooring substrate, (c) trafficking the floor in a manner causing the floor to undergo a degradation of appearance, (d) cooling the cool-releasable wear layer to a temperature of less than 15°C, and (e) agitating the cool-releasable wear layer while the cool-releasable wear layer is at a temperature of less than 15°C, to disintegrate the cool-releasable wear layer and separate the cool-releasable wear layer from the flooring substrate. The cool-release wear layer composition comprises a cool-release polymer having a freezing temperature T_f of less than 15°C and a peak melt temperature T_p of greater than 25°C. The film-forming polymer comprises at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate. In an embodiment, the process can be carried-out using the process according to the ninth aspect. In an embodiment, the process can be carried-out to produce a coating according to the eighth aspect.

[0021] An eleventh aspect is directed to a coated floor comprising a flooring substrate, a cool-release coating over the flooring substrate. The cool-release coating comprises (i) a polymeric adhesion composition which is substantially non-tacky at or below about 7.2°C and which is tacky at 18°C. The adhesive composition

comprises a cool-release polymer having a heat of fusion of at least 20 Joules/g and an onset of melt temperature T_o of from about 2°C to 18°C. The cool release coating further comprises (ii) a film-forming polymer comprising at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate. In an embodiment, the polymeric adhesion composition is substantially non-tacky at or below 10°C. In another embodiment, the polymeric adhesion composition is substantially nontacky at or below 12.8°C. In another embodiment, the polymeric adhesion composition is substantially nontacky at or below 15.6°C. In an embodiment, the process of the eleventh aspect can be carried-out using the system according to the eighth aspect. In an embodiment, the process can be carried-out to produce a coating according to the seventh aspect.

Brief Description of the Drawings

[0022] FIG. 1 is a schematic cross-sectional view of a floor having a temperature releasable coating thereon. [single layer]

[0023] FIG. 2 is a schematic cross-sectional view of a floor having a multilayer temperature releasable coating thereon. [two layer]

[0024] FIG. 3 is a schematic cross-sectional view of a floor having an alternative temperature releasable coating thereon. [three layer]

Detailed Description

[0025] As used herein, the phrase “temperature-releasable coating system” refers to a temperature-releasable coating which is on a substrate, such as a floor made from vinyl composition tile, including monolayer and multilayer coating systems. The phrase “temperature-releasable coating system” also includes the composition(s) to be applied to the substrate, i.e., a single composition to be applied over the substrate to prepare a monolayer coating, as well as multiple compositions to be applied over the substrate to prepare a multilayer coating. The phrase “temperature-releasable” includes heat-releasable as well as cool-releasable, as described below. Optionally, the temperature-releasable coating composition (as well as the temperature-

releasable layer) may further comprise a film forming polymer (FFP) which imparts wear qualities (i.e., durability) to the temperature-release layer, thereby providing a layer with dual functions of temperature-release and durability.

[0026] As used herein, the phrases “heat releasable coating,” “heat-releasable coating,” both refer to a coating having at least one heat-releasable component having an onset of melting temperature (T_o) of at least 27°C. Upon heating the heat-releasable coating to a temperature of $\geq T_o$, coating removal can be carried out by subjecting the coating to agitation while heated.

[0027] As used herein, the phrases “heat releasable layer,” and “heat-releasable layer,” both refer to a layer of heat-releasable coating which contains the at least one heat-releasable component having a T_o of at least 27°C, so that upon heating the heat-releasable layer to $\geq T_o$, coating removal can be carried out by subjecting the coating to agitation while heated. The heat-releasable layer can be present in a monolayer coating or in a multilayer coating. The heat-releasable component may have a T_o of at least 29°C, or at least 32°C, or at least 35°C.

[0028] Temperature-releasability of the floor coating is provided by a temperature-release polymer (“TRP”) or “TR polymer,” and is a non-SCC polymer. TR polymers may have a narrow melt point range, i.e., the temperature range from T_o (the temperature at the onset of melting) to T_p (the peak melting temperature). Accordingly, as heat is applied, once such a TR polymer reaches T_o , very little heat is required in order for the TR polymer to transition from solid to liquid. In contrast, other polymers have a broader temperature range between T_o and T_p , requiring substantially more heat before the transition to liquid, with the polymer remaining in an at least partially amorphous state between T_o and T_p . TR polymers can be designed in a manner so as to adjust T_o and T_p from 0°C to $\geq 120^\circ\text{C}$ by selection of monomer type and amount from which the TR polymer is made.

[0029] The TR polymer can be a single polymer or a mixture of polymers, and can be a homopolymer or a copolymer, including random copolymer, graft copolymer, thermoplastic elastomer. The TR polymer can be a non-SCC thermoplastic elastomer which is a non-SCC block copolymer. The TR polymer may for example be derived from one or more acrylic, methacrylic, olefinic, epoxy, vinyl, ester-containing, amide-containing or ether-containing monomers. The molecular

weight of a non-SCC TR polymer is relatively unimportant to its peak melt temperature T_p .

[0030] TR polymers include for example, polymers of α -olefins containing 2 to 12 carbon atoms, or 2 to 8 carbon atoms, e.g. polymers of monomers having the formula $\text{CH}_2\text{-CHR}$, where R is hydrogen, methyl, propyl, butyl, pentyl, 4-methylpentyl, hexyl or heptyl, as well as other polymers such as polyesters, polyamides, and polyalkylene oxides, for example polytetrahydrofuran.

[0031] The TR polymer can be present in a specifically designed temperature “releasable layer” which is between the flooring substrate and a wear layer. Alternatively, the TR polymer can be provided in a layer that also provides service durability, i.e., as a “temperature-releasable wear layer.” The TR polymer may provide the floor coating with heat releasability in a temperature range that is non-destructive or mild to the flooring substrate.

[0032] The non-SCC TR polymer may have a heat of fusion of at least 20 Joules/gram. The non-SCC TR polymer may have a heat of fusion, as measured by a differential scanning calorimeter, of at least 20 Joules/gram while the non-SCC TR polymer has an onset of melting temperature T_o of at least 27°C and a peak melting temperature T_p such that T_o is less than $T_p^{0.7}$. The non-SCC TR polymer may have a heat of fusion, as measured by a differential scanning calorimeter, of at least 20 Joules/gram, in combination with an onset of melting temperature T_o of at least 27°C as well as a peak melting temperature T_p such that $T_p - T_o$ is less than 25°C. The non-SCC TR polymer may include any non-side chain crystalline polymer (“non-SCC polymer”). As used herein, the phases “non-side chain crystalline polymer,” and “non-SCC polymer,” include polymers other than, and hereby expressly exclude, polymers such as the side chain crystalline polymers disclosed in U.S. Patent No. 6,255,367, to Bitler et al, which is hereby incorporated, in its entirety, by reference thereto.

[0033] The TR polymer may be an acrylic polymer (including those derived from one or more monomers such as substituted and unsubstituted acrylates, methacrylates, fluoroacrylates, acrylamides, methacrylamides), vinyl polymer, polyester (including polymers formed from vinyl esters), polyimide (including maleimides), polyolefin (including α -olefins), polystyrene (including p-alkyl styrenes),

polyether (including alkylvinyl ethers), polyalkylene oxide (including alkylethylene oxides), polyphosphazene (including alkyl phosphazenes), amino acid polymer, polyisocyanate, polyurethane, polysilane, and polysiloxane.

[0034] Heat energy can be used to melt a TR polymer having a sharp melt point used in a primer layer or releasable layer, or as a component of a floor coating layer which provides gloss, transparency, and durability. The TR polymer may enable removal of the coating by the application of heat, without the need for the use of chemical stripper or excessive heat energy, either of which can damage the flooring substrate as well as other undesirable side-effects. The T_m of the non-SCC polymer can be adjusted from 0°C up to $\geq 120^\circ\text{C}$ through monomer composition, allowing the floor coating to be removed with relatively mild heat energy. The invention combines the non-SCC TR polymer into a construction for a floor coating that provides service durability, while being removable with “mild” heat energy. “Mild” heat is in the operating range of from 30°C to 80°C, or from 35°C to 50°C. Floor temperatures in populated buildings rarely exceed 35°C.

[0035] In the heat-releasable layer or the heat-releasable wear layer, the heat-release polymer is not a pressure sensitive adhesive, because the onset of tack occurs at the onset of melting, i.e., T_o . The onset of melting (T_o) of the heat-release polymer may be at least 27°C, with room temperature being 21°C.

[0036] Polymers lacking substantial tack exhibit a tack value less than 25 g.cm/sec of force, measured in accordance with ASTM D2979. Polymers which are slightly tacky exhibit a tack value from 25 to 100 g.cm/sec of force, measured in accordance with ASTM D2979. Polymers which are tacky exhibit a tack value of greater than 100 g.cm/sec, measured in accordance with ASTM D2979.

[0037] In the cool-releasable layer or the cool-releasable wear layer, the cool-release polymer is not a pressure sensitive adhesive, because the onset of tack occurs at the onset of melting, i.e., T_o . The onset of melting (T_o) of the cool-release polymer is at least 27°C, with room temperature being 21°C. Polymers lacking substantial tack exhibit a tack value less than 25 g.cm/sec of force, measured in accordance with ASTM D2979. Polymers which are slightly tacky exhibit a tack value from 25 to 100 g.cm/sec of force, measured in accordance with ASTM D2979.

Polymers which are tacky exhibit a tack value of greater than 100 g.cm/sec, measured in accordance with ASTM D2979.

[0038] Non-SCC TR polymers may be prepared by polymerizing one or more corresponding linear aliphatic acrylates or methacrylates, or equivalent monomers such as acrylamides or methacrylamides. A number of such monomers are available commercially, either as individual monomers or as mixtures of identified monomers. The polymers can optionally also contain units derived from one or more other comonomers preferably selected from other alkyl, hydroxyalkyl and alkoxyalkyl acrylates, methacrylates (e.g. glycidal methacrylate), acrylamides and methacrylamides; acrylic and methacrylic acids; acrylamide; methacrylamide; maleic anhydride; and comonomers containing amine groups. Such other co-monomers are generally present in total amount less than 50%, particularly less than 35%, especially less than 25%, e.g. 0 to 15%. They may be added to modify the melting point or other physical properties of the polymers. For example, homopolymers of C₁₄ acrylate, C₁₆ acrylate, C₁₈ acrylate, C₂₀ acrylate, C₂₂ acrylate, C₃₀ acrylate, C₄₀ acrylate, and C₅₀ acrylate respectively typically have melting points of 20, 36, 49, 60, 71, 76, 96 and 102°C, while the homopolymers of the corresponding n-alkyl methacrylates typically have melting points of 10, 26, 39, 50, 62, 68, 91 and 95°C. Copolymers of such monomers generally have intermediate melting points. Copolymers with other monomers, e.g. acrylic acid or butyl acrylate, typically have somewhat lower melting points.

[0039] The TR polymer may comprise 30 to 100%, preferably 40 to 100%, of units derived from at least one monomer selected from the group consisting of alkyl acrylates, alkyl methacrylates, N-alkyl acrylamides, N-alkyl methacrylamides, alkyl oxazolines, alkyl vinyl ethers, alkyl vinyl esters, .alpha.-olefins, alkyl 1,2-epoxides and alkyl glycidyl ethers; 0 to 20% of units derived from at least one monomer selected from the group consisting of alkyl acrylates, alkyl methacrylates, N-alkyl acrylamides, alkyl vinyl ethers, and alkyl vinyl esters in which the alkyl groups are n-alkyl groups containing 4 to 12 carbon atoms; and 0 to 15% of units derived from at least one polar monomer selected from the group consisting of acrylic acid, methacrylic acid, itaconic acid, acrylamide, methacrylamide, acrylonitrile, methacrylonitrile, vinyl acetate and N vinyl pyrrolidone. Such TR polymers may also

contain units derived from other monomers, including styrene, vinyl acetate, monoacrylic functional polystyrene and the like.

[0040] The number average molecular weight of the TR polymer may be < 200,000; or < 100,000, or < 50,000, or < 20,000, or from 1,000 to 200,000, or from 1,000 to 100,000, or from 1,000 to 50,000, or from 1,000 to 20,000. The molecular weight of the TR polymer can be adjusted (for example through choice of the reaction conditions and addition of chain transfer agents) without a substantial change in the T_p .

[0041] In an embodiment, the TR polymer is chemically linked to a matrix, e.g. incorporated in a crosslinked polymeric structure, in order to provide a desired effect on the properties of the coating. The TR polymer can be selected to provide, for example, enhanced tensile strength, elongation, toughness, flexibility, adhesion, etc, for example to other organic polymers (e.g., vinyl composition tile), wood, stone, concrete, stone, steel, glass, wood, etc. The TR polymer can be selected to provide resistance to degradation by moisture or other chemicals, pests, mildew, fungus, light or other electromagnetic radiation, heat or burning.

[0042] In an embodiment, the TR polymer is present in combination with a second polymeric ingredient which becomes covalently linked, e.g. crosslinked, to provide one or more desired properties. The second polymer may be for example a polymer having a melting point higher or lower than T_p .

[0043] In an embodiment, the TR polymer comprises a thermoplastic elastomer, for example one in which an active chemical moiety is attached to the hard block, and the soft blocks have a toughening effect on the final product. For example, the thermoplastic elastomer can include hard blocks and amorphous soft blocks. The hard blocks can for example be derived from TR polymers as described above. The amorphous soft blocks can for example have a T_g of -60 to 150°C, or from -60 to 120°C. Suitable soft blocks can for example be derived from one or more of butyl acrylate, ethyl hexylacrylate, and butadiene.

[0044] As used herein, the phrases “cool releasable coating,” “cool-releasable coating,” both refer to a coating having a cool-releasable component having a freezing point temperature (T_f) at or below 20°C. The T_f of the cool-releasable component may correspond with the T_o of the cool-releasable component. In an

embodiment, the cool-releasable component is polymeric. In an embodiment, the cool-releasable component is a cool-release polymer. Upon cooling the at least one cool-releasable coating to a temperature $\leq T_f$, coating removal can be carried out by subjecting the coating to agitation while cooled.

[0045] In an embodiment, the cool-release component can have a freezing point of less than 45°F, or less than 40°F, or less than 35°F, or less than 30°F, or less than 20°F; or from 0° to 45°F, or from 5°F to 40°F, or from 10°F to 35°F, or from 20°F to 35°F, or from 25°F to 35°F, or from 30°F to 35°F.

[0046] In a cool-release embodiment, the cool-release polymer may become embrittled at a triggering temperature below a freezing point of the cool-release polymer, thereby upon application of agitation enabling release of the cool-release layer.

[0047] As used herein, the term “layer” includes a single layer having a particular composition throughout, as well as two or more layers in directly adhering to one another, which layers have a substantially identical composition.

[0048] As used herein, the phrases “cool releasable layer,” and “cool-releasable layer,” both refer to a layer of cool-releasable coating which contains the at least one cool-releasable component having $T_f \leq 13^\circ\text{C}$, so that upon cooling the cool-releasable layer to $\leq T_f$, the coating can be removed by agitation. The cool-releasable layer can be present in a monolayer coating or in a multilayer coating. The cool-releasable component may have a T_f of $\leq 10^\circ\text{C}$, or $\leq 7^\circ\text{C}$, or $\leq 4^\circ\text{C}$.

[0049] As used herein, the phrases “wear layer” and “durability layer” are used to refer to any layer of a coating which provides durability, i.e., the ability to withstand wear. The wear layer contains a durability component such as a tough polymer capable of withstanding substantial wear, such as polyurethane, acrylic polymer, polysiloxane, polyester, polyamide, epoxy polymer, etc. In an embodiment, the tough polymer of the wear layer can be a film-forming polymer.

[0050] As used herein, the phrases “heat releasable wear layer” and “heat-releasable wear layer” both refer to a layer of a coating which both provides durability and heat-releasability. The heat-releasable wear layer comprises both the durability component and the heat-releasable component. Upon heating the heat-

releasable layer to a temperature of at least T_o , removal of the heat-releasable wear layer can be effected by agitation of the coating.

[0051] As used herein, the phrases “cool releasable wear layer,” and “cool-releasable wear layer,” both refer to a layer of a coating which provides both durability and cool-releaseability. The cool-releasable wear layer comprising both the durability component and the cool-releasable component. Upon cooling the cool-releasable layer to a temperature of $\leq T_f$, removal of the cool-releasable wear layer can be effected by agitation of the coating.

[0052] As used herein, “ T_o ” refers to the temperature of the onset of melting, i.e., the temperature at which a solid undergoes the onset of melt fracture. As used herein, “ T_p ” refers to the peak melt temperature. As used herein, “ T_m ” refers generally to the melting point of a material, i.e., the temperature at which the transition from solid to liquid occurs.

[0053] As used herein, “ T_f ” refers to freezing temperature. Although T_o , T_p , and T_f can be applied to singular components of a composition, T_o , T_p , and T_f can also be applied to a blend of diverse components, i.e., the blend as a whole.

[0054] As used herein, the phrase “vinyl polymer” refers to a polymer containing mer units from the polymerization of a monomer having the vinyl grouping ($\text{CH}_2=\text{CH}-$).

[0055] As used herein, the phrase “polymeric block” refers to a portion of a copolymer chain composed of homopolymer subunits linked by covalent bonds.

[0056] As used herein, all references to molecular weight (M_w) refer to weight average molecular weight.

[0057] As used herein, the phrase “pressure-sensitive adhesive” (i.e., “PSA”) refers to a composition which at room temperature (i.e., $20^\circ\text{C} \pm 5^\circ\text{C}$) forms a bond when pressure is applied to marry the adhesive with an adherent. No solvent, water, or heat is needed to activate the adhesive. The degree of bond is influenced by the amount of pressure which is used to apply the adhesive to the surface. PSAs are designed to form a bond and hold properly at room temperature.

[0058] In an indoor environment which is provided with heating and cooling so as to be maintained at room temperature, the heat-releasable component does not serve as a PSA because the onset of tack occurs at the onset of melting, i.e., at T_o ,

which for the heat-releasable component is at least 27°C. Polymers lacking substantial tack at room temperature exhibit a tack value less than 25 g.cm/sec of force at room temperature, measured in accordance with ASTM D2979. Polymers which are slightly tacky at room temperature exhibit a tack value from 25 to 100 g.cm/sec of force at room temperature, measured in accordance with ASTM D2979. Polymers which are tacky at room temperature exhibit a tack value of greater than 100 g.cm/sec at room temperature, measured in accordance with ASTM D2979.

[0059] As used herein, the phrase “physical blend” refers to a polymer composition including a mixture of two or more polymer networks that do not form an interpenetrating polymer network. For example, a physical blend polymer composition may be prepared by combining and mixing a composition including acrylic emulsion polymers with a composition including polyurethane emulsion polymers.

[0060] As used herein, the term “emulsion” is inclusive of both liquid-in-liquid emulsions and solid-in-liquid emulsions, the latter sometimes also being referred to as dispersions. As used herein, the term “emulsion” is interchangeable with the terms “dispersion,” “latex,” or other terms describing water-borne polymers and resins that are known and used by those skilled in the art.

[0061] As used herein, the phrase “volatile carrier” includes (i) a solvent for temperature-release polymer and/or the polymeric film forming agent (ii) a liquid continuous phase having a discontinuous phase therein of the temperature-release polymer and/or the polymeric film forming agent. The discontinuous phase of the temperature-release polymer and/or the polymeric film forming agent can be a liquid or a solid, i.e., the temperature-release polymer and/or the polymeric film forming agent can be present as an emulsion or as a suspension.

[0062] As used herein, the phrase “single discontinuous phase” refers to an emulsion in which all discrete regions of the discontinuous phase have the same polymeric composition. More particularly, if some of the regions of the discontinuous phase comprise the polymeric film forming agent and other regions of the discontinuous phase do not comprise the polymeric film forming agent or comprise a substantially different proportion of the polymeric film forming agent, then the emulsion does not have a single discontinuous phase. On the other hand, if all of

the discrete regions of the discontinuous phase comprise both the polymeric film forming agent and one or more additional components in the same proportion, then the emulsion has a single discontinuous phase because the discontinuous phase is of uniform composition.

[0063] As used herein, the word “drying” refers to evaporation of volatile components from a coating composition until substantial equilibrium is reached with respect to the atmosphere. As used herein, the word “drying” includes actively driving off water and/or any other volatile compound(s) as well as passively allowing the volatile compounds to evaporate into the ambient atmosphere.

[0064] As used herein, the word “curing” refers to a chemical reaction covalently bonding organic molecules, including polymerization of monomer into polymer chains and/or crosslinking of polymer chains.

[0065] As used herein, the term “trafficking” refers to the process of subjecting a floor coating to pedestrian and/or vehicular traffic.

[0066] As used herein, the term “agitating,” relative to processes for removing floor coatings, refers to the process of subjecting the floor coating to mechanical action including one or more of abrasion, impact, scraping, vacuum, blowing, flexing, prying, cutting, and shearing, with a machine and/or manually. In the removal of a temperature-releasable floor coating, agitation is used while the floor coating is heated or cooled to a temperature at which the releasable of the floor coating is triggered by a temperature-release polymer.

[0067] Agitation in the form of abrasion can utilize a grit of from 50 to 3000, or from 100 to 2500, or from 220 to 2500, or from 500 to 2000, or from 600 to 1500, or from 800 to 1200.

[0068] The surface coating system can be made as a “single cycle” system or as a “multi-cycle” system. A “single cycle” system includes, for example, a temperature releasable layer (TRL) having a wear layer (WL) thereover, with the single cycle system over the flooring substrate (FS) represented as FS/TRL/WL. A multi-cycle system includes, for example, flooring substrate having multiples of the single cycle thereover, e.g., FS/TRL/WL/TRL/WL (a two cycle system), and FS/TRL/WL/TRL/WL/TRL/WL (a three cycle system) etc.

[0069] As used herein, the phrase “hybrid polymer” refers to a polymer composition having microphase separated domains of, for example, acrylic polymer and/or vinyl polymer dispersed within a continuous polyurethane matrix phase. Hybrid polymers are prepared by the polymerization of monomers to make the secondary polymer in the presence of a polyurethane emulsion.

[0070] As used herein, the phrase “acrylic polymer” or the term “polyacrylate” is inclusive of homopolymer and copolymer of acrylic acid and/or methacrylic acid with acrylic acid ester and/or methacrylic acid ester. The phrase “acrylic polymer” is also inclusive of copolymer made from one or more vinyl monomer, such as styrene, with any one or more of acrylic acid, methacrylic acid, acrylic acid ester, and methacrylic acid ester.

[0071] As used herein, the term “polyurethane” is interchangeable with the term “urethane” and includes polyurethane-acrylic physical blend, polyurethane-acrylic chemical blend, as well as polyurethanes made from the reaction of a diisocyanate (e.g., isophorone diisocyanate and toluene diisocyanate) with a diol, for example, a diol containing a polyester, a diol containing a polycarbonate, a diol containing a polyurea, a diol containing a polybutadiene, a diol containing a polyether, and a diol containing a polyamide.

[0072] As used herein, the term “polybutadiene” is inclusive of butadiene homopolymer, copolymer thereof, terpolymer thereof, etc., including styrene/butadiene copolymer (including styrene/butadiene block copolymer, styrene/butadiene random copolymer), acrylonitrile/butadiene/styrene, etc., as well as hydrogenated forms of all these polymers.

[0073] As used herein, the word “multi-functional” is interchangeable with the word “polyfunctional,” and refers to 2 or more functional groups thereon, preferably 3 or more functional groups thereon.

[0074] As used herein, the phrase “polysiloxane made from multi-functional alkoxy silane” refers to a polysiloxane produced from silanes having at least two alkoxy groups thereon, preferably three or more alkoxy groups thereon. These multi-functional alkoxy silanes result in highly networked polysiloxanes, which can be prepared using a sol-gel process.

[0075] Surfaces to which the temperature-releasable floor coating composition can be applied include any surface where protection is desired, such as floors, food preparation surfaces, kitchen surfaces, bathroom surfaces, desks, tables, etc., as well as vertical surfaces such as walls, windows, and the like, as well as irregular surfaces such as food preparation equipment, vessels, tanks, parts, etc. The surfaces to be coated, including the flooring substrate, may be any of a large variety of materials, including, but not limited to plastic, linoleum, vinyl (particularly vinyl composition tile, i.e., "VCT", as well as vinyl asbestos), stone (particularly marble, granite, terrazzo, travertine, slate, as well as engineered stone), concrete, ceramic, glass, wood (including engineered wood), metal, and rubber.

[0076] The coating can be used on any surface to be protected from scuffs, black heel marks, scratches, as well as any surface in which it is desired that the surface be provided with slip-resistance, water-resistance, soil-resistance, ethanol-resistance, and/or stain-resistance. The coating composition should be formulated to be compatible with the flooring substrate, i.e., so that the coating composition does not chemically attack the flooring substrate.

[0077] FIG. 1 is a schematic cross-sectional view of coated floor 10 including a flooring substrate 12 having thereon a temperature-releasable monolayer coating 14. Temperature-releasable coating 14 contains a temperature-releasable polymer and a wear polymer. The temperature-releasable polymer can be a heat-releasable polymer or a cool-releasable polymer.

[0078] FIG. 2 is a schematic cross-sectional view of coated floor 20 including flooring substrate 12 having thereon temperature-releasable multilayer coating which includes temperature-releasable layer 16 and wear layer 18. Temperature-releasable layer 16 contains a temperature-releasable polymer which can be a heat-releasable polymer or a cool-releasable polymer. Temperature releasable layer 16 is between flooring substrate 12 and wear layer 18.

[0079] FIG. 3 is a schematic cross-sectional view of coated floor 30 including flooring substrate 12 having thereon temperature-releasable multilayer coating which including temperature-releasable layer 16, wear layer 18, and base layer 20. Base layer 20 is between flooring substrate 12 and temperature-releasable layer 16. Temperature-releasable layer 16 contains a temperature-releasable polymer which

can be a heat-releasable polymer or a cool-releasable polymer. Temperature-releasable layer 16 is between base layer 20 and wear layer 18.

[0080] In multilayer coating systems, each layer may be allowed to solidify before the application of the next layer. The layers may all have the same composition, may all be different, or some or all of the compositions may be put on repeatedly.

[0081] One multilayer coating system has a temperature-releasable layer (TRL) directly adhered to the substrate (e.g., floor substrate, FS), with a wear layer (WL) containing a film-forming polymer over the temperature-releasable layer. The temperature-releasable layer may be a heat-release layer or a cool-release layer. The resulting coated substrate can be represented as "FS-TRL-WL."

[0082] The temperature-release layer may have any desired thickness. More particularly, the TRL may have a thickness of from 0.05 mil to 5 mils, or 0.1 mil to 2 mils, or 0.1 mil to 1 mil, or 0.1 mil to 0.5 mil, or 0.1 mil to 0.3 mil.

[0083] The wear layer may also have any desired thickness. More particularly, the WL may have a thickness of from 0.05 mil to 15 mils, or from 0.1 mil to 10 mils, or from 0.2 to 8 mils, or from 0.3 to 7 mils, or from 0.4 to 6 mils, or from 0.5 mil to 5 mils, or from 0.5 mil to 3 mils, or from 0.5 mil to 2 mils, or from 0.5 mil to 1 mil.

[0084] Another multilayer coating system has a base layer (BL) directly adhered to the flooring substrate, with the temperature-release layer over the base layer, further with the wear layer over the temperature-releasable layer (heat-release or cool-release), with the resulting coated substrate represented as FS-BL-TRL-WL.

[0085] Yet another multilayer coating system has a primer layer (PL) directly adhered to the flooring substrate, with a temperature-releasable layer (heat-release or cool-release) over the primer layer, and with a wear layer over the temperature-release layer, with the resulting coated substrate represented as FS-PL-TRL-WL.

[0086] Yet another multilayer coating system has a primer layer directly adhered to the flooring substrate, with a base layer over the primer layer, a temperature-releasable layer (heat-release or cool-release) over the base layer, and a wear layer over the temperature-release layer, with the resulting coated substrate represented as FS-PL-BL-TRL-WL.

[0087] Yet another multilayer coating system has a first temperature-releasable layer (heat-release or cool-release) over the substrate, and a first wear layer over the

first temperature-release layer, and a second temperature-releasable layer (heat-release or cool-release) over the first wear layer, and a second wear layer over the second temperature-release layer, with the resulting coated substrate represented as FS-TRL₁-WL₁-TRL₂-WL₂.

[0088] Additional multilayer coating systems of this type include:

FS-BL-TRL₁-WL₁-TRL₂-WL₂;
 FS-PL-TRL₁-WL₁-TRL₂-WL₂;
 FS-PL-BL-TRL₁-WL₁-TRL₂-WL₂;
 FS-TRL₁-WL₁-TRL₂-WL₂-TRL₃-WL₃;
 FS-BL-TRL₁-WL₁-TRL₂-WL₂-TRL₃-WL₃;
 FS-PL-TRL₁-WL₁-TRL₂-WL₂-TRL₃-WL₃; and
 FS-PL-BL-TRL₁-WL₁-TRL₂-WL₂-TRL₃-WL₃.

Additional “TRL_x-WL_x” layer “cycles” can be added on to any degree desired. In coatings having multiple wear layers, a temperature-release layer is provided between each of the wear layers. Optionally, a temperature-release layer can also be provided between the substrate and the wear layer closest to the substrate.

[0089] Having multiple cycles of temperature-release layers and wear layers can (a) enable stripping one cycle at a time to reveal a fresh wear layer without having to re-coat, and/or (b) be provided as relatively thin layers, allowing the wear layer to be more easily broken up and removed in the stripping process, with either all layers stripped at once, or the stripping of only a single cycle at a time, and/or (c) be provided with at least one heat-release layer and at least one cool-release layer to allow different methods for removing one TR-W cycle at a time, without removing more than one cycle.

[0090] Alternatively, a single coating layer may contain both the temperature-release polymer and the film-forming polymer (FFP) which provides durability to the coating, with the layer providing the dual functions of temperature release and durability. The temperature-release polymer and the film forming polymer may be present in the layer as a blend.

[0091] This “dual function” layer may be used as the sole layer over a substrate, i.e., a substrate/layer designated “FS-TRP&FFP,” or it may be used in conjunction

with additional layers, such as a base layer (FS-BL-TRP&FFP), or with a primer (FS-PL-TRP&FFP) or with both a primer and a base layer (FS-PL-BL-TRP&FFP). The temperature-release polymer may be present as a continuous phase or as a discontinuous phase. The film-forming polymer may be present as a continuous phase or as a discontinuous phase.

[0092] A multi-cycle system can possess different temperature-release layers. For example, one multi-cycle system has the structure FS-TRL₁-WL₁-TRL₂-WL₂ wherein TRL₁ contains a cool-release polymer and TRL₂ contains a heat-release polymer, so that after trafficking WL₂ the multi-cycle coating system is subjected to heat and agitation to remove both TRL₂ and WL₂, while leaving FS-TRL₁-WL₁ in place, so that the floor takes on a desired fresh appearance.

[0093] Any layer comprising the temperature-release polymer (i.e., the TRP, either heat-release or cool-release) can comprise the temperature-release polymer in an amount of at least 10 wt %, based on layer weight, or in an amount of at least 15 wt %, or at least 20 wt %, or at least 25 wt %, or at least 30 wt %, or at least 40 wt %, or at least 50 wt %, or at least 60 wt %, or at least 70 wt %, or at least 80 wt %, or at least 90 wt %, or even 100 wt %, based on layer weight.

[0094] The temperature-release layer (either heat-release or cool-release) can have a thickness of at least 0.001 inch, or at least 0.0015 inch, or at least 0.002 inch, or at least 0.003 inch.

[0095] In an embodiment, the temperature-release polymer (whether heat-release or cool-release) is compatible with flooring substrate, particularly flooring substrate made from polyvinylchloride ("PVC"), also known as vinyl composition tile ("VCT"). More particularly, neither the TRP nor the temperature-release coating composition nor the temperature-release coating layer chemically attacks the PVC flooring substrate. In an embodiment, neither the TRP nor the temperature-release coating composition nor the temperature-release coating layer chemically attacks a flooring substrate containing one or more of: urethane, polyolefin, linoleum, Portland cement matrix (concrete, grout, terrazzo, etc), marble, or granite.

[0096] In an embodiment, the TRP, the temperature-release coating composition, and the temperature-release layer (whether heat-release or cool-release) are also compatible with the film forming polymer (FFP) which provides durability. More

particularly, the temperature-release polymer, the temperature-release coating composition, and the temperature-release layer (whether heat-release or cool-release) do not alter the durability properties of the wear layer composition in the absence of the temperature-release polymer, temperature-release coating composition, and/or temperature-release layer.

[0097] In one embodiment, the temperature-releasable multilayer coating on a substrate is a coating comprises a base layer. The base layer may be used to seal a substrate (i.e., to decrease substrate porosity), and/or to provide a more uniform surface for the addition of one or more layers above the base layer. Base layers can be advantageous for use on, for example, concrete, wood, unglazed ceramic, terrazzo, among others. The base layer may also be used to generate adequate adhesion of the temperature-release layer to the substrate. The base layer can be between the flooring substrate and the temperature-releasable layer, which can be a heat-release layer, a heat-release wear layer, a cool-release layer, or a cool-release wear layer. One or more cycles of temperature-release layer + wear layer can be provided over the base layer.

[0098] Exemplary base layers include traditional floor finishes, including crosslinked and non-crosslinked durable coatings such as acrylic polymer (including uv-cured acrylic polymer), polyurethane (including uv-cured polyurethane and polyurethane that is not uv-cured), polyurea, epoxy polymer (including uv-cured epoxy polymer), polysiloxane, vinyl polymer, styrene-butadiene polymer, as well as factory-applied coatings, concrete treatments, penetrating sealers, densifiers and other suitable coatings and treatments known to those skilled in the art. A base coating may have a dry weight coating thickness of about 0.01 mil to about 100 mil.

[0099] The base layer coating composition may further comprise a volatile carrier comprising at least one member selected from organic solvent and water.

[00100] In an embodiment, the coating system is provided with heat-releasability in the form of a heat-release layer containing a heat-release polymer. In a heat-releasable coating, the heat-release polymer exhibits an onset of melting temperature, T_o , of at least 27°C. The heat-release polymer can have any combination of these characteristics which are not contradictory to each other. The

heat-release polymer can have any one or more of the characteristics set forth below, to the extent that the characteristics are not inconsistent with one another.

[00101] In a heat-releasable embodiment, the heat-release polymer has a heat of fusion of at least 20 Joules/gram.

[00102] In a heat-releasable embodiment, the heat-release polymer exhibits an onset of melting temperature, T_o , of from 27°C to 100°C.

[00103] In a heat-releasable embodiment, the heat-release polymer exhibits a peak melting temperature, T_p , of from 30°C to 110°C.

[00104] In a heat-releasable embodiment, the heat-release polymer has a heat of fusion, as measured by a differential scanning calorimeter, of at least 20 Joules/gram and the heat-release polymer has an onset of melting temperature T_o of at least 27°C and a peak melting temperature T_p such that $T_p - T_o$ is less than $T_p^{0.7}$.

[00105] In a heat-releasable embodiment, heat-releasable polymer has a heat of fusion, as measured by a differential scanning calorimeter, of at least 20 Joules/gram and the heat-release polymer has an onset of melting temperature T_o of at least 27°C and a peak melting temperature T_p such that $T_p - T_o$ is less than 25°C.

[00106] In a heat-releasable embodiment, the heat-release polymer exhibits a peak melting temperature, T_p , of at least 85°F, or at least 90°F, or at least 95°F, or at least 100°F, or at least 105°F, or at least 110°F; or from 85°F to 212°F, or from 90°F to 212°F, or from 90°F to 180°F or from 90°F to 150°F; or from or from 85°F to 95°F; or from 85°F to 90°F, or from 90°F to 95°F.

[00107] In a heat-releasable embodiment, the heat-release polymer comprises at least one member selected from the group consisting of acrylic polymer, vinyl polymer, polyester, polyimide, polyolefin, polystyrene, polyether, polyalkylene oxide, polyalkyl phosphazene, poly amino acid, polyisocyanate, polyurethane, polysilane, and polysiloxane.

[00108] In an embodiment, the coating system is provided with cool-releasability in the form of a cool-release polymer. The cool-release polymer can have one or more of the characteristics as set forth below. The cool-release polymer can have any combination of these characteristics which are not contradictory to each other.

[00109] In a cool-release embodiment, the cool-release polymer can have a freezing temperature T_f of less than 15°C and a peak melt temperature T_p of greater than 25°C.

[00110] In a cool-release embodiment, the cool-release polymer can have a freezing temperature T_f of less than 13°C, or less than 10°C, or less than 7°C.

[00111] In a cool-release embodiment, the cool-release polymer can have a peak melt temperature T_p of at least 30°C, or at least 33°C, or at least 36°C, or at least 39°C.

[00112] In a cool-release embodiment, the cool-release polymer can have repeating units derived from at least one member selected from the group consisting of acrylic acid, hydroxyethylacrylate, acrylamide, methacrylamide, methacrylic acid, linear or branched alkyl acrylates and methacrylates, styrene, substituted styrene, and polyoxyalkylene.

[00113] In a cool-release embodiment, the cool-release polymer can comprise repeating units derived from at least one n-alkyl acrylate or methacrylate in which the alkyl group contains from 14 to 22 carbon atoms

[00114] In a cool-release embodiment, the cool-release polymer can contain from 1 wt % to 10 wt % of units derived from acrylic acid.

[00115] In a cool-release embodiment, the cool-release polymer can comprise repeating units derived from at least one polar monomer selected from polyoxyalkylene, acrylate, acrylamide, and methacrylamide.

[00116] In a cool-release embodiment, the cool-release polymer can comprise repeating units derived from at least two different monomers.

[00117] A film-forming polymer ("FFP") provides the temperature-releasable coating system with durability. As such, the film forming polymer can be present in a layer designated as a "durability layer" or as a "wear layer."

[00118] The film forming polymer can be in a temperature-release wear layer composition, i.e., present as a blend with a temperature-release polymer.

Alternatively, the film-forming polymer can be in a wear layer composition, with the temperature-releasable coating system further comprising a temperature-release layer.

[00119] In an embodiment, the FFP comprises at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate. More specifically, the FFP comprises at least one member selected from the group consisting of polyurethane made from polyester diol, styrene/acrylic copolymer, polyurethane/acrylic hybrid polymer, polysiloxane made from multi-functional alkoxy silane.

[00120] The wear layer can have an average thickness of from 0.2 mil to 3 mils, or from 0.2 to 2.5 mils.

[00121] The wear layer can exhibit an average König hardness value of at least 60 seconds, or at least 70 seconds, or an average König hardness value of from 100 to 200 seconds.

[00122] The wear layer can be a durable layer formed from a coating composition as disclosed in USPN 5,977,228, to Mauer, which is hereby incorporated, in its entirety, by reference thereto.

[00123] The wear layer can be a durable layer formed from the "Second Polymer Composition" in accordance with PCT/US2012/039649 (International Publication No WO 2012/162641, published 29 Nov 2012) entitled "Surface Coating System and Method of Making and Using Same," to Sarkis, which is hereby incorporated, in its entirety, by reference thereto.

[00124] In an embodiment, the film-forming polymer is not a pressure-sensitive adhesive.

[00125] A substrate having the temperature-releasable coating thereon can be prepared using a process of applying a coating composition and thereafter solidifying the coating composition on the substrate by evaporation and/or reaction of volatile and/or flowable components in the coating composition. Monolayer or multilayer coating systems can be applied, using one or more coating compositions, which coating compositions may be the same or different.

[00126] The floor coating system comprises a coating system containing both a temperature-release polymer and a film-forming polymer.

[00127] In an embodiment, the coating system may comprise a single composition which contains both the temperature-release polymer and the film-forming polymer.

The temperature-release polymer and the film-forming polymer can be together in the same solution, emulsion, or dispersion, as reactants which react to form a solid, or can be present as a blend of solids free of water and free of organic solvent (e.g., epoxy and/or polysiloxanes may be applied without a volatile carrier and reacted to cure).

[00128] More particularly, the composition can be a solution in an organic solvent, or an aqueous emulsion free of organic solvent, or an aqueous emulsion containing organic solvent, or a blend of solids containing neither water nor organic solvent. The presence of an organic solvent lowers the minimum film forming temperature of the film-forming polymer.

[00129] Optionally, organic solvent may be present in a coating composition in an amount of from 0.1% to 50% based on composition weight. A coating composition comprising organic solvent could also contain water (e.g., from 0.1 to 50 wt % organic solvent and from 50 to 99.9% water). The coating composition could have a solids content of (A) up to 50 wt %, based on total polymer weight, or from 0.1-25 wt %, or from 0.5-15 wt %, or from 0.7 to 10 wt % or from 1-5 wt %, with the remainder being organic solvent and or another volatile carrier.

[00130] In a coating system comprising an emulsion, the temperature-release polymer can be in a first discontinuous phase with the film-forming polymer being in a second discontinuous phase, or the TRP and the film-forming polymer can be in the same discontinuous phase.

[00131] In another embodiment, the single composition described above forms a portion of the coating system, with the coating system further comprising a second composition which is a base layer composition.

[00132] In another embodiment, the single composition described above forms a portion of the coating system, with the coating system further comprising a primer composition.

[00133] In another embodiment, the single composition described above form a portion of the coating system, with the coating system further comprising a second composition which is a primer composition and a third composition which is a base layer composition.

[00134] In an alternative embodiment, the coating system comprises (i) a first composition which is a temperature-release composition comprising the temperature-release polymer and (ii) a second composition which is a wear layer composition comprising the film-forming polymer. The first composition can be applied to the substrate to form the temperature-release layer. The second composition can be applied over the temperature-release layer to form a wear layer. In an embodiment, the temperature release layer is applied directly to the substrate.

[00135] In another embodiment, a base layer composition is applied directly to the substrate and thereafter the temperature-release layer composition is applied over the base layer, following which the wear layer composition applied over the temperature-release layer.

[00136] In another embodiment, a primer layer composition is adhered directly to the substrate and the temperature-release layer composition is then applied over the primer layer, following which the wear layer composition is adhered over the temperature-release layer.

[00137] In another embodiment, a primer layer composition is adhered directly to the substrate, and thereafter a base layer composition is applied over the primer layer, and thereafter a temperature-release layer is applied over the base layer, and thereafter the wear layer composition is applied over the temperature-release layer.

[00138] In the various embodiments of primer layer composition, base layer composition, temperature-release layer composition, and wear layer composition, each of the compositions can be present as a solution, as an emulsion, as a dispersion, reactants which react to form a solid, or as a solid free of water and free of organic solvent.

[00139] In the various floor coating systems described above, the temperature-release polymer can be as described above, i.e., can be a heat-release heat-release polymer or a cool-release polymer.

[00140] In the various floor coating systems described above, in which the TRP is a heat-release polymer or a cool-release polymer, the temperature-release polymer can be in a temperature-release layer coating composition further comprising volatile carrier. The volatile carrier can be water and/or organic solvent.

[00141] In the various floor coating systems described above, the TRP can be present in a wear-layer composition further comprising volatile carrier. The volatile carrier can be water and/or organic solvent.

[00142] The volatile carrier for the temperature-release layer coating composition can be the same as, or different from the volatile carrier for the wear layer coating composition.

[00143] The coating system can comprise a first coating composition and a second coating composition, with the first coating composition comprising the TRP for temperature-release in a first aqueous emulsion, with the second coating composition comprising the TRP in a second aqueous emulsion.

[00144] In a floor coating system utilizing a coating composition containing both a temperature-release polymer to provide heat-release or cool-release and a FFP for durability, i.e., a layer which provides both temperature-releasability and wear properties, the coating composition may further comprise a volatile carrier. The volatile carrier may be water and/or organic solvent.

[00145] In the temperature-release coating, the TRP can be present in an amount of up to 25 wt %, based on total polymer weight, or from 0.1 to 25 wt %, or from 0.5 to 15 wt %, or from 0.7 to 10 wt %, or from 1 to 5 wt %.

[00146] In an embodiment, one or more of the coating compositions used in a coating system, up to and including all of the coating compositions in a coating system, comprise an active component (e.g., reactive component such as a crosslinking agent, catalyst, etc) dispersed throughout a continuous liquid phase and/or dispersed throughout the film-forming polymer.

[00147] In an alternative embodiment, one or more of the coating compositions used in a coating system, up to and including all of the coating compositions in a coating system, are free of an active component.

[00148] In an embodiment, all of the layers of the coating system taken together have an average combined thickness (i.e., average thickness of the total coating system) of from 3 to 10 mils, or from 3.1 to 9 mils, or from 3.2 to 8 mils, or from 3.4 to 7 mils, or from 3.5 to 6 mils.

[00149] In an embodiment, the coating system dries to form a coating system having a high gloss appearance, i.e., a 60° gloss of at least 60%, measured in

accordance with ASTM D 1792. In another embodiment, the dried coating system can have a satin gloss appearance, i.e., a 60° gloss of from 40% to 60%, measured in accordance with ASTM D 1792. In another embodiment, the dried coating system can have a matte appearance, i.e., a 60° gloss of less than 40%, measured in accordance with ASTM D 1792.

[00150] In an embodiment, the coating system dries to form a “clear” coating, without having a blotchy or hazy appearance. In an embodiment, the dried coating system exhibits a percent transparency of at least 10%, or at least 20%, or at least 30%, measured in accordance with ASTM D 1746-97, and a percent haze of less than 20%, or less than 15%, or less than 10%, or less than 7%, or less than 5%, measured in accordance with ASTM D 1003-00.

[00151] The completed floor coating may be clear, with clarity being measured by distinctness of image (DOI) or light transmission. The coating can be free of dyes, pigments, and color bodies in order to provide a desired level of clarity, and allow visibility of the decorative substrate being protected. In some cases, the coating may be opaque. In some cases, the coating is clear with a Gardner color no greater than 1. In some embodiments, the color is water-white.

[00152] In an embodiment, the coating compositions and process can be used to produce a floor coating exhibiting a coefficient of friction of ≥ 0.5 . The coefficient of friction is measured in accordance with ASTM D2047-11 “Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.” In an embodiment, the durable wear layer provides a scratch-resistant and abrasion-resistant coating. Scratch-resistance and abrasion-resistance can be provided by an acrylic durable layer. In an embodiment, the scratch and abrasion-resistant durable wear layer can be provided using Diversey Vectra[®] dry-bright floor finish or Diversey Signature[®] ultra-high speed floor finish.

[00153] The TR polymer and the film forming polymer can be combined into a single coating composition and applied directly to the flooring substrate as a single layer or as a plurality of layers of the same composition.

[00154] Alternatively, any one or more of the primer layer, base layer, temperature-release layer, and wear layer can be: (i) a one-component composition that does not require mixing with another component before application to the upper surface of the

flooring substrate or to the upper surface of a layer previously applied to the flooring substrate, or (ii) a two-or-more-component composition in which the components are mixed with one another to form the coating composition which is thereafter applied to the upper surface of the flooring substrate or to the upper surface of one or more earlier-applied layers present on the flooring substrate. If a two-or-more-component composition is used, it should be designed to provide a pot life of at least 3 hours.

[00155] If a plurality of layers of different composition is applied on top of one another, or if a plurality of layers of identical composition is applied on top of one another, each coating composition application can be allowed to dry before the next application is made.

[00156] Any portion of the coating system, including the entirety of the coating system, can be applied as a single layer or as a plurality of identical layers to build up a thick coating system.

[00157] The coating compositions can be wiped on or applied as a curtain. The compositions can be applied using any one or more of a variety of devices including mop, sprayer, roller, brush, and specialty apparatus.

[00158] In an embodiment, the process is carried out on a floor so that the floor is serviceable to foot traffic within 6 to 8 hours of the start of the process. In another embodiment, the process is carried out on a floor so that the floor is serviceable to foot traffic within 6 to 8 hours of the application of the final coating composition which upon curing is to provide an upper surface for trafficking.

[00159] In an embodiment, the time for a full cure can vary from a few hours to a week, a month, or even longer. In an embodiment, the formulation and selection of the coating compositions and application processes are designed so that the floor is serviceable to foot traffic within 6 to 8 hours of the start of the process, or within 6 to 8 hours of the application of the final coating composition which upon curing is to provide an upper surface for trafficking. In an embodiment, the cured coating is serviceable in its intended environment.

[00160] Upon triggering Released floor coating comes off dry, not sticky or tacky. This is critical for reduction to practice in both handling and disposal as waste.

[00161] The temperature releasable floor coating can be rejuvenated by cleaning, buffing, or burnishing. The floor coating may also be rejuvenated by the addition of one or more topcoats or the addition of one or more cycles of a primer followed by the addition of a topcoat.

WHAT IS CLAIMED IS:

Claim 1: A coated floor comprising:

- (A) a flooring substrate;
- (B) a heat-releasable multilayer coating system on the flooring substrate, the heat-releasable multilayer coating comprising:
 - (i) a heat-releasable layer comprising a heat-release non-SCC polymer exhibiting an onset of melting temperature, T_o , of at least 27°C; and
 - (ii) a wear layer comprising a film-forming polymer comprising at least one non-SCC member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate; andwherein the heat-releasable layer is between the flooring substrate and the wear layer.

Claim 2: The coated floor according to any of claim 1, wherein the heat-release polymer has a heat of fusion of at least 20 Joules/gram.

Claim 3: The coated floor according to any of claims 1-2, wherein the heat-release polymer exhibits an onset of melting temperature, T_o , of from 27°C to 100°C.

Claim 4: The coated floor according to any of claims 1-3, wherein the heat-release polymer exhibits a peak melting temperature, T_p , of from 30°C to 110°C.

Claim 5: The coated floor according to any of claims 1-4, wherein the heat-release polymer has a heat of fusion, as measured by a differential scanning calorimeter, of at least 20 Joules/gram and the heat-release polymer has an onset of melting temperature T_o of at least 27°C and a peak melting temperature T_p such that $T_p - T_o$ is less than $T_p^{0.7}$.

Claim 6: The coated floor according to any of claims 1-5, wherein the heat-release polymer has a heat of fusion, as measured by a differential scanning calorimeter, of at least 20 Joules/gram and the heat-release polymer has an onset of melting temperature T_o of at least 27°C and a peak melting temperature T_p such that $T_p - T_o$ is less than 25°C.

Claim 7: The coated floor according to any of claims 1-6, wherein the heat-release polymer comprises at least one member selected from the group consisting of acrylic polymer, vinyl polymer, polyester, polyimide, polyolefin, polystyrene, polyether, polyalkylene oxide, polyphosphazene, poly amino acid, polyisocyanate, polyurethane, polysilane, and polysiloxane.

Claim 8: The coated floor according to any of claims 1-7, further comprising a non-SCC base layer between the flooring substrate and the heat-releasable layer.

Claim 9: The coated floor according to claim 8, wherein the base layer comprises at least one member selected from the group consisting of acrylic polymer, polyurethane, polyurea, epoxy polymer, polysiloxane, vinyl polymer, and styrene-butadiene polymer.

Claim 10: The coated floor according to any of claims 1-9, wherein the heat-releasable multilayer coating comprises a plurality of heat-releasable layers and a plurality of wear layers, with one of the heat-releasable layers being between each of the wear layers.

Claim 11: The coated floor according to any of claims 1-10, wherein the heat-releasable layer comprises the heat-release polymer in an amount of at least 10 weight percent, based on layer weight.

Claim 12: A multilayer floor coating system, comprising:

- (A) a heat-release layer composition comprising a heat-release non-SCC polymer exhibiting an onset of melting temperature, T_o , of at least 27°C; and
- (B) a wear layer composition comprising a film-forming non-SCC polymer, wherein the film-forming polymer comprises at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate.

Claim 13: The multilayer floor coating system according to claim 12, wherein heat release polymer has a heat of fusion of at least 20 Joules/gram.

Claim 14: The multilayer floor coating system according to any of claims 12-13, wherein the heat-release polymer exhibits an onset of melting temperature, T_o , of from 27°C to 100°C.

Claim 15: The multilayer floor coating system according to any of claims 12-14, wherein the heat-release polymer exhibits a peak melting temperature, T_p , of from 30°C to 110°C.

Claim 16: The multilayer floor coating system according to any of claims 12-15, wherein the heat-release polymer has a heat of fusion, as measured by a differential scanning calorimeter, of at least 20 Joules/gram and the heat-release polymer has an onset of melting temperature T_o of at least 27°C and a peak melting temperature T_p such that $T_p - T_o$ is less than $T_p^{0.7}$.

Claim 17: The multilayer floor coating system according to any of claims 12-16, wherein the heat-release polymer has a heat of fusion, as measured by a differential scanning calorimeter, of at least 20 Joules/gram and the heat-release polymer has an onset of melting temperature T_o of at least 27°C and a peak melting temperature T_p such that $T_p - T_o$ is less than 25°C.

Claim 18: The multilayer floor coating system according to any of claims 12-17, wherein the heat-release polymer comprises at least one member selected from the group consisting of acrylic polymer, vinyl polymer, polyester, polyimide, polyolefin, polystyrene, polyether, polyalkylene oxide, polyalkyl phosphazene, poly amino acid, polyisocyanate, polyurethane, polysilane, and polysiloxane.

Claim 19: The floor coating system according to any of claims 12-18, wherein the film-forming polymer is not a pressure-sensitive adhesive.

Claim 20: The multilayer floor coating system according to any of claims 12-19, wherein the heat-release layer composition further comprises a first volatile carrier, and the wear layer composition further comprises a second volatile carrier.

Claim 21: The multilayer floor coating system according to claim 20, wherein the first volatile carrier comprises at least one member selected from the group consisting of water and organic solvent, and the second volatile carrier comprises at least one member selected from the group consisting of water and organic solvent.

Claim 22: The multilayer floor coating system according to any of claims 20-21, wherein the heat-release layer composition comprises the heat-release polymer in an amount of at least 10 weight percent, based on composition weight.

Claim 23: The multilayer floor coating system according to any of claims 20-22, wherein: (i) the heat-release polymer is present as a first discontinuous phase in a first emulsion comprising the first volatile carrier, and (ii) the polymeric film forming agent is present as a second discontinuous phase in a second emulsion comprising the second volatile carrier.

Claim 24: The floor coating system according to claim 23, wherein the first emulsion is an aqueous emulsion and the second emulsion is an aqueous emulsion.

Claim 25: The multilayer floor coating system according to any of claims 12-24, further comprising a non-SCC base layer composition comprising (i) at least one member selected from the group consisting of acrylic polymer, polyurethane, polyurea, epoxy polymer, polysiloxane, vinyl polymer, and styrene-butadiene polymer, and (ii) a third volatile carrier.

Claim 26: A process for applying and removing a floor coating, comprising:

- (A) applying a heat-release coating composition to a flooring substrate, the heat-release coating composition comprising a heat-release non-SCC polymer having onset of melting temperature, T_m , of at least 27°C;
- (B) drying the heat-release coating composition to form a heat-releasable layer over the flooring substrate;
- (C) applying a wear layer coating composition over the heat-releasable layer, the wear layer coating composition comprising a film-forming non-SCC polymer comprising at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate;
- (D) drying the wear layer coating composition to form a wear layer over the heat-releasable layer to produce a heat-releasable multilayer floor coating over the flooring substrate;
- (E) trafficking the floor in a manner causing the floor to undergo a degradation of appearance;
- (F) heating the heat-releasable multilayer floor coating until the heat-releasable layer reaches a temperature of at least 27°C; and
- (G) agitating the wear layer while the heat-releasable layer is at a temperature of at least 27°C, to disintegrate the wear layer and separate the wear layer from the flooring substrate.

Claim 27: The process for applying and removing a floor coating according to claim 26, wherein the heat-releasable layer is heated to a temperature of at least

50°C and the wear layer is agitated while the heat-releasable layer is at the temperature of at least 50°C.

Claim 28: The process for applying and removing a floor coating according to claim 26, wherein the heat-releasable layer is heated to a temperature of at least 70°C and the wear layer is agitated while the heat-releasable layer is at the temperature of at least 70°C.

Claim 29: The process for applying and removing a floor coating according to claim 26, wherein the heat-releasable layer is heated to a temperature of at least 80°C and the wear layer is agitated while the heat-releasable layer is at the temperature of at least 80°C.

Claim 30: The process for applying and removing a floor coating according to claim 26, wherein the heat-releasable layer is heated to a temperature of at least 90°C and the wear layer is agitated while the heat-releasable layer is at the temperature of at least 90°C.

Claim 31: The process for applying and removing a floor coating according to claim 26, wherein the heat-releasable layer is heated to a temperature of at least 95°C and the wear layer is agitated while the heat-releasable layer is at the temperature of at least 95°C.

Claim 32: The process for applying and removing a floor coating according to any of claims 26-31, wherein the agitation of the wear layer is carried out by at least one member selected from the group consisting of abrasion, impact, scraping, vacuum, blowing, flexing, prying, cutting, and shearing.

Claim 33: The process for applying and removing a floor coating according to any of claims 26-32, wherein the agitation of the wear layer is carried out by subjecting the wear layer to abrasion with a grit of from 50 to 3000.

Claim 34: The process for applying and removing a floor coating according to any of claims 26-33, wherein the heating is carried out by exposing the heat-releasable multilayer floor coating to steam.

Claim 35: A coated floor, comprising:

- (A) a flooring substrate;
- (B) a heat-releasable wear layer over the flooring substrate, the heat-releasable wear layer comprising:
 - (i) a heat-release non-SCC polymer having an onset of melting temperature, T_o , of at least 27°C; and
 - (ii) a film-forming non-SCC polymer comprising at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate.

Claim 36: The coated floor according to any of claims 35, wherein the heat-release polymer has a heat of fusion of at least 20 Joules/gram.

Claim 37: The coated floor according to any of claims 35-36, wherein the heat-release polymer exhibits an onset of melting temperature, T_o , of from 27°C to 100°C.

Claim 38: The coated floor according to any of claims 35-37, wherein the heat-release polymer exhibits a peak melting temperature, T_p , of from 30°C to 110°C.

Claim 39: The coated floor according to any of claims 35-38, wherein the heat-release polymer has a heat of fusion, as measured by a differential scanning calorimeter, of at least 20 Joules/gram and the heat-release polymer has an onset of melting temperature T_o of at least 27°C and a peak melting temperature T_p such that $T_p - T_o$ is less than $T_p^{0.7}$.

Claim 40: The coated floor according to any of claims 35-39, wherein the heat-release polymer has a heat of fusion, as measured by a differential scanning calorimeter, of at least 20 Joules/gram and the heat-release polymer has an onset of melting temperature T_o of at least 27°C and a peak melting temperature T_p such that $T_p - T_o$ is less than 25°C.

Claim 41: The coated floor according to any of claims 35-41, wherein the heat-release polymer comprises at least one member selected from the group consisting of acrylic polymer, vinyl polymer, polyester, polyimide, polyolefin, polystyrene, polyether, polyalkylene oxide, polyalkyl phosphazene, poly amino acid, polyisocyanate, polyurethane, polysilane, and polysiloxane.

Claim 42: The coated floor according to any of claims 35-41, further comprising a non-SCC base layer between the flooring substrate and the heat-releasable wear layer.

Claim 43: The coated floor according to claim 42, wherein the base layer comprises at least one member selected from the group consisting of acrylic polymer, polyurethane, polyurea, epoxy polymer, polysiloxane, vinyl polymer, and styrene-butadiene polymer.

Claim 44: The coated floor according to any of claims 35-43, wherein the heat-releasable wear layer comprises the heat-release polymer in an amount of at least 10 weight percent, based on layer weight.

Claim 45: The coated floor according to any of claims 35-44, wherein the heat-release polymer is present as a plurality of blocks of a block copolymer, and the film-forming polymer is also present as a plurality of blocks of the block copolymer.

Claim 46: A floor coating system comprising a heat-release wear layer composition comprising:

- (A) a heat-release non-SCC polymer having an onset of melting temperature, T_o , of at least 27°C; and
- (B) a film-forming non-SCC polymer comprising at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate.

Claim 47: The floor coating system according to claim 46, wherein the heat-release wear layer composition further comprises a volatile carrier comprising at least one member selected from the group consisting of water and organic solvent.

Claim 48: The floor coating system according to any of claims 46-47, wherein the heat-release wear layer composition is an emulsion with the volatile carrier present as a continuous phase.

Claim 49: The floor coating system according to any of claims 46-48, wherein the heat-release polymer is present in a first discontinuous phase and the film-forming polymer is present in a second discontinuous phase.

Claim 50: The floor coating system according to any of claims 46-49, wherein the heat-release polymer and the film-forming polymer are present in a single discontinuous phase.

Claim 51: The floor coating system according to any of claims 46-50, wherein the heat-release wear layer composition is a first composition and the floor coating system further comprises a non-SCC base layer composition comprising at least one member selected from the group consisting of acrylic polymer, polyurethane, polyurea, epoxy polymer, polysiloxane, vinyl polymer, and styrene-butadiene polymer.

Claim 52: The floor coating system according to any of claims 46-51, wherein the heat-release wear layer composition contains a first volatile carrier comprising at least one member selected from the group consisting of water and organic solvent, and a second volatile carrier comprising at least one member selected from the group consisting of water and organic solvent.

Claim 53: The floor coating system according to any of claims 46-52, wherein the heat-release polymer has a heat of fusion of at least 20 Joules/gram.

Claim 54: The floor coating system according to any of claims 46-53, wherein the heat-release polymer exhibits an onset of melting temperature, T_o , of from 27°C to 100°C.

Claim 55: The floor coating system according to any of claims 46-54, wherein the heat-release polymer has a heat of fusion, as measured by a differential scanning calorimeter, of at least 20 Joules/gram and the heat-release polymer has an onset of melting temperature T_o of at least 27°C and a peak melting temperature T_p such that $T_p - T_o$ is less than $T_p^{0.7}$.

Claim 56: The floor coating system according to any of claims 46-55, wherein the heat-release polymer has a heat of fusion, as measured by a differential scanning calorimeter, of at least 20 Joules/gram and the heat-release polymer has an onset of melting temperature T_o of at least 27°C and a peak melting temperature T_p such that $T_p - T_o$ is less than 25°C.

Claim 57: The floor coating system according to any of claims 46-56, wherein the heat-release polymer exhibits a peak melting temperature, T_p , of from 30°C to 110°C.

Claim 58: The floor coating system according to any of claims 46-57, wherein the heat-release polymer comprises at least one member selected from the group consisting of acrylic polymer, vinyl polymer, polyester, polyimide, polyolefin,

polystyrene, polyether, polyalkylene oxide, polyalkyl phosphazene, poly amino acid, polyisocyanate, polyurethane, polysilane, and polysiloxane.

Claim 59: The floor coating system according to any of claims 46-58, wherein the heat-release wear layer composition comprises the heat-release polymer in an amount of at least 10 weight percent, based on a total weight of solids in the composition.

Claim 60: The floor coating system according to any of claims 46-59, wherein the film-forming polymer is not a pressure-sensitive adhesive.

Claim 61: A process for applying and removing a floor coating, comprising:

(A) applying a heat-release wear layer coating composition to a flooring substrate, the coating composition containing:

(i) a heat-release non-SCC polymer having an onset of melting temperature, T_o , of at least 27°C; and

(ii) a film-forming non-SCC polymer comprising at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate;

(B) drying the heat-release wear layer composition to form a heat-releasable wear layer over the flooring substrate;

(C) trafficking the floor in a manner causing the floor to undergo a degradation of appearance;

(D) heating the heat-releasable wear layer to a temperature of at least 27°C; and

(E) agitating the heat-releasable wear layer while the heat-releasable wear layer is at a temperature of at least 27°C, to disintegrate the heat-releasable wear layer and separate it from the flooring substrate.

Claim 62: The process for applying and removing a floor coating according to claim 61, wherein the heat-releasable wear layer is heated to a temperature of at least 50°C and the heat-releasable wear layer is agitated while the heat-releasable wear layer is at the temperature of at least 50°C.

Claim 63: The process for applying and removing a floor coating according to claim 61, wherein the heat-releasable wear layer is heated to a temperature of at least 70°C and the heat-releasable wear layer is agitated while the heat-releasable wear layer is at the temperature of at least 70°C.

Claim 64: The process for applying and removing a floor coating according to claim 61, wherein the heat-releasable wear layer is heated to a temperature of at least 80°C and the heat-releasable wear layer is agitated while the heat-releasable wear layer is at the temperature of at least 80°C.

Claim 65: The process for applying and removing a floor coating according to claim 61, wherein the heat-releasable wear layer is heated to a temperature of at least 90°C and the heat-releasable wear layer is agitated while the heat-releasable wear layer is at the temperature of at least 90°C.

Claim 66: The process for applying and removing a floor coating according to claim 61 wherein the heat-releasable wear layer is heated to a temperature of at least 95°C and the heat-releasable wear layer multilayer coating is agitated while the heat-releasable wear layer is at the temperature of at least 95°C.

Claim 67: The process for applying and removing a floor coating according to any of claims 61-66, wherein the agitation of the heat-releasable wear layer is carried out by at least one member selected from the group consisting of abrasion, impact, scraping, vacuum, blowing, flexing, prying, cutting, and shearing.

Claim 68: The process for applying and removing a floor coating according to claim 67, wherein the agitation of the heat-releasable wear layer comprises subjecting the heat-releasable wear layer to abrasion with a grit of from 50 to 3000.

Claim 69: A coated floor comprising a flooring substrate and a cool-releasable coating thereon, wherein the cool-releasable coating comprises:

- (A) a cool-release non-SCC polymer having freezing temperature T_f of less than 15°C and a peak melt temperature T_p of greater than 25°C; and
- (B) a film-forming non-SCC polymer comprising at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate.

Claim 70: The coated floor according to claim 69, wherein the freezing temperature T_f of the cool-release polymer is less than 13°C.

Claim 71: The coated floor according to claim 69, wherein the freezing temperature T_f of the cool-release polymer is less than 10°C.

Claim 72: The coated floor according to claim 69, wherein the freezing temperature T_f of the cool-release polymer is less than 7°C.

Claim 73: The coated floor according to any of claims 69-72, wherein the peak melt temperature T_p of the cool-release polymer is at least 30°C.

Claim 74: The coated floor according to any of claims 69-73, wherein the peak melt temperature T_p of the cool-release polymer is at least 33°C.

Claim 75: The coated floor according to any of claims 69-74, wherein the peak melt temperature T_p of the cool-release polymer is at least 36°C.

Claim 76: The coated floor according to any of claims 69-75, wherein the peak melt temperature T_p of the cool-release polymer is at least 39°C.

Claim 77: The coated floor according to any of claims 69-76, wherein the cool-release polymer contains repeating units derived from at least one member selected from the group consisting of acrylic acid, hydroxyethylacrylate, acrylamide, methacrylamide, methacrylic acid, linear or branched alkyl acrylates and methacrylates, styrene, substituted styrene, and polyoxyalkylene.

Claim 78: The coated floor according to claim 77, wherein the repeating units comprise units derived from at least one n-alkyl acrylate or methacrylate in which the alkyl group contains from 14 to 22 carbon atoms.

Claim 79: The coated floor according to any of claims 77-78, wherein the cool-release polymer contains from 1 wt % to 10 wt % of units derived from acrylic acid.

Claim 80: The coated floor according to any of claims 77-79, wherein the cool-release polymer comprises units derived from at least one polar monomer selected from polyoxyalkylene, acrylate, acrylamide, and methacrylamide.

Claim 81: The coated floor according to any of claims 77-80, wherein the cool-release polymer contains units derived from at least two different monomers.

Claim 82: The coated floor according to any of claims 69-81, wherein the cool-release polymer has a heat of fusion of at least 20 Joules/gram.

Claim 83: The coated floor according to any of claims 69-82, wherein the coating comprises a cool-releasable wear layer comprising both the cool-release polymer and the film-forming polymer.

Claim 84: The coated floor according to claim 83, further comprising a non-SCC base layer between the flooring substrate and the cool-releasable wear layer.

Claim 85: The coated floor according to claim 84, wherein the base layer comprises at least one member selected from the group consisting of acrylic polymer, polyurethane, polyurea, epoxy polymer, polysiloxane, vinyl polymer, and styrene-butadiene polymer.

Claim 86: The coated floor according to any of claims 69-85, wherein the cool-release polymer is present in a cool-releasable layer, and the film-forming polymer is present in a wear layer, and the cool-releasable layer is between the flooring substrate and the wear layer.

Claim 87: The coated floor according to claim 86, wherein the cool-releasable layer comprises the cool-release polymer in an amount of at least 10 weight percent, based on layer weight.

Claim 88: The coated floor according to any of claims 86-87, wherein the cool-releasable layer has a thickness of at least 0.001 inch.

Claim 89: The coated floor according to any of claims 86-88, further comprising a non-SCC base layer between the flooring substrate and the cool-releasable layer.

Claim 90: The coated floor according to claim 111, wherein the base layer comprises at least one member selected from the group consisting of acrylic polymer, polyurethane, polyurea, epoxy polymer, polysiloxane, vinyl polymer, and styrene-butadiene polymer.

Claim 91: The coated floor according to any of claims 86-90, wherein the cool-releasable coating comprises a plurality of cool-releasable layers and a plurality of wear layers, with one of the cool-releasable layers being between each of the wear layers.

Claim 92: The coated floor according to any of claims 69-91, wherein the flooring substrate comprises vinyl composition tile, stone, concrete, plastic, linoleum, vinyl, vinyl composition tile, vinyl asbestos tile, marble, granite, terrazzo, travertine, slate, ceramic, glass, wood, metal, and rubber.

Claim 93: A floor coating system including a cool-release coating composition comprising:

- (A) a cool-release non-SCC polymer having a freezing temperature T_f of less than 15°C and a peak melt temperature T_p of greater than 25°C; and
- (B) a film-forming non-SCC polymer, wherein the film-forming polymer comprises at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate.

Claim 94: The floor coating system according to claim 93, wherein the freezing temperature T_f of the cool-release polymer is less than 13°C.

Claim 95: The floor coating system according to claim 93, wherein the freezing temperature T_f of the cool-release polymer is less than 10°C.

Claim 96: The floor coating system according to claim 93, wherein the freezing temperature T_f of the cool-release polymer is less than 7°C.

Claim 97: The floor coating system according to any of claims 93-96, wherein the peak melt temperature T_p of the cool-release polymer is at least 30°C.

Claim 98: The floor coating system according to any of claims 93-96, wherein the peak melt temperature T_p of the cool-release polymer is at least 33°C.

Claim 99: The floor coating system according to any of claims 93-96, wherein the peak melt temperature T_p of the cool-release polymer is at least 36°C.

Claim 100: The floor coating system according to any of claims 93-96, wherein the peak melt temperature T_p of the cool-release polymer is at least 39°C.

Claim 101: The floor coating system according to any of claims 93-100, wherein the cool-release polymer comprises repeating units derived from at least one member selected from the group consisting of acrylic acid, hydroxyethylacrylate, acrylamide, methacrylamide, methacrylic acid, linear or branched alkyl acrylates and methacrylates in which the alkyl group is not crystallizable, styrene, substituted styrene, and polyoxyalkylene.

Claim 102: The floor coating system according to any of claims 93-101, wherein the cool-release polymer comprises at least one member selected from the group consisting of acrylic polymer, vinyl polymer, polyester, polyimide, polyolefin, polystyrene, polyether, polyalkylene oxide, polyalkyl phosphazene, poly amino acid, polyisocyanate, polyurethane, polysilane, and polysiloxane.

Claim 103: The floor coating system according to claim 102, wherein the cool-release polymer comprises repeating units derived from at least two different monomers.

Claim 104: The floor coating system according to any of claims 93-103, wherein the cool-release polymer comprises repeating units derived from at least one n-alkyl acrylate or methacrylate in which the alkyl group contains from 14 to 22 carbon atoms.

Claim 105: The floor coating system according to any of claims 93-104, wherein the cool-release polymer contains from 1 wt % to 10 wt % of units derived from acrylic acid.

Claim 106: The floor coating system according to any of claims 93-105, wherein the cool-release polymer comprises units derived from at least one polar monomer selected from polyoxyalkylene, acrylate, acrylamide, and methacrylamide.

Claim 107: The floor coating system according to any of claims 116-131, wherein the cool-release polymer has a heat of fusion of at least 20 Joules/gram.

Claim 108: The floor coating system according to any of claims 93-107, wherein the cool-release polymer is present in a cool-release layer composition and the film-forming polymer is present in a wear layer composition.

Claim 109: The floor coating system according to claim 108, wherein the cool-release layer composition further comprises a first volatile carrier comprising at least one member selected from the group consisting of water and organic solvent, and the wear layer composition further comprises a second volatile carrier comprising at least one member selected from the group consisting of water and organic solvent.

Claim 110: The floor coating system according to any of claims 108-109, wherein: (i) the cool-release polymer is present as a first discontinuous phase in a first emulsion comprising a first volatile carrier, and (ii) the polymeric film forming agent is present as a second discontinuous phase in a second emulsion comprising a second volatile carrier.

Claim 111: The floor coating system according to claim 110, wherein the first emulsion is an aqueous emulsion and the second emulsion is an aqueous emulsion.

Claim 112: The floor coating system according to any of claims 108-111, wherein the cool-release layer composition comprises the cool-release polymer in an amount of at least 10 weight percent, based on layer weight.

Claim 113: The floor coating system according to any of claims 108-112, further comprising a non-SCC base layer composition.

Claim 114: The floor coating system according to claim 113, wherein the base layer composition comprises at least one member selected from the group consisting of acrylic polymer, polyurethane, polyurea, epoxy polymer, polysiloxane, vinyl polymer, and styrene-butadiene polymer and a third volatile carrier.

Claim 115: The floor coating system according to any of claims 93-107, wherein the coating comprises a cool-release wear layer composition comprising both the side-chain crystallizable polymer and the film-forming polymer.

Claim 116: The floor coating system according to claim 115, further comprising a non-SCC base layer composition.

Claim 117: The floor coating system according to claim 116, wherein the base layer composition comprises at least one member selected from the group consisting of acrylic polymer, polyurethane, polyurea, epoxy polymer, polysiloxane, vinyl polymer, and styrene-butadiene polymer.

Claim 118: The floor coating system according to any of claims 93-117, wherein the film-forming polymer is not a pressure-sensitive adhesive.

Claim 119: A process for applying and removing a floor coating, comprising:

- (A) applying a cool-release coating composition to a flooring substrate, the cool-release coating composition comprising a cool-release non-SCC polymer having a freezing temperature T_f of less than 15°C and a peak melt temperature T_p of greater than 25°C; and;

- (B) drying the cool-release non-SCC coating composition to form a cool-releasable layer over the flooring substrate;
- (C) applying a wear layer coating composition over the cool-releasable layer, the wear layer coating composition comprising a film-forming non-SCC polymer comprising at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate;
- (D) drying the wear layer coating composition to form a wear layer over the cool-releasable layer and provide a cool-releasable multilayer floor coating over the flooring substrate;
- (E) trafficking the floor in a manner causing the floor to undergo a degradation of appearance;
- (F) cooling the cool-releasable multilayer floor coating to a temperature of less than 15°C; and
- (G) agitating the cool-releasable multilayer floor coating while the cool-releasable multilayer floor coating is at a temperature of less than 15°C, to disintegrate the wear layer and separate the wear layer from the flooring substrate.

Claim 120: The process for applying and removing a floor coating according to claim 119, wherein the freezing temperature T_f is less than 13°C, and the cool-releasable layer is cooled to a temperature of less than 13°C and the cool-releasable multilayer floor coating is agitated while the cool-releasable layer is at the temperature of less than 13°C.

Claim 121: The process for applying and removing a floor coating according to claim 119, wherein the freezing temperature T_f is less than 10°C, and the cool-releasable layer is cooled to a temperature of less than 10°C and the cool-releasable multilayer floor coating is agitated while the cool-releasable layer is at the temperature of less than 10°C.

Claim 122: The process for applying and removing a floor coating according to claim 119, wherein the freezing temperature T_f is less than 7°C, and the cool-releasable layer is cooled to a temperature of less than 7°C and the cool-releasable multilayer floor coating is agitated while the cool-releasable layer is at the temperature of less than 7°C.

Claim 123: The process for applying and removing a floor coating according to any of claims 119-122, wherein the peak melt temperature T_p of the cool-release polymer is greater than 30°C.

Claim 124: The process for applying and removing a floor coating according to any of claims 119-122, wherein the peak melt temperature T_p of the cool-release polymer is greater than 33°C.

Claim 125: The process for applying and removing a floor coating according to any of claims 119-122, wherein the peak melt temperature T_p of the cool-release polymer is greater than 36°C.

Claim 126: The process for applying and removing a floor coating according to any of claims 119-125, wherein the agitation of the multilayer coating is carried out by at least one member selected from the group consisting of abrasion, impact, scraping, vacuum, blowing, flexing, prying, cutting, and shearing.

Claim 127: The process for applying and removing a floor coating according to any of claims 119-126, wherein the agitation of the multilayer coating is carried out by subjecting the wear layer to abrasion with a grit of from 50 to 3000.

Claim 128: A process for applying and removing a floor coating, comprising:

- (A) applying a cool-release wear layer composition to a flooring substrate, the cool-release wear layer composition comprising a cool-release non-SCC polymer having a freezing temperature T_f of less than 15°C and a peak melt temperature T_p of greater than 25°C, and a film-forming non-

SCC polymer comprising at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate;

- (B) drying the cool-release composition to form a cool-releasable wear layer over the flooring substrate;
- (C) trafficking the floor in a manner causing the floor to undergo a degradation of appearance;
- (D) cooling the cool-releasable wear layer to a temperature of less than 15°C; and
- (E) agitating the cool-releasable wear layer while the cool-releasable wear layer is at a temperature of less than 15°C, to disintegrate the cool-releasable wear layer and separate the cool-releasable wear layer from the flooring substrate.

Claim 129: The process for applying and removing a floor coating according to claim 128, wherein the freezing temperature T_f is less than 13°C, the cool-releasable wear layer is cooled to a temperature of less than 13°C, and the cool-releasable wear layer is agitated while the cool-releasable layer is at the temperature of less than 13°C.

Claim 130: The process for applying and removing a floor coating according to claim 128, wherein the freezing temperature T_f is less than 10°C, the cool-releasable wear layer is cooled to a temperature of less than 10°C, and the cool-releasable wear layer is agitated while the cool-releasable layer is at the temperature of less than 10°C.

Claim 131: The process for applying and removing a floor coating according to claim 128, wherein the freezing temperature T_f is less than 7°C, the cool-releasable wear layer is cooled to a temperature of less than 7°C, and the cool-releasable wear layer is agitated while the cool-releasable layer is at the temperature of less than 7°C.

Claim 132: The process for applying and removing a floor coating according to any of claims 128-131, wherein the peak melt temperature T_p of the cool-release polymer is greater than 30°C.

Claim 133: The process for applying and removing a floor coating according to any of claims 128-131, wherein the peak melt temperature T_p of the cool-release polymer is greater than 33°C.

Claim 134: The process for applying and removing a floor coating according to any of claims 128-131, wherein the peak melt temperature T_p of the cool-release polymer is greater than 36°C.

Claim 135: The process for applying and removing a floor coating according to any of claims 128-134, wherein the agitation of the multilayer coating is carried out by at least one member selected from the group consisting of abrasion, impact, scraping, vacuum, blowing, flexing, prying, cutting, and shearing.

Claim 136: The process for applying and removing a floor coating according to claim 135, wherein the agitation of the multilayer coating is carried out by subjecting the wear layer to abrasion with a grit of from 50 to 3000.

NOTE: the process can be carried out using the system according to claims 116-133 and 141-144 to make a coated floor in accordance with claims 87-107.

Claim 137: A coated floor comprising:

- (A) a flooring substrate, and
- (B) a cool-releasable coating over the flooring substrate, the coating comprising:
 - (i) a non-SCC polymeric adhesion composition which is substantially nontacky at or below about 7.2°C and which is tacky at 18°C, wherein the adhesive composition comprises a

cool-release polymer having a heat of fusion of at least 20 Joules/g and an onset of melt temperature T_o of from about 2°C to 18°C,

- (ii) a non-SCC film-forming polymer comprising at least one member selected from the group consisting of polyurethane, acrylic polymer, polysiloxane, polysilazane, polyester, polyamide, polyurea, epoxy polymer, vinyl polymer, polyether, polyaldehyde, polyketone, and polycarbonate.

Claim 138: The coated floor according to claim 137, wherein the polymeric adhesion composition is substantially nontacky at or below 10°C.

Claim 139: The coated floor according to claim 137, wherein the polymeric adhesion composition is substantially nontacky at or below 12.8°C.

Claim 140: The coated floor according to claim 137, wherein the polymeric adhesion composition is substantially nontacky at or below 15.6°C.

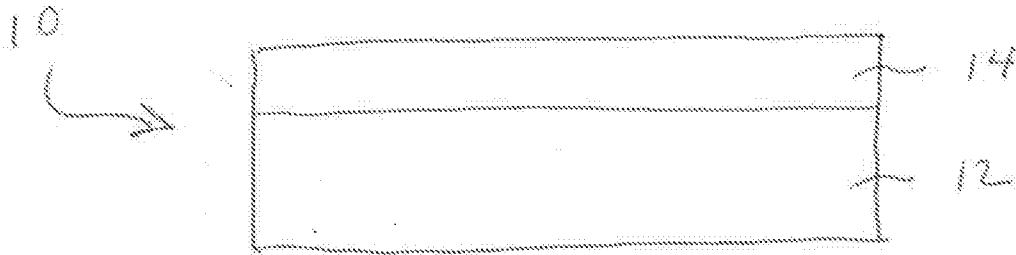


Fig 1

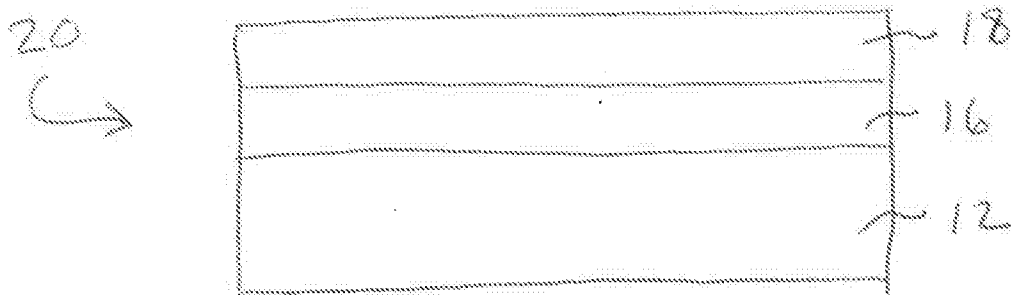


Fig 2

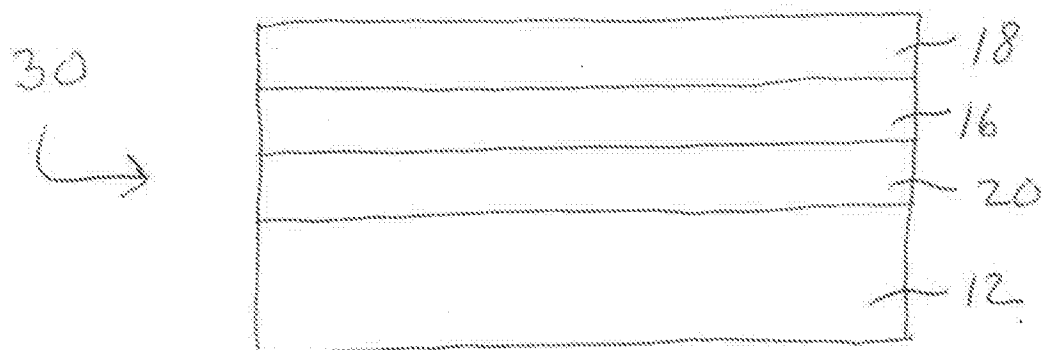


Fig 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/049001

A. CLASSIFICATION OF SUBJECT MATTER
INV. C09D133/04 C09D5/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C09D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal

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X	EP 2 891 555 A1 (ARMSTRONG WORLD IND INC [US]) 8 July 2015 (2015-07-08) claims and examples -----	1-140
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Further documents are listed in the continuation of Box C.



See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

9 December 2016

Date of mailing of the international search report

21/12/2016

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/049001

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