



(43) International Publication Date
8 June 2017 (08.06.2017)

(10) International Publication Number
WO 2017/096047 A1

(51) International Patent Classification:

C08L 23/10 (2006.01) *C09D 125/10* (2006.01)
C08L 53/02 (2006.01) *C09D 153/02* (2006.01)
D04H 1/72 (2006.01) *C09D 7/12* (2006.01)
A47L 13/16 (2006.01)

(21) International Application Number:

PCT/US2016/064426

(22) International Filing Date:

1 December 2016 (01.12.2016)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/261,652 1 December 2015 (01.12.2015) US
62/315,714 31 March 2016 (31.03.2016) US

(71) Applicant: **KIMBERLY-CLARK WORLDWIDE, INC.**
[US/US]; 2300 Winchester Road, Neenah, Wisconsin
54956 (US).

(72) Inventor: **MACDONALD, John Gavin**; 1472 Knollwood
Terrace, Decatur, Georgia 30033 (US).

(74) Agents: **KOHTALA, Luke D.** et al.; Kimberly-Clark
Worldwide, Inc., 2300 Winchester Road, Neenah, Wisconsin
54956 (US).

(81) Designated States (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,
SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM,
ZW.

(84) Designated States (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a
patent (Rule 4.17(ii))*

Published:

— *with international search report (Art. 21(3))*

(54) Title: ABSORBENT AND PROTECTIVE COMPOSITION INCLUDING AN ELASTOMERIC COPOLYMER AND SUPERABSORBENT

(57) Abstract: A composition for absorbing liquids such as water and oil can include a thermoplastic elastomeric copolymer, a superabsorbent material, and a solvent. The composition can be applied as a coating to a non-woven substrate. A method of removing water or oil from a surface employing the composition is also disclosed.



WO 2017/096047 A1

**ABSORBENT AND PROTECTIVE COMPOSITION INCLUDING
AN ELASTOMERIC COPOLYMER AND SUPERABSORBENT**

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Patent Application No. 62/261,652 filed
5 December 1, 2015 and U.S. Provisional Patent Application No. 62/315,714 filed March 31, 2016, the
contents of which are hereby incorporated by reference in their entirety for all purposes.

BACKGROUND OF THE DISCLOSURE

Various commercial as well as home-use activities include the desire for cleaning up liquids,
whether the liquids are in place on purpose or by accident. For example, in a commercial setting, it
10 may be desired to remove water and/or oils from surfaces that may accumulate during activities such
as cleaning, maintenance, over-application, or unintentional application of such liquids to the surface.
Many such situations exist in manufacturing facilities, machine shops, repair facilities, etc. And in
some circumstances, surfaces exposed to liquids need to be sufficiently free from liquids such as
water and oil before further processing can occur on the surface, whether it be surface finishing,
15 painting, or other processing.

While some solutions that are currently proposed may suffice in some circumstances, issues
also exist with methods currently in use to clean such surfaces from contaminants such as oil and
grease. Some of the current methods of cleaning oil and grease use wipes or towels and cleaning
solvents which can generate toxic fumes, hazardous waste and flammable hazards. Further, the
20 effectiveness of the absorption of such wipes can be somewhat limited to the characteristics of the
medium from which they are composed. This can lead to increased time to remove the liquids from
the surface, as well as additional materials to do so.

Additionally, some operations involved in the construction of vehicles, buildings, or airplanes
can include surfaces that need to be protected from other production processes or finishing steps on
25 adjacent or nearby surface(s), including, but not limited to, painting, welding, and grinding. Solutions
have been proposed to the problems of protecting surfaces during mechanical processing operations
and painting. However, such techniques have often not found extensive use. Some of the proposed
chemical masks have been unsuitable for application to portions of a vehicle, building, or airplane
because of damage which would potentially occur to the protected portions of the vehicle, building, or
30 airplane. Other compositions are difficult to apply, difficult to remove, excessively costly, or the like.

Thus, there is a need for an improved composition which can be used in a variety of industries and settings to remove liquids such as water and oil. There is also a need for use of such composition as a coating on non-woven substrates to improve the absorption of the non-woven material. There is also a need for an improved composition which can be used to protect surfaces and is easily applied to and removed from the surface without causing damage to the surface. There is also a need for an improved composition that can reduce the levels of toxic fumes, hazardous waste and flammable hazards that a worker may be exposed to.

SUMMARY OF THE DISCLOSURE

In various embodiments, a composition can include a thermoplastic elastomeric copolymer. The composition can also include a superabsorbent material and a solvent. The thermoplastic elastomeric copolymer can be dissolved in the solvent.

In another embodiment, a non-woven substrate can include a non-woven material including a plurality of fibers. The non-woven substrate can also include a composition applied to the non-woven material. The composition can include a thermoplastic elastomeric copolymer, a superabsorbent material, and a solvent.

In yet another embodiment, a method of removing oil or water from a surface can include providing a composition, the composition including a thermoplastic elastomeric copolymer, a superabsorbent material, and a solvent. The thermoplastic elastomeric copolymer can be dissolved in the solvent. The method can include applying the composition to the surface to absorb the oil or water. The method can additionally include removing the composition from the surface to remove the absorbed oil or water.

DETAILED DESCRIPTION OF THE DISCLOSURE

The present disclosure provides an improved composition for absorbing liquids such as water and oil. In some embodiments, the composition can be employed as a coating. In some circumstances, the coating can be applied to a substrate, such as a non-woven material. In some circumstances, the composition can be applied to a surface and can be used for protecting a surface of a vehicle, building, or airplane that may be painted or mechanically processed. For example, certain surfaces of a vehicle, building, or airplane may be masked in accordance with the present disclosure to protect those surfaces from paint overspray as well as from marring, scratching, or other deleterious effects associated with mechanical processing. The composition described herein produces a film which adheres well to a surface to be protected, with few or no pinholes. Additionally, the composition

described herein can absorb any oil or grease present on a surface which can eliminate the need for towels and chemical solvents that may create toxic fumes, hazardous waste, and flammable hazards. Further, the composition described herein can be removed easily from the surface after use by peeling the film layer away from the surface.

5 In various embodiments, the composition of the present disclosure can include a copolymer that can demonstrate the following desired attributes. A desired attribute of the copolymer utilized in the composition described herein is that the copolymer can be soluble in a solvent. A benefit of the currently described composition is that it can be applied via brush, spray, or roller application. Such application is less time consuming than utilizing masking tape to adhere a protective material to a
10 surface to be protected. Another desired attribute of the copolymer utilized in the composition described herein is that it demonstrate good adhesion to a variety of surfaces. A benefit of the currently described composition is the ability to apply the composition to a variety of surfaces such that it can be utilized in a variety of industries as a protective coating. The composition should also demonstrate good adherence to the desired surface such that it does not shift during processing such
15 as painting. Another desired attribute of the copolymer utilized in the composition described herein is that it be elastomeric in physical property in order that the composition can be easily peeled off of the surface which the composition had been protecting. A benefit of the composition described herein is that it can be peeled off as a single piece leaving a clean surface behind.

 A copolymer which can demonstrate the attributes described above is a thermoplastic
20 elastomer. In order for a material to qualify as a thermoplastic elastomer, the material must have these three essential characteristics: 1) the ability to be stretched to moderate elongations and, upon the removal of stress, return to something close to its original shape; 2) the material can be processed as a melt at elevated temperature; and 3) there is an absence of significant creep.

 There are six generic classes of commercial thermoplastic elastomers ("TPEs") which are: 1)
25 styrenic block copolymers ("TPE-s"); 2) polyolefin blends ("TPE-o"); 3) elastomeric alloys ("TPE-v" or "TPV"); 4) thermoplastic polyurethanes ("TPU"); 5) thermoplastic copolyester; and 6) thermoplastic polyamides. Examples of TPE copolymers that come from a block copolymer group include Santoprene (by ExxonMobil), Termoton (by Termopol Polimer), Arnitel (by DSM), Solprene (by Dynasol), Engage (by Dow Chemical), Hytrel (by DuPont), Dryflex and Mediprene (by ELASTO),
30 Kraton (by Kraton Polymers), and Pibiflex. Examples of TPV copolymers include FORPRENE and TERMOTON-V. Examples of styrenic block copolymers (TPE-s) are SOFPRENE (SBS) and LAPRENE (SEBS).

More specific examples of thermoplastic elastomers include polystyrene-polyisoprene-polystyrene (the styrene can be present at 14 wt%, 17 wt% or 22 wt%), polystyrene-block-polybutadiene-block-polystyrene (the molecular weight can be about 140,000 and the styrene can be present at 30 wt%), polystyrene-block-poly(ethylene-ran-polybutylene)-block-polystyrene (the molecular weight can be either about 89,000 or 118,000), polystyrene-block-polybutadiene-block-polystyrene (Kraton™ types), alpha-methylstyrene-vinyltoluene-copolymer (Eastman™ Regalrez® resin), ethylene-octene-1 copolymer (Dow® Affinity™ polyolefin plastomer and/or Infuse™ from the Dow Chemical Company), and isotactic propylene repeat units with random ethylene distribution (Vistamaxx™ from ExxonMobil Chemical Company).

The composition can additionally include a superabsorbent material. The term "superabsorbent material" refers herein to a water-swellable, water-insoluble organic or inorganic material capable, under the most favorable conditions, of absorbing at least about 15 times its weight and, in an embodiment, at least about 30 times its weight, in an aqueous solution containing 0.9 weight percent sodium chloride. The superabsorbent material can be natural, synthetic and modified natural polymers and materials. In addition, the superabsorbent materials can be inorganic materials, such as silica gels, or organic compounds, such as cross-linked polymers. Cross-linking can be covalent, ionic, Van der Waals, or hydrogen bonding.

In compositions including a superabsorbent material, the superabsorbent material can provide between about 1% to about 50% by weight of the composition. More preferably, the superabsorbent material can provide between about 5% to about 50% by weight of the composition.

The superabsorbent material can be oligomeric or polymeric. Examples of superabsorbent materials include polyacrylamides, polyvinyl alcohol, ethylene maleic anhydride copolymers, polyvinyl ethers, hydroxypropyl cellulose, carboxymethyl cellulose, polyvinylmorpholinone, polymers and copolymers of vinyl sulfonic acid, polyacrylates, polyacrylamides, polyvinyl pyrrolidone, and the like. Additional polymers suitable for superabsorbent material include hydrolyzed, acrylonitrile grafted starch, acrylic acid grafted starch, polyacrylates and isobutylene maleic anhydride copolymers and mixtures thereof. One exemplary superabsorbent material that is polymeric and that can be used is HySorb® 8760D, by BASF Corporation.

One example of an oligomeric superabsorbent material is an absorbent binder composition, or alternatively referred to as a superabsorbent binder polymer solution described in U.S. Patent Nos. 6,849,685 to Soerens et al., 7,312,286 to Lang et al., and U.S. 7,335,713 to Lang et al., the entirety of each of these references is herein incorporated by reference. The superabsorbent binder polymer solution described therein is capable of post-application, moisture-induced crosslinking. Whereas

most superabsorbent polymers require the addition of an internal crosslinker to reinforce the polymer, this superabsorbent polymer material does not require the addition of a crosslinking agent because the organic monomers act as an internal crosslinker. The internal crosslinker allows the superabsorbent polymer material to be formed by coating the water-soluble precursor polymer onto the substrate and then removing the water to activate the latent crosslinker.

The absorbent binder composition disclosed in Soerens et al. is a monoethylenically unsaturated polymer and an acrylate or methacrylate ester that contains an alkoxysilane functionality that is particularly suitable for use in manufacturing absorbent articles. Also described in Soerens et al. is a method of making the absorbent binder composition that includes the steps of preparing a monomer solution, adding the monomer solution to an initiator system, and activating a polymerization initiator within the initiator system reported an alcohol-based, water-soluble binder composition. "Monomer(s)" as used herein includes monomers, oligomers, polymers, mixtures of monomers, oligomers and/or polymers, and any other reactive chemical species which are capable of co-polymerization with monoethylenically unsaturated carboxylic, sulphonic or phosphoric acid or salts thereof. Ethylenically unsaturated monomers containing a trialkoxysilane functional group are appropriate for this invention and are desired. Desired ethylenically unsaturated monomers include acrylates and methacrylates, such as acrylate or methacrylate esters that contain an alkoxysilane functionality.

The superabsorbent binder polymer composition disclosed in the references noted above is the reaction product of at least 15 percent by mass monoethylenically unsaturated carboxylic, sulphonic or phosphoric acid or salts thereof, an acrylate or methacrylate ester that contains an alkoxysilane functionality which, upon exposure to water, forms a silanol functional group which condenses to form a crosslinked polymer, a copolymerizable hydrophilic glycol containing ester monomer; and/or, a plasticizer.

The monoethylenically unsaturated monomer is desirably acrylic acid. Other suitable monomers include carboxyl group-containing monomers: for example monoethylenically unsaturated mono or poly-carboxylic acids, such as (meth)acrylic acid (meaning acrylic acid or methacrylic acid; similar notations are used hereinafter), maleic acid, fumaric acid, crotonic acid, sorbic acid, itaconic acid, and cinnamic acid; carboxylic acid anhydride group-containing monomers: for example monoethylenically unsaturated polycarboxylic acid anhydrides (such as maleic anhydride); carboxylic acid salt-containing monomers: for example water-soluble salts (alkali metal salts, ammonium salts, amine salts, and the like) of monoethylenically unsaturated mono- or poly-carboxylic acids (such as sodium (meth)acrylate, trimethylamine (meth)acrylate, triethanolamine (meth)acrylate), sodium

maleate, methylamine maleate; sulfonic acid group-containing monomers: for example aliphatic or aromatic vinyl sulfonic acids (such as vinylsulfonic acid, allyl sulfonic acid, vinyltoluenesulfonic acid, styrene sulfonic acid), (meth)acrylic sulfonic acids [such as sulfopropyl (meth)acrylate, 2-hydroxy-3-(meth)acryloxy propyl sulfonic acid]; sulfonic acid salt group-containing monomers: for example alkali metal salts, ammonium salts, amine salts of sulfonic acid group containing monomers as mentioned above; and/or amide group-containing monomers: vinylformamide, (meth)acrylamide, N-alkyl (meth)acrylamides (such as N-methylacrylamide, N-hexylacrylamide), N,N-dialkyl (meth)acrylamides (such as N,N-dimethylacrylamide, N,N-di-n-propylacrylamide), N-hydroxyalkyl (meth)acrylamides [such as N-methylol (meth)acrylamide, N-hydroxyethyl (meth)acrylamide], N,N-dihydroxyalkyl (meth)acrylamides [such as N,N-dihydroxyethyl (meth)acrylamide], vinyl lactams (such as N-vinylpyrrolidone).

Suitably, the amount of monoethylenically unsaturated carboxylic, sulphonic or phosphoric acid or salts thereof relative to the weight of the superabsorbent binder polymer composition may range from about 15 percent to about 99.9 percent by weight. The acid groups are desirably neutralized to the extent of at least about 25 mol percent, that is, the acid groups are preferably present as sodium, potassium or ammonium salts. The degree of neutralization is preferably at least about 50 mol percent.

One of the issues in preparing water-soluble polymers is the amount of the residual monoethylenically unsaturated monomer content remaining in the polymer. For applications in personal hygiene it is required the amount of residual monoethylenically unsaturated monomer content of the superabsorbent polymer composition be less than about 1000 ppm, and more preferably less than 500 ppm, and even more preferably less than 100 ppm. U.S. Patent No. 7,312,286 discloses at least one method by which an absorbent binder composition may be manufactured so that the residual monoethylenically unsaturated monomer content is at least less than 1000 parts per million. The analysis of residual monoethylenically unsaturated monomer is determined according to the Residual Monoethylenically Unsaturated Monomer Test which is disclosed in U.S. Patent No. 7,312,286. More specifically, the residual monoethylenically unsaturated monomer analysis is carried out using solid film obtained from the polymer solution or superabsorbent composition. By way of example for this test description, the monoethylenically unsaturated monomer is acrylic acid. High performance liquid chromatography (HPLC) with a SPD-IOAvp Shimadzu UV detector (available from Shimadzu Scientific Instruments, having a place of business in Columbia, Md., U.S.A) is used to determine the residual acrylic acid monomer content. To determine the residual acrylic acid monomer, about 0.5 grams of cured film is stirred in 100 ml of a 0.9% NaCl-solution for 16 h using a 3.5 cm Lx0.5 cm W magnetic

stirrer bar at 500 rpm speed. The mixture is filtered and the filtrate is then passed through a Nucleosil C8 100A reverse phase column (available from Column Engineering Incorporated, a business having offices located in Ontario, Calif. , U.S.A.) to separate the acrylic acid monomer. The acrylic acid monomer elutes at a certain time with detection limit at about 10 ppm. The peak area of resulting elutes calculated from the chromatogram is then used to calculate the amount of residual acrylic acid monomer in the film. Initially, a calibration curve was generated by plotting the response area of pure acrylic acid elutes against its known amount (ppm). A linear curve with a correlation coefficient of greater than 0.996 was obtained.

Desirably, an aqueous solution of an oligomeric polyacrylic acid having a silanol cross-linker covalently bonded to the backbone chain of a polyacrylic acid is used for the superabsorbent material described herein.

The superabsorbent material may be in the form of discrete particles or a powder. The discrete particles can be of any desired shape, for example, spiral or semi-spiral, cubic, rod-like, polyhedral, etc. Shapes having a largest greatest dimension/smallest dimension ratio, such as needles, flakes, and fibers are also contemplated for use herein.

In some embodiments, the composition can also include a tackifier. Tackifiers can be added to provide increased adhesion to a surface or substrate to which the composition can be applied. Tackifiers can also provide a higher coefficient of friction for the composition, resulting in enhanced properties for removing oil and grease from a surface. Tackifiers tend to have low molecular weight, and glass transition and softening temperature above room temperature, providing them with suitable viscoelastic properties. Tackifiers are usually resins (e.g., rosins and their derivatives, terpenes and modified terpenes, aliphatic, cycloaliphatic and aromatic resins (C5 aliphatic resins, C9 aromatic resins, and C5/C9 aliphatic/aromatic resins), hydrogenated hydrocarbon resins, and their mixtures, terpene-phenol resins (TPR, used often with ethylene-vinyl acetate adhesives)). One preferred tackifier includes Regalrez™ 1126 hydrocarbon resin (available from Eastman Chemical Company). Other preferable tackifiers include Vistamaxx™ 6202 and Vistamaxx™ 6102 (available from ExxonMobil Chemical Company). In preferred embodiments, a tackifier can comprise about 1% to about 25% by weight of the composition, more preferably about 3% to about 20% by weight of the composition, and even more preferably about 5% to about 15% by weight of the composition.

In compositions including a thermoplastic elastomeric copolymer, a solvent, and a superabsorbent material, it is preferable to have a weight percentage of the thermoplastic elastomeric copolymer by weight of the composition be greater than a weight percentage of the superabsorbent material by weight of the composition. Having a greater weight percentage of the thermoplastic

elastomeric copolymer than the superabsorbent material provides for beneficial absorbent properties where the liquid being absorbed will include at least some oil. In some preferred embodiments, a weight percentage of the thermoplastic elastomeric copolymer by weight of the composition is at least 50% greater than a weight percentage of the superabsorbent by weight of the composition. In some
5 embodiments, a weight percentage of the thermoplastic elastomeric copolymer by weight of the composition is at least 100% greater than a weight percentage of the superabsorbent by weight of the composition. In still other embodiments, a weight percentage of the thermoplastic elastomeric copolymer by weight of the composition is at least 200% greater than a weight percentage of the superabsorbent by weight of the composition.

10 To formulate the composition described herein, the copolymer can be soluble in a solvent in order to formulate a composition which can be applied via a brush or spraying. Examples of suitable solvents include mineral spirits, methylethylketone, toluene, p-xylene, tetrahydrofuran, and dimethoxymethane. Other suitable solvents can include cyclohexane, ethyl acetate, acetonitrile, carbon disulfide, methanol, propanol, vinyl acetate, tetrahydrofuran, pyridine, ethanol, turpentine, white
15 spirits, xylene, and ethylene glycol. It is preferable to dissolve the copolymer in a solvent because the composition can then be sprayed from a wider variety of spray nozzles and can be more easily applied to various substrates. As discussed further below, the copolymer and solvent can be mixed with the superabsorbent material.

20 The composition described herein can be made by conventional means, typically including the steps of incorporating the copolymer into the solvent at room temperature and allowing the copolymer to fully dissolve in the solvent. This can be further aided by mixing the solution of the solvent and the copolymer so as to form a substantially homogenous composition. In examples prepared herein (as discussed further below), the composition can additionally include superabsorbent material, which can be added to the copolymer and the solvent after the copolymer is dissolved in the solvent. However, it
25 is contemplated that the composition can be made by mixing the superabsorbent with the thermoplastic elastomeric copolymer or the solvent prior to the mixing of the thermoplastic elastomeric copolymer with the solvent.

30 The composition can be applied to a non-woven material, such as a wipe, or to a desired surface. Various techniques for application of the composition to a surface, wipe or paper product include brushing and spraying of the composition or dipping the desired surface into the composition.

 If the composition is applied to a non-woven material, the composition can be allowed to dry at room temperature, or alternatively at a temperature elevated from room temperature, to form a coating on the non-woven material. If the composition is applied to a surface as a protective or absorbent

coating, the composition can be allowed to dry at room temperature, such as, for about 10 to 15 seconds, thereby forming a dried composition film which can have a thickness from about 0.5 or 1.5 mils to about 2, 2.5, or 4 mils thick.

In various embodiments, the composition described herein can absorb oil-based
5 contaminants, such as oil and grease, from a surface. The composition described herein is oleophilic through the usage of thermoplastic elastomers and can, therefore, demonstrate an affinity for oil based contaminants such as oil and grease. In some embodiments, the composition can be applied to a non-woven material, such as a hydroknit wipe used in industrial applications or a paper product more
10 suitable for home consumer applications. Such a wipe or paper product including the composition can be used to wipe up liquids such as water and/or oil-based contaminants. In various embodiments, the composition can be applied to the wipe or paper product in a pattern. In various embodiments, the pattern can have at least one of a dot, line, circle, or wavy line.

In other embodiments, to absorb an oil based contaminant such as oil or grease from a surface, the composition described herein can be sprayed onto the surface whereupon the oil based
15 contaminant is located, can be allowed to dry, such as, for about 10 to 15 seconds, and the dried composition can be peeled away from the surface thereby removing the oil based contaminants leaving a clean surface.

Another beneficial use of the composition can be as a protective coating on surfaces such as those that are going to be painted. The protective coating can prevent paint overspray from
20 contaminating a surface which is desired to be protected from the paint overspray. To protect the desired surface from being contaminated by paint overspray, the composition described herein can be sprayed onto the surface which is desired to be protected, can be allowed to dry, such as, for about 10 to 15 seconds, paint the area which needs to be painted, and the dried composition can be peeled away from the protected surface leaving a clean surface. The superabsorbent in the composition can
25 increase the effectiveness in absorbing any overspray paint to reduce any mess when the composition is removed from the surface being protected.

In various embodiments, it may be desirable to incorporate a visual change indicator into the liquid composition to alert a user of the liquid composition that the composition has dried and is ready
30 to either be removed from the surface or the user can continue processing the surface, such as, for example, applying a paint to the surface. In one embodiment, fluorescein (Sigma-Aldrich Chemical Co., Milwaukee, WI) can be added to the composition as an indicator. The fluorescein is soluble in organic solvents. With the addition of the fluorescein, the liquid composition can be pale pink in color initially, and upon drying, the color can change to bright orange.

Hydroknit Wipe:

A hydroknit wipe can be formed by hydraulically entangling a wet laid pulp layer with a continuous filament nonwoven substrate.

A suspension of pulp fibers can be wet laid onto a forming fabric of a conventional
5 papermaking machine. In various embodiments, the suspension may contain from about 0.01 to about 1.5 percent by weight pulp fibers suspended in water. Water is removed from the suspension of pulp fibers to form a uniform layer of pulp fibers. The pulp fibers may be any high average fiber length pulp, low average fiber length pulp, or mixtures of the same. The high average fiber length pulp typically have an average fiber length from about 1.5 mm to about 6 mm. The low average fiber length pulp
10 may be, for example, certain virgin hardwood pulps and secondary (i.e., recycled) fiber pulp from sources such as, for example, newsprint, reclaimed paperboard, and office waste. The low average fiber length pulps typically have an average fiber length of less than about 1.2 mm, for example, from 0.7 mm to 1.2 mm. Mixtures of high average fiber length and low average fiber length pulps may contain a significant proportion of low average fiber length pulps. For example, mixtures may contain
15 more than about 50 percent by weight low average fiber length pulp and less than about 50 percent by weight high average fiber length pulp. One exemplary mixture contains 75 percent by weight low average fiber length pulp and about 25 percent high average fiber length pulp. The pulp fibers may be unrefined or may be beaten to various degrees of refinement. Small amounts of wet strength resins and/or resin binders may be added to improve strength and abrasion resistance. Cross-linking agents
20 and/or hydrating agents may also be added to the pulp mixture. Debonding agents may be added to the pulp mixture to reduce the degree of hydrogen bonding if a very open or loose nonwoven pulp fiber web is desired.

A continuous filament nonwoven substrate may be formed by any known continuous filament nonwoven extrusion processes, such as, for example, known solvent spinning or melt-spinning
25 processes. In various embodiments, the continuous filament nonwoven substrate is a nonwoven web of conjugate spun filaments. Description of such filaments and a method for making the same may be found in, for example, U.S. Patent No. 5,382,400 to Pike, et al., the disclosure of which is incorporated herein by reference to the extent it does not conflict with the disclosure herein. Such filaments may be shaped filaments, sheath/core filaments, side-by-side filaments or the like.

30 The spunbond filaments may be formed from any melt-spinnable polymer, copolymer or blends thereof. Desirably, the conjugate spun filaments are conjugate melt-spun filaments. More desirably, the conjugate spun filaments are conjugate melt-spun filaments composed of at least one low softening point component and at least one high softening point component (in which at least

some of the exterior surfaces of the filaments are composed of at least one low softening point component). One polymeric component of the conjugate melt-spun filaments should be a polymer characterized as a low softening point thermoplastic material (e.g., one or more low softening point polyolefins, low softening point elastomeric block copolymer, low softening point copolymers of ethylene and at least one vinyl monomer (such as, for example, vinyl acetates, unsaturated aliphatic monocarboxylic acids, and esters of such monocarboxylic acids) and blends of the same). For example, polyethylene may be used as a low softening point thermoplastic material. Another polymeric component of the conjugate melt-spun filaments should be a polymer characterized as a high softening point material (e.g., one or more polyesters, polyamides, high softening point polyolefins, and blends of the same). For example, polypropylene may be used as a high softening point thermoplastic material.

The conjugate spun filaments may include from about 20 to about 85 percent, by weight, of the high softening point component and from about 15 to about 80 percent, by weight, of the low softening point component. For example, the conjugate spun filaments may include from about 40 to about 75 percent, by weight, of the high softening point component and from about 25 to about 60 percent, by weight, of the low softening point component. Desirably, the conjugate spunbond filaments contain from about 20 to about 85 percent, by weight of a polypropylene component and from about 15 to about 80 percent, by weight, of a polyethylene component. More desirably, conjugate spunbond filaments contain from about 40 to about 75 percent, by weight, of a polypropylene component and from about 25 to about 60 percent, by weight, of a polyethylene component.

If the filaments are formed from polyolefins such as, for example, a polypropylene, the nonwoven substrate may have a basis weight from about 3.5 or 10 to about 35 or 70 grams per square meter (gsm). The polymers may include additional materials such as, for example, pigments, antioxidants, flow promoters, stabilizers, and the like.

In an embodiment, the nonwoven continuous filament substrate may have a total bond area of less than about 30 percent and a uniform bond density greater than about 100 bonds per square inch. For example, the nonwoven continuous filament substrate may have a total bond area from about 20 to about 30 percent (as determined by conventional optical microscope methods) and a bond density from about 250 to about 500 pin bonds per square inch. Such a combination total bond area and bond density may be achieved by bonding the continuous filament substrate with a pin bond pattern having more than about 100 pin bonds per square inch which provides a total bond surface area less than about 30 percent when fully contacting a smooth anvil roll. Desirably, the bond pattern may have a pin bond density from about 250 to about 350 pin bonds per square inch and a total bond surface area

from about 10 percent to about 25 percent when contacting a smooth anvil roll. Although pin bonding produced by thermal bond rolls is described above, any form of bonding which produces good tie down of the filaments with minimum overall bond area is contemplated. For example, a combination of thermal bonding and latex impregnation may be used to provide desirable filament tie down with minimum bond area. Alternatively and/or additionally, a resin, latex or adhesive may be applied to the nonwoven continuous filament web by, for example, spraying or printing, and dried to provide the desired bonding.

When conjugate spun filaments are used to form the nonwoven substrate or are included in the nonwoven substrate, the nonwoven substrate may be relatively lightly bonded or even unbonded prior to entanglement with the pulp layer and still produce a durable nonwoven composite fabric. Desirably, the conjugate spun filaments are conjugate melt-spun filaments. In particular, if the nonwoven substrate is a nonwoven layer of conjugate melt-spun filaments composed of at least one low softening point component and at least one high softening point component (in which at least some of the exterior surfaces of the filaments are composed of at least one low softening point component), it has been found that, as long as the web remains sufficiently coherent to be handled in the process, conventional levels of thermal bonding are not necessary prior to the hydraulic entangling step. In such cases, it is very desirable to carry out thermal treatment immediately after the hydraulic entangling is complete.

The pulp fiber layer is then laid on the nonwoven substrate which rests upon a foraminous entangling surface of a conventional hydraulic entangling machine. It is preferable that the pulp layer is between the nonwoven substrate and the hydraulic entangling manifolds. The pulp fiber layer and nonwoven substrate pass under one or more hydraulic entangling manifolds and are treated with jets of fluid to entangle the pulp fibers with the filaments of the continuous filament nonwoven substrate. The jets of fluid also drive pulp fibers into and through the nonwoven substrate to form the composite material. Alternatively, hydraulic entangling may take place while the pulp fiber layer and nonwoven substrate are on the same foraminous screen (i.e., mesh fabric) which the wet-laying took place. Also contemplated is superposing a dried pulp sheet on a continuous filament nonwoven substrate, rehydrating the dried pulp sheet to a specified consistency and then subjecting the rehydrated pulp sheet to hydraulic entangling.

The hydraulic entangling may take place while the pulp fiber layer is highly saturated with water. For example, the pulp fiber layer may contain up to about 90 percent by weight water just before hydraulic entangling. Alternatively, the pulp fiber layer may be an air-laid or dry-laid layer of pulp fibers. Hydraulic entangling a wet-laid layer of pulp fibers is desirable because the pulp fibers can

be embedded into and/or entwined and tangled with the continuous filament substrate without interfering with "paper" bonding (sometimes referred to as hydrogen bonding) since the pulp fibers are maintained in a hydrated state. "Paper" bonding also appears to improve the abrasion resistance and tensile properties of the high pulp content composite fabric.

5 The hydraulic entangling may be accomplished utilizing conventional hydraulic entangling equipment such as may be found in, for example, U.S. Patent No. 3,485,706 to Evans, the disclosure of which is hereby incorporated by reference to the extent it does not conflict with the disclosure herein. The hydraulic entangling may be carried out with any appropriate working fluid such as, for example, water. The working fluid flows through a manifold which evenly distributes the fluid to a
10 series of individual holes or orifices. These holes or orifices may be from about 0.003 to about 0.015 inch in diameter. In various embodiments, a single manifold may be used or several manifolds may be arranged in succession.

 In the hydraulic entangling process, the working fluid passes through the orifices at a pressure ranging from about 200 to about 2000 pounds per square inch gage (psig). At the upper ranges, it is
15 contemplated that the composite fabrics may be processed at speeds of about 1000 feet per minute (fpm). The fluid impacts the pulp fiber layer and the nonwoven substrate which are supported by a foraminous surface which may be, for example, a single plane mesh having a mesh size of from about 40x40 to about 100x100. The foraminous surface may also be a multi-ply mesh having a mesh size from about 50x50 to about 200x200. As is typical in many water jet treatment processes, vacuum slots
20 may be located directly beneath the hydro-needling manifolds or beneath the foraminous entangling surface downstream of the entangling manifold so that excess water is withdrawn from the hydraulically entangled composite material.

 A relatively lightly bonded or unbonded nonwoven layer of conjugate, spunbond filaments (desirably conjugate, melt-spun filaments composed of at least one high softening point component
25 and having at least some exterior surfaces of the filaments composed of at least one low softening point component) can be used to produce a durable high pulp content hydraulically entangled nonwoven composite fabric. When the relatively lightly bonded or unbonded layer of conjugate spun filaments is used in combination with a thermal treatment to cause regions in which the low softening point component at the surfaces of the filaments is fused to the pulp fibers, the resulting fabric has
30 enhanced toughness, abrasion resistance and uniformity.

 The use of a relatively lightly bonded or unbonded nonwoven layer of conjugate, spun filaments in combination with a thermal post treatment provides a coherent substrate which may be formed into a pulp fiber composite fabric by hydraulic entangling on only one side and still provide a

strong, useful fabric as well as a composite fabric having desirable dimensional stability. The term "relatively lightly bonded" is used to describe a generally coherent nonwoven matrix or layer of filaments and/or fibers that is held together primarily by interfiber entanglement and/or mechanical bonding in the absence of conventional levels of web bonding provided by standard web bonding techniques such as, for example, thermal pattern bonding and/or adhesive bonding.

The energy of the fluid jets that impact the pulp layer and substrate may be adjusted so that the pulp fibers are inserted into and entangled with the continuous filament substrate in a manner that enhances the two-sidedness of the fabric. That is, the entangling may be adjusted to produce high pulp fiber concentration on one side of the fabric and a corresponding low pulp fiber concentration on the opposite side. Alternatively, the continuous filament substrate may be entangled with a pulp fiber layer on one side and a different pulp fiber layer on the other side to create a composite fabric with two pulp-rich sides.

After the fluid jet treatment, the composite fabric may be transferred to a non-compressive drying operation. If desired, the composite fabric may be wet-creped prior to the drying operation. Non-compressive drying may be accomplished utilizing a conventional rotary drum through-air drying apparatus. The web may be dried first and then treated (e.g., heat treated) separately to create regions in which the low softening point component at the exterior surfaces of the filaments is fused to at least a portion of the fibrous component. The drying step may also be carried out in a manner that simultaneously created regions in which the low softening point component at the exterior surfaces of the filaments is fused to at least a portion of the fibrous component. Through-air drying processes have been found to work particularly well. Other drying processes which incorporate infrared radiation, yankee dryers, steam cans, vacuum dewatering, microwaves, and ultrasonic energy may also be used.

It may be desirable to use finishing steps and/or post treatment process to impart selected properties to the composite fabric of the hydroknit wipe. For example, the wipe may be lightly pressed by calendar rolls, creped or brushed to provide a uniform exterior appearance and/or certain tactile properties. Alternatively and/or additionally, chemical post treatments such as, adhesives or dyes can be added to the fabric. In various embodiments, the composition described herein can be applied to the hydroknit wipe such that the hydroknit wipe can wipe a surface clean and/or absorbent an oil based contaminant such as oil or grease. An example of a hydroknit wipe is the Wypall® X60 Wipers sold by Kimberly-Clark Professional, Roswell, GA, U.S.A.

Paper Product

A "paper product" as described herein is meant to include products such as bath tissues, facial tissues, paper towels, industrial wipes, food service wipes, napkins, medical pads, and other similar products. The paper product can be a nonwoven sheet formed from a plurality of papermaking fibers and having a first outer surface and a second outer surface. The paper product may have one, two, 5 three or more plies and each ply can be made from any suitable type(s) of papermaking fiber.

Papermaking fibers can include any pulp fibers, cellulosic fibers, other natural fibers, non-cellulosic synthetic fibers, chemithermomechanical fibers, or recycled cellulosic fibers which are known to be useful for making paper products. Fibers suitable for making a paper product can include, but 10 are not limited to, any natural or synthetic cellulosic fibers including, but not limited to, nonwoody fibers, such as cotton, wool, human hair, boar bristles, abaca, kenaf, sabai grass, flax, esparto grass, straw, jute hemp, bagasse, milkweed floss fibers, and pineapple leaf fibers; and woody fibers such as those obtained from deciduous and coniferous trees, including softwood fibers, such as northern and southern softwood kraft fibers; hardwood fibers, such as eucalyptus, maple, birch, and aspen. Woody 15 fibers can be prepared in high-yield or low-yield forms and can be pulped in any known method, including kraft, sulfite, high-yield pulping methods and other known pulping methods. A portion of the fibers, such as up to 50% or less by dry weight, or from about 5% to about 30% by dry weight, can be synthetic fibers such as rayon, polyolefin fibers, polyester fibers, polypropylene fibers, polystyrene fibers, butylene fibers, bicomponent sheath-core fibers, copolymer fibers, multi-component binder 20 fibers, and the like. Any known bleaching method can be used. Synthetic cellulose fiber types include rayon in all its varieties and other fibers derived from viscose or chemically modified cellulose. Chemically treated natural cellulosic fibers can be used such as mercerized pulps, chemically stiffened or crosslinked fibers, or sulfonated fibers. Other papermaking fibers that can be used include recycled cellulosic fibers and high yield fibers. As used herein, recycled cellulosic fibers means any cellulosic 25 fiber which has previously been isolated from its original matrix via physical, chemical or mechanical means and, further, has been formed into a fiber web, dried to a moisture content of about 10 weight percent or less and subsequently reisolated from its web matrix by some physical, chemical or mechanical means. High yield fibers are those papermaking fibers produced by pulping processes providing a yield of about 65% or greater, more specifically about 75% or greater, and still more 30 specifically about 75% to about 95%. Yield is the resulting amount of processed fibers expressed as a percentage of the initial wood mass. Such pulping processes include bleached chemithermomechanical pulp, chemithermomechanical pulp, pressure/pressure thermomechanical pulp, thermomechanical pulp, thermomechanical chemical pulp, high yield sulfite pulps, and high yield

kraft pulps, all of which leave the resulting fibers with high levels of lignin. High yield fibers are known for their stiffness in both dry and wet states relative to typical chemically pulped fibers.

Paper products can be made with a homogeneous fiber furnish or can be formed from a stratified fiber furnish producing layers within the single- or multi-ply product. Stratified base webs of the paper product can be formed using equipment known in the art, such as a multi-layered headbox. Both strength and softness of the base web can be adjusted as desired through manufacture of layers, such as those produced from stratified headboxes.

For instance, different fiber furnishes can be used in each layer in order to create a layer with the desired attributes. For example, layers containing softwood fibers have higher tensile strengths than layers containing hardwood fibers. Hardwood fibers, on the other hand, can increase the softness of the paper product. In an embodiment, a single ply can include a first outer layer and a second outer layer containing primarily hardwood fibers. The hardwood fibers can be mixed, if desired, with recycled cellulosic fibers in an amount up to about 10% by weight and/or softwood fibers in an amount up to about 10% by weight. The ply can further include a middle layer positioned in between the first outer layer and the second outer layer. The middle layer can contain primarily softwood fibers. If desired, other fibers such as high-yield fibers or synthetic fibers may be mixed with the softwood fibers in an amount up to about 10% by weight.

When constructing a ply from a stratified fiber furnish, the relative weight of each layer can vary depending upon the particular application. For example, in an embodiment, when constructing a ply containing three layers, each layer can be from about 15% to about 40% of the total weight of the ply, such as from about 25% to about 35% of the weight of the ply.

Wet strength resins may be added to the furnish as desired to increase the wet strength of the final paper product. Useful wet strength resins include diethylenetriamine (DETA), triethylenetetramine (TETA), tetraethylenepentamine (TEPA), epichlorohydrin resin(s), polyamide-epichlorohydrin (PAE), or any combinations thereof, or any resins to be considered in these families of resins. Particularly preferred wet strength resins are polyamide-epichlorohydrin (PAE) resins. Commonly PAE resins are formed by first reacting a polyalkylene polyamine and an aliphatic dicarboxylic acid or dicarboxylic acid derivative. A polyaminoamide made from diethylenetriamine and adipic acid or esters of dicarboxylic acid derivatives is most common. The resulting polyaminoamide is then reacted with epichlorohydrin. Useful PAE resins are sold under the tradename Kymene® (commercially available from Ashland, Inc., Covington, KY).

Similarly, dry strength resins can be added to the furnish as desired to increase the dry strength of the final paper product. Such dry strength resins include, but are not limited to

carboxymethyl celluloses (CMC), any type of starch, starch derivatives, gums, polyacrylamide resins, and others as are well known. Commercial suppliers of such resins are the same as those that supply the wet strength resins discussed above.

The paper products can generally be formed by any of a variety of papermaking processes known in the art. In various embodiments, the base web of the paper product is formed by through-air drying and can be either creped or uncreped. For example, a papermaking process can utilize adhesive creping, wet creping, double creping, embossing, wet-pressing, air pressing, through-air drying, creped through-air drying, uncreped through-air drying, as well as other steps in forming the base web. Some examples of such techniques are disclosed in US Patent Nos. 5,048,589, 5,399,412, 5,129,988 and 5,494,554 all of which are incorporated herein in a manner consistent with the present disclosure. When forming multi-ply tissue products, the separate plies can be made from the same process or from different processes as desired.

In various embodiments, the base web is formed by an uncreped through-air drying process, such as the processes described, for example, in US Patent Nos. 5,656,132 and 6,017,417, both of which are hereby incorporated by reference herein in a manner consistent with the present disclosure.

In an uncreped through-air drying process, a twin wire former can have a papermaking headbox which injects or deposits a stream of an aqueous suspension of papermaking fibers onto the forming fabric which serves to support and carry the newly-formed wet web downstream in the process as the wet web is partially dewatered to a consistency of about 10 dry weight percent. Additional dewatering of the wet web may be carried out by known paper making techniques, such as vacuum suction boxes. The wet web may be additionally dewatered to a consistency of greater than 20 percent, more specifically between about 20 to about 40 percent, and more specifically about 20 to about 30 percent. The wet web is then transferred from the forming fabric to a transfer fabric traveling at a slower speed than the forming fabric in order to impart increased strength into the web. Transfer can be carried out with the assistance of a vacuum shoe. The wet web is then transferred from the transfer fabric to the through-air drying fabric with the aid of a vacuum transfer roll or a vacuum transfer shoe. The through-air drying fabric can be traveling at about the same speed or a different speed relative to the transfer fabric. If desired, the through-air drying fabric can be run at a slower speed to further enhance stretch. While supported by the through-air drying fabric, the wet web is dried to a consistency of about 94 percent or greater by the through-air dryer. The drying process can be any noncompressive drying method which tends to preserve the bulk or thickness of the wet web including, without limitation, through-air drying, infrared radiation, microwave drying, etc.

In order to provide stretch to the paper product, a speed differential is provided between fabrics at one or more points of transfer of the wet web. This process is known as rush transfer. The speed difference between the forming fabric and the transfer fabric can be from about 5 to about 75 percent or greater, such as from about 10 to about 35 percent. For instance, in an embodiment, the speed difference can be from about 15 to about 25 percent, based on the speed of the slower transfer fabric. The stretch can be imparted to the web using a single differential speed transfer or two or more differential speed transfers of the wet web prior to drying. Hence there can be one or more transfer fabrics. The amount of stretch imparted to the web can hence be divided among one, two, three or more differential speed transfers. Rush transfer from one fabric to another can follow the principles taught in any one of the following patents, US Patent Nos. 5,667,636, 5,830,321, 4,440,597, 4,551,199, 4,849,054, all of which are hereby incorporated by reference herein in a manner consistent with the present disclosure.

Softening agents can be used to enhance the softness of the paper product and such softening agents can be incorporated with the fibers before, during, or after formation of the aqueous suspension of fibers. Such agents can also be sprayed or printed onto the web after formation of the wet web. Suitable agents include, but are not limited to, fatty acids, waxes, quaternary ammonium salts, dimethyl dehydrogenated tallow ammonium chloride, quaternary ammonium methyl sulfate, carboxylated polyethylene, cocamide diethanol amine, coco betaine, sodium lauryl sarcosinate, partly ethoxylated quaternary ammonium salt, distearyl dimethyl ammonium chloride, polysiloxanes, and the like. The softening agents can be added in an amount from about 0.05, 0.25, or 0.5 to about 0.75 or 1 weight percent based upon the weight of the fiber.

The basis weight of webs made can vary depending upon the final paper product. In general, the basis weight of the web may vary from about 15, 16, 18, 30 or 30 gsm to about 32, 34, 36, 40, 45, 60 or 80 gsm.

In various embodiments, a topical binder may be used to bond the papermaking fibers together which can impart added strength to the final paper product. In various embodiments, a binder can be added onto each side of an uncreped through-dried web and each side of the web can then be creped. Binder may be "added" by gravure printing, flexo printing, coating, spraying, ink jet, or hot melt applications. In various embodiments, the web for the paper product is first formed by conventional means and then rush-transferred and through-air dried (and not creped or calendared). Next, each side of the uncreped, through-air dried base sheet has binder added to it, and then each side of the base sheet is creped.

The binder composition can be applied to one or more surfaces of the ply or plies within the product. For example, a single-ply product can have one or both surfaces treated with the binder composition. A two-ply product can have one or both outer surfaces treated with the binder composition and/or one or both inner surfaces treated with the binder composition. In the case of a two-ply product, it can be advantageous to have one or both binder-treated surfaces plied inwardly in order to expose the untreated surface(s) of the plies on the outside of the product for purposes of hand-feel or absorbency. When the binder is applied to the inner surfaces of a multi-ply product, the binder also provides a means of bonding the plies together. In such cases, mechanical bonding may not be required. In the case of a three-ply product, the same options are available. The surface area of the coverage of the binder composition on the fibrous web can be about 5 percent or greater, more specifically about 30 percent or greater, still more specifically, from about 5 to about 90 percent or from about 20 to about 75 percent.

The binder composition can be applied to one or both surfaces of the fibrous web by any suitable method such as printing, spraying, coating, foaming and the like. Curing temperatures for the binder composition can be about 260°C or less, more specifically about 120°C or less, more specifically about 100°C or less, more specifically about 40°C or less, more specifically from about 10 to about 260°C and still more specifically from about 20 to about 120°C. It will be appreciated that although the binder compositions can be cured at relatively low temperatures, the rate of curing can be accelerated at higher temperatures associated with curing conventional binders.

After the paper product is formed and dried, the paper product can undergo any subsequent converting process. In an embodiment, the paper product can undergo a shear calendaring process in order to generate a high value of fuzziness while maintaining sufficient tensile strength. In an embodiment, the paper product can be placed into final packaging comprising an air impermeable material.

Examples

Example 1: Thermoplastic Elastomeric Copolymer Solubility Test

To test the solubility of a copolymer in a solvent, an amount of the copolymer can be added to a volume of the solvent and observed over time. For example, three copolymers were evaluated for their solubility in a variety of potential solvents. The three copolymers which were evaluated were: polystyrene-polyisoprene-polystyrene (styrene at 14 wt%)(Sigma-Aldrich Chemical Company), ethylene-octene-1 (Dow™ Affinity®), and alpha-methylstyrene-vinyltoluene (Eastman™ Regalrez®). To test the solubility of each of the copolymers in solvents, 0.1g of the copolymer was placed in a 20 ml vial followed by 10 ml of solvent and the vial was then sealed with a cap. Each vial was placed at

ambient temperature (25°C) and observed over 10 hours. If a copolymer was completely dissolved a check mark ("√") will appear in Table 1 below. If the copolymer did not dissolve completely, an "X" will appear in Table 1 below.

Table 1:

Solvent	Polystyrene-polyisoprene-polystyrene	Ethylene-octene-1	Alpha-methylstyrene-vinyltoluene
Dimethoxymethane	√ (20%)	X	X
Toluene	√ (10%)	√ (5%)	√ (6%)
Xylene	√ (15%)	√ (8%)	√ (8%)
Acetonitrile	X	X	X
1-butanol	X	X	X
Methylethylketone	√ (10%)	X	X
Mineral spirits	√ (8%)	X	√ (6%)
Acetone	X	X	X
tetrahydrofuran	√ (10%)	X	√ (10%)

5 (x) = maximum solubility of copolymer that dissolves in each solvent at ambient temperature

As can be seen from Table 1, the solvents of mineral spirits, methylethylketone, toluene, p-xylene, tetrahydrofuran, and dimethoxymethane were found to be suitable solvents within which the copolymers could dissolve.

Example 2: Surface Adhesion for Thermoplastic Elastomeric Copolymer and Solvent

10 As described herein, another desired attribute of the composition described herein is the ability to adhere to a variety of surfaces. To demonstrate the test for surface adhesion, 4 grams of polystyrene-block-polyisoprene-block-polystyrene (styrene at 14 wt%, available from Sigma-Aldrich Chemical Company) was dissolved in 60 ml dimethoxymethane (available from Sigma-Aldrich Chemical Company) at room temperature. This solution was then sprayed using a Prevail spray gun

15 (Prevail Co., Coal City, IL) onto four different surfaces: 1) aluminum sheet metal, 12"x12"x0.25" (available from Grainger Co., Loves Park, IL), 2) polycarbonate sheet, 12"x12"x1/8" (available from Grainger Co., Loves Park, IL), 3) Glass Sheet, 12"x12"x1/8", and 4) black laboratory bench top (mineral-polymer composite). Each sprayed sample was allowed to dry for 10 – 15 seconds. The

dried compositions were then peeled from each surface to make a visual observation as to whether surface adhesion was achieved. For each of the four surfaces, the coating of the dried composition was observed to have adhered to each surface and yet could be easily peeled off of each surface.

Simple peel tests were also conducted for compositions including a thermoplastic elastomeric copolymer, solvent, and superabsorbent material. No changes from the behavior noted above were observed for compositions including superabsorbent material.

Example 3: Oil-Based Contaminant Absorption by Thermoplastic Elastomeric Copolymer and Solvent

To test the oleophilicity of a composition, 0.25g of each of engine oil (Chevron SAE 30 10W30), grease (lard, Armour brand, ConAgra Foods, Omaha, NE), vegetable oil (Safflower oil, Ventura Foods LLC) was applied to the surface of an aluminum metal sheet, 12"x12"x0.25" (available from Grainger Co., Loves Park, IL) and using a gloved finger spread across the surface to form a light streak (6 inches long and 1 inch wide). A liquid composition was prepared of 4 grams of polystyrene-block-polyisoprene-block-polystyrene dissolved in 60 ml of dimethoxymethane. A light spray coating was applied on top of the streaks and allowed to dry for about 20 seconds to form a film. The film was then removed by peeling the film off of the aluminum surface. On visible inspection, no visible sign of the oil or grease was observed on the aluminum surface. This composition, therefore, absorbed and removed the oils and grease from the surface in a single easy step.

Example 4: Protective Coating for Painting Processes by Thermoplastic Elastomeric Copolymer and Solvent

Aluminum plates (having a 6" diameter hole in the center) and polycarbonate sheets (Grainger Company, Loves Park, IL) were glued together using a 5 minute epoxy glue (Loctite® Heavy Duty [5 min, 3500 psi], Henkel Corp.). The polycarbonate sheet formed the "window" within the hole of the aluminum plate to model a vehicle or airplane window. A liquid composition was prepared of 4 grams of polystyrene-block-polyisoprene-block-polystyrene dissolved in 60 ml of dimethoxymethane. The liquid composition was brushed onto the polycarbonate window, using a 1 inch paint brush (Craftsmart® 1 inch with 1.5 inch bristles) as a mask before spray painting. The liquid composition was allowed to dry. Red enamel spray paint ("Fire Red" ColorTouch® Spray Enamel by Krylon Products Group) was applied to the metal and the composition mask. When the paint was dry (about 20 minutes), the mask was peeled off to leave a clean line on the metal with no paint on the polycarbonate window. The mask was found to peel off easily taking the paint overspray with it.

Example 5: Visual Change Indicator

A liquid composition was formulated with 4 grams of polystyrene-block-polyisoprene-block-polystyrene dissolved in 60 ml of dimethoxymethane. An amount, 0.02 grams, of fluorescein (Sigma-Aldrich Chemical Co., Milwaukee, WI) was added to the liquid composition. The fluorescein is soluble
 5 in organic solvents. With the addition of the fluorescein, the liquid composition was pale pink in color. Upon drying, the color changed from pale pink to bright orange.

Example 6: Determination of Oil Capacity over Time for Thermoplastic Elastomeric Copolymer and Solvent

A 0.27 gram sample of a dried copolymer film (4 grams of polystyrene-block-polyisoprene-
 10 block-polystyrene dissolved in 60 ml of dimethoxymethane (14 wt% styrene)) was placed in an excess of engine oil (100 grams Chevron SAE 30, 10W30) in a 8"x12" Pyrex® baking dish. The film was then removed, blotted with paper towels and weighed. This was repeated over certain time points. Table 2 shows the weight gain over time.

Table 2:

Time (min)	Weight of film plus oil (grams)
0	0.27
10	0.35
20	0.38
30	0.42
40	0.45
75	0.52
110	0.58
235	0.72
320	0.77

15 These steps were repeated over additional time. After 32 hours, the film sample had absorbed 3.3 grams of oil per gram of copolymer film. Following 32 hours, the film sample had grown to 4 times its starting size.

Example 7: Absorption of Different Types of Oils for Thermoplastic Elastomeric Copolymer

A series of common oils and lubricants were tested to determine how well an elastomeric
 20 copolymer (an ethylene-octene block copolymer sold under the trade name Infuse™ 9807 by Dow Chemical Co.) absorbs different oil and lubricant types:

Ethylene glycol (antifreeze) (available from Sigma-Aldrich Chemical Co., Milwaukee, WI)

Brake fluid 672701 (available from Atlas Supply Co., Springfield, NJ)

Automatic transmission fluid (available from Sovereign Oil Co., Chicago, IL)

Safflower Oil (available from Ventura Foods, Brea, CA)

5 Synthetic 10W30 motor oil (available from Kendall, Houston, TX)

Motor Oil 10W30 Mototech (available from The Kroger Co., Cincinnati, OH)

A known weight of the dried elastomeric copolymer film, about 0.4 grams, was placed in an excess of each of the listed oil/lubricants, about 100 ml, for a period of time. At certain time points, the film was then removed, blotted with paper towels, and weighed. The results are shown in Table 3

10 below.

Table 3:

Oil/Lubricant	Sample	Base wt (g)	wt. 1 min (g)	wt. 2 min (g)	wt. 5 min (g)	wt. 10 min (g)
Safflower Oil	1	0.41	0.74	0.72	0.74	0.74
	2	0.41	0.75	0.73	0.76	0.71
Avg wt% absorbed			82%	77%	82%	77%
Transmission Fluid	1	0.41	1.29	1.53	1.6	1.58
	2	0.4	1.29	1.5	1.61	1.6
Avg wt% absorbed			219%	274%	297%	293%
Brake fluid	1	0.41	0.67	0.68	0.67	0.7
	2	0.41	0.66	0.7	0.65	0.71
Avg wt% absorbed			62%	68%	61%	72%
Synthetic Motor Oil	1	0.4	1.19	1.45	1.49	1.5
	2	0.41	1.16	1.4	1.5	1.54
Avg wt% absorbed			191%	252%	270%	275%
Antifreeze	1	0.41	0.43	0.43	0.43	0.44
	2	0.41	0.43	0.43	0.43	0.43
Avg wt% absorbed			5%	5%	5%	5%
Motor Oil	1	0.4	1.23	1.53	1.57	1.63
	2	0.41	1.25	1.49	1.58	1.6
Avg wt% absorbed			206%	273%	289%	299%

The results in Table 3 show that the elastomeric copolymer has good oil absorption of most oil and lubricant types with the exception of small alcohol based oils such as antifreeze (ethylene glycol) which are more hydrophilic in nature. The safflower oil (unsaturated fatty acids) was absorbed and, therefore, this coating could be used in the kitchen environment. It is noted that adding
 5 superabsorbent materials to the thermoplastic elastomeric copolymers noted above would not significantly change the copolymer's ability to absorb various oils.

Example 8: Applying the Elastomeric Copolymer and Solvent Composition via Roller Ball Applicator

A solution of a polystyrene-polyisoprene-polystyrene (14% polystyrene) was dissolved in
 10 dimethoxymethane (1:1) and was placed in a roller ball applicator (available from Lotion Crater, Eastsound, WA) and shown to deliver a complete 2 – 4 mm thick layer of the elastomeric copolymer composition coating on most surfaces including metal, glass, tile, and the like. After allowing the composition to dry, the dried film was easily removed by peeling off as an elastic layer.

Example 9: Application of Thermoplastic Elastomeric Copolymer and Solvent Composition as 15 a Coating on a Wipe

Wypall® X-60 Hydroknit wipes were lightly spray coated with a liquid copolymer composition including a thermoplastic elastomeric copolymer and a solvent (4 grams of polystyrene-block-polyisoprene-block-polystyrene dissolved in 60 ml of dimethoxymethane). One sample of the liquid copolymer composition further included 0.02 grams of fluorescein as a visual change indicator (pink
 20 liquid changes to dark orange when the coating dries, indicating when the coating is ready to paint). Following the spraying of each of the wipes, the liquid copolymer compositions were allowed to dry. Typical add-ons ranged from 5%wt/wt to 28%wt/wt. Next, 0.25 g of engine oil (Chevron SAE 30, 10W30) was streaked onto an aluminum plate as three lines. The wipes (wipe control, wipe with copolymer composition, wipe with copolymer composition and visual change indicator) were each
 25 placed onto one of the oil streaks and then a second aluminum plate was placed on top of the wipes to compress the wipes into the oil for 20 seconds and then removed. Table 4 provides the measurement of the oil in each of the wipes.

Table 4:

Sample	Wipe Control	Wipe + Copolymer	Wipe+Copolymer+Visual Change Indicator
Oil in wipe (grams)	0.05	0.27	0.29

The wipes with the copolymer composition were able to absorb about 5 times more oil when compared with the wipe control.

Example 10: Application of Thermoplastic Elastomeric Copolymer and Solvent Composition as a Coating on a Wipe – Oil Capacity

- 5 Identical samples of Wypall® X-60 Hydroknit wipes (7cm x 14cm) were coated with a liquid copolymer solution (4 grams of polystyrene-block-polyisoprene-block-polystyrene dissolved in 60 ml of dimethoxymethane) at different add-on levels. Each wipe was then placed in a bath of engine oil (100 grams Chevron SAE 30, 10W30 in an 8"x12" Pyrex® baking dish for 10 minutes. Following the 10 minutes, each wipe was removed from the bath of engine oil and lightly blotted with paper towels and
- 10 the oil add-on was measured. Table 5 below provides the measurement of the oil in each of the wipes.

Table 5:

Copolymer wt%	Oil Capacity wt%
0.0	250
0.16	279
1.1	294
20.0	351
22.3	361
31.3	366

Over a ten minute testing period, a steady state increase in oil capacity was observed until about 20wt% of copolymer solution on the wipes.

- Example 11: Coefficient of Friction of Thermoplastic Elastomeric Copolymer and Solvent
- 15 Composition

- To evaluate the coefficient of friction when cleaning a contaminated surface, the elastomeric copolymer and solvent composition was applied to the contaminated surface as a liquid composition which was then allowed to dry and also via a wipe containing a coating of the elastomeric copolymer and solvent composition. Both techniques of application of the elastomeric composition were further
- 20 compared against a wipe which did not contain a coating of the elastomeric composition and solvent. The elastomeric copolymer composition was prepared by dissolving 4 grams of polystyrene-block-polyisoprene-block-polystyrene (14 wt% styrene) in 60 ml of dimethoxymethane. The elastomeric

copolymer and solvent composition when then sprayed onto Wypall® X-60 Hydroknit wipes (7cm x 14cm) at different add-on levels.

Engine oil, 0.25 grams, (Chevron SAE 30, 10W30) was streaked onto an aluminum plate in four lines. A hydroknit wipe without the elastomeric copolymer and solvent composition and each of the coated hydroknit wipes were used to wipe three of the lines of engine oil, respectively. The elastomeric copolymer and solvent composition by itself was also sprayed onto the fourth line of engine oil. The Gardner Abrasion Test was performed and Table 6 outlines of the coefficient of friction for each application technique. The Gardner Abrasion Test follows ASTM 1792. The Gardner Abrasion Tester II abrasion tester (BYK Instruments, Geretsried, Germany) offers a versatile design for abrasion and coefficient of friction. The instrument arm is designed to hold from 1 – 3 brush holders or shuttle for wipes or towels. The test method was followed as written with the following notations: 1) the wipe was placed under the shuttle, 2) 1 cycle is 3 seconds, 3) 1 lb was applied to the instrument arm, and 4) the stroke length was 11 inches.

Table 6:

Sample	Coefficient of Friction
Hydroknit wipe with 25%wt/wt Add-On Level of Coating	0.4424
Hydroknit wipe with 17%wt/wt Add-On Level of Coating	0.3328
Elastomeric Copolymer Composition	0.3002
Hydroknit Wipe	0.1482

The hydroknit wipes coated with the elastomeric copolymer composition had a higher coefficient of friction than the hydroknit wipe without the coating of the elastomeric copolymer composition. The elastomeric copolymer and solvent composition can provide a “squeegee” effect and can help scrape the oil off of the surface and into the hydroknit wipe.

Bench testing was conducted for compositions including a thermoplastic elastomeric copolymer, a solvent, and a superabsorbent material and no significant reduction in the behaviors noted above were observed.

Example 12: Patterned Coating of Thermoplastic Elastomeric Copolymer and Solvent Composition

Wypall® X-60 wipes and Scott® paper towels (both available from Kimberly-Clark Corporation) were lightly sprayed with a solution of 6 grams of polystyrene-polyisoprene-polystyrene (14% polystyrene) dissolved in 60 ml dimethoxymethane. The copolymer and solvent solution was sprayed onto the wipes and towels in a lined pattern. The lined patterns were achieved by placing a Weber® grill grate on top of the wipes and towels first before spraying. After spraying the composition onto the wipes and towels, the grill grate was lifted off to reveal the elastomeric copolymer and solvent composition coating in a line or tread pattern. Various subsequent tread designs were achieved by rotating the grill grate to obtain zig-zag tread patterns. Repeated oil wiping testing showed the “tread-like” patterned wipes and towels were able to absorb 1.5 – 2 times as much engine oil as a lightly coated wipe/towel. This is thought to be due, in part, to the tread design delivering the squeegee effect of high friction, but the gaps (no copolymer coating) allowed faster oil flow through and capture. Furthermore, it is believed the tread-like pattern allowed for the squeegee to channel the oil to the uncoated areas for improved wicking and capture.

Example 13: Oil Absorption of Thermoplastic Elastomeric Copolymer

Several thermoplastic elastomeric copolymers were tested to determine their effectiveness of absorbing oil (Chevron 10W30 SAE80, engine oil) over time. The thermoplastic elastomeric copolymers noted below were made into small circular discs by using a hot plate press (Atlas press) at approximately 380°F. These discs were placed in excess engine oil for specified time periods as noted in Table 7 below, removed from the oil, blotted, and their weight was re-measured, being shown as a percentage increase from initial weight.

Table 7:

Sample	Weight after 1 min.	Weight after 2 mins.	Weight after 5 mins.	Weight after 10 mins.
Styrene-isoprene- styrene (Eastman) 14% styrene	20%	30%	45%	65%
Styrene-isoprene- styrene (Eastman) 17% styrene	22%	39%	67%	78%
Styrene-isoprene- styrene (Eastman) 22% styrene	36%	43%	64%	86%
Polystyrene	9%	9%	9%	9%
Infuse™ (Dow 9807)	20%	30%	40%	55%
Affinity™ (Ethylene- octene-1)	24%	35%	53%	71%
Kraton (styrene- butadiene-styrene, 30% styrene)	8%	8%	8%	8%

As shown in Table 7 above, the block polystyrene-block-polyisoprene-block-polystyrene copolymers provided the highest amount of engine oil absorption.

Example 14: Oil and Water Absorption for Thermoplastic Elastomeric Copolymer and

5 Superabsorbent Material Composition

A thermoplastic elastomeric copolymer was mixed with a superabsorbent material (polystyrene-polyisoprene-polystyrene, 22% styrene, with HySorb® 8760D, BASF) at a ratio of 70:30 wt/wt and was melt pressed into a thin film using a hot plate press (Atlas Press) at approximately 380°F. Small discs were cut from the film (5cm in diameter, 0.2 g) and were placed into excess oil (Chevron 10W30 SAE80, engine oil) (Table 8) and excess water (Table 9) for the specified time periods as noted in Tables 8 and 9 below, removed from the water, blotted, and their weight was re-measured, being shown as a percentage increase from initial weight.

Table 8: Oil

Sample	Weight after 1 min.	Weight after 2 mins.	Weight after 5 mins.	Weight after 10 mins.
Styrene-isoprene- styrene (Eastman) 22% styrene + HySorb® 8760D	36%	43%	64%	86%

Table 9: Water

Sample	Weight after 1 min.	Weight after 2 mins.	Weight after 5 mins.	Weight after 10 mins.
Styrene-isoprene- styrene (Eastman) 22% styrene + HySorb® 8760D	21%	75%	144%	190%

Comparing the sample in Table 8 to Table 7, the addition of the superabsorbent material did not have an effect on the absorption characteristics of oil. However, the water absorption intake and capacity was significantly increased, as shown in Table 9.

5 Example 15: Application of Thermoplastic Elastomeric Copolymer, Solvent, and Superabsorbent Material Composition as a Coating on a Wipe – Oil and Water Absorption

A thermoplastic elastomeric copolymer was mixed with a superabsorbent material (polystyrene-polyisoprene-polystyrene, 22% styrene, with HySorb® 8760D, BASF). This was accomplished by dissolving 6g of the thermoplastic elastomeric copolymer in 60 mL of a solvent (dimethoxymethane) and then adding 3g of the superabsorbent material. The composition was applied to X-60 Hydroknit wipes by a dip and squeeze technique by dipping the X-60 Hydroknit wipes into the composition and then running the dipped wipes through an Atlas Wringer with 25lb of nip pressure. Thereafter, the wipes were allowed to air dry in a fume hood until dry to the touch. Samples of the coated wipes were then cut and the water absorption and capacity testing described above with respect to Example 14 was conducted and were compared against the absorption results of a control X-60 Hydroknit wipe. The results of this testing are shown in Table 10 (oil - Chevron 10W30 SAE80) and Table 11 (water) below, with the weight percentage of the wipes being as a percentage increase from the initial weight of the wipe prior to being put in the oil or water.

Table 10: Oil

Sample	Weight after 1 min.	Weight after 2 mins.	Weight after 5 mins.	Weight after 10 mins.
X-60 Hydroknit wipe (Control)	100%	100%	100%	100%
X-60 Hydroknit wipe with composition coating	136%	143%	164%	186%

Table 11: Water

Sample	Weight after 1 min.	Weight after 2 mins.	Weight after 5 mins.	Weight after 10 mins.
X-60 Hydroknit wipe (Control)	100%	100%	100%	100%
X-60 Hydroknit wipe with composition coating	121%	175%	244%	290%

As illustrated in the results of the testing shown in Tables 10 and 11 above, the X-60 Hydroknit wipe with the coating composition absorbed significantly more quickly and had significantly higher absorption capacities for both oil and water than did the control X-60 Hydroknit wipes. For example, the wipes with the coating composition had an absorbent capacity that was 86% greater than the

Example 16: Mixture of Thermoplastic Elastomeric Copolymer, a Solvent, and a Superabsorbent Material

A composition including 6gram polystyrene-polyisoprene-polystyrene (14% styrene) in 60mL of dimethoxymethane along with 8ml of polyacrylic acid oligomer (oligomeric superabsorbent material) in water (32%wt/wt. solids, pursuant to 6,849,685 to Soerens et al.) was mixed to form an emulsion which was then a) sprayed (32oz heavy duty spray bottle, Rubbermaid) and also b) brushed (1.5" nylon/polyester paint brush, Purdy XL, Portland OR) onto an aluminum metal surface and also 6"x6" samples 0.9osy through-air bonded carded web ("TABCW") non-woven and allowed to air dry. The spray coating gave a 17%wt/wt coating and the brush application gave 32%wt/wt coating. The sprayed and brushed coatings on the metal plate could be peeled off in one sheet without ripping or breaking. The coated non-woven fabric samples were cut in half and placed in beakers of motor oil and water and allowed to soak for sixty minutes at ambient temperature. The samples were then removed, blotted between paper towels and reweighed similar to procedures discussed above. Table 12 below shows the results.

Table 12:

Sample	Weight gain of sample in motor oil	Water gain of sample in water
Control non-woven	105%	120%
Spray coated non-woven	317%	1221%
Brush coated non-woven	620%	2008%

As shown in Table 12, the spray coated non-woven sample and the brush coated non-woven sample absorbed significantly more motor oil and water than the control non-woven sample.

Example 17: Oil and Water Absorption for Hot Melt Adhesive including a Superabsorbent

5 Material

Additional testing was completed to test for the absorption and capacity of a hot melt adhesive that included superabsorbent material (HB Fuller HydroLock™ FC-9230-N). The hot melt adhesive was pressed into thin film samples, and then placed into engine oil (Chevron 10W30 SAE80) and water, similar to the testing described above with respect to examples 14 and 15. The results are shown in Table 13 (oil - Chevron 10W30 SAE80) and Table 14 (water) below.

Table 13: Oil

Sample	Weight after 1 min.	Weight after 2 mins.	Weight after 5 mins.	Weight after 10 mins.
HB Fuller Hydro Lock FC-9230-N	3.0%	3.5%	3.5%	5.0%

Table 14: Water

Sample	Weight after 1 min.	Weight after 2 mins.	Weight after 5 mins.	Weight after 10 mins.
HB Fuller Hydro Lock FC-9230-N	43%	69%	76%	124%

As can be seen by comparing the results of the hot melt adhesive including the superabsorbent material from Tables 13 and 14 with the results of the composition including a thermoplastic elastomeric copolymer, a solvent, and a superabsorbent material of Tables 8 and 9 of Example 14, the hot melt adhesive including a superabsorbent material (HB Fuller Hydro Lock FC-

9230-N) provided significantly reduced kinetic absorption characteristics and significantly reduced absorbent capacity with respect to oil. For example, the hot melt adhesive (HB Fuller Hydro Lock FC-9230-N) only provided a 3.0% increase in weight due to absorption of oil after one minute and a 5.0% increase in weight due to absorption of oil after ten minutes whereas the composition including a thermoplastic elastomeric copolymer, a solvent, and a superabsorbent material of Example 14 provided a 36% increase in weight due to absorption of oil after one minute and an 86% increase in weight due to absorption of oil after 10 minutes. Due to the low kinetic absorption and absorbent capacity, the hot melt adhesive including a superabsorbent material (HB Fuller Hydro Lock FC-9230-N) would not be suitable.

10 Additionally, the hot melt adhesive including a superabsorbent material (HB Fuller Hydro Lock FC-9230-N) also provided a significantly reduced absorbent capacity with respect to water. The hot melt adhesive only provided a 124% increase in weight due to absorption of water after ten minutes whereas the composition including a thermoplastic elastomeric copolymer, a solvent, and a superabsorbent material of Example 14 provided a 190% increase in weight due to absorption of water after ten minutes.

 Due to the low kinetic absorption and absorbent capacity, the hot melt adhesive including a superabsorbent material (HB Fuller Hydro Lock FC-9230-N) would not be suitable for a dual use environment including oil and water. However, from these results, it can be seen that the composition including a thermoplastic elastomeric copolymer and a superabsorbent material, such as in Example 14, can be suitable for absorbing both oil and water.

Embodiments:

Embodiment 1: A composition comprising: a thermoplastic elastomeric copolymer; a superabsorbent material; and a solvent, the thermoplastic elastomeric copolymer being dissolved in the solvent.

Embodiment 2: The composition of embodiment 1, wherein the thermoplastic elastomeric copolymer is oleophilic.

Embodiment 3: The composition of embodiment 1 or embodiment 2, wherein the thermoplastic elastomeric copolymer is selected from the group consisting of: polystyrene-polyisoprene-polystyrene, polystyrene-block-polybutadiene-block-polystyrene, polystyrene-block-poly(ethylene-ran-polybutylene)-block-polystyrene, polystyrene-block-polybutadiene-block-polystyrene, alpha-methylstyrene-vinyltoluene-copolymer, and ethylene-octene-1 copolymer.

Embodiment 4: The composition of any one of the preceding embodiments, wherein the thermoplastic elastomeric copolymer is polystyrene-polyisoprene-polystyrene.

Embodiment 5: The composition of embodiment 4, wherein a styrene content of the polystyrene-polyisoprene-polystyrene is at least about 10%.

Embodiment 6: The composition of embodiment 4, wherein a styrene content of the polystyrene-polyisoprene-polystyrene is no greater than about 25%.

- 5 Embodiment 7: The composition of any one of the preceding embodiments, wherein the solvent is selected from the group consisting of: mineral spirits, methylethylketone, toluene, p-xylene, tetrahydrofuran, and dimethoxymethane.

Embodiment 8: The composition of any one of the preceding embodiments, wherein the superabsorbent material comprises between about 5% to about 50% by weight of the composition.

- 10 Embodiment 9: The composition of any one of embodiments 1-7, wherein a weight percentage of the thermoplastic elastomeric copolymer by weight of the composition is at least 50% greater than a weight percentage of the superabsorbent material by weight of the composition.

Embodiment 10: A non-woven substrate comprising: a non-woven material comprising a plurality of fibers; and a composition applied to the non-woven material, the composition comprising: a

- 15 thermoplastic elastomeric copolymer; a superabsorbent material; and a solvent.

Embodiment 11: The non-woven substrate of embodiment 10, wherein the thermoplastic elastomeric copolymer is oleophilic.

Embodiment 12: The non-woven substrate of embodiment 10 or embodiment 11, wherein the thermoplastic elastomeric copolymer is selected from the group consisting of: polystyrene-

- 20 polyisoprene-polystyrene, polystyrene-block-polybutadiene-block-polystyrene, polystyrene-block-poly(ethylene-ran-polybutylene)-block-polystyrene, polystyrene-block-polybutadiene-block-polystyrene, alpha-methylstyrene-vinyltoluene-copolymer, and ethylene-octene-1 copolymer.

Embodiment 13: The non-woven substrate of any one of embodiments 10-12, wherein the thermoplastic elastomeric copolymer is polystyrene-polyisoprene-polystyrene.

- 25 Embodiment 14: The non-woven substrate of any one of embodiments 10-13, wherein the solvent is selected from the group consisting of: mineral spirits, methylethylketone, toluene, p-xylene, tetrahydrofuran, and dimethoxymethane.

Embodiment 15: The non-woven substrate of any one of embodiments 10-14, further comprising a tackifier.

- 30 Embodiment 16: A method of removing oil or water from a surface, the method comprising: providing a composition, the composition including a thermoplastic elastomeric copolymer, a superabsorbent

material, and a solvent, the thermoplastic elastomeric copolymer being dissolved in the solvent; applying the composition to the surface to absorb the oil or water; and removing the composition from the surface to remove the absorbed oil or water.

5 Embodiment 17: The method of embodiment 16, wherein the composition is provided as a coating on a non-woven material of a non-woven substrate, and wherein applying the composition to the surface to absorb the oil or water and removing the composition from the surface to remove the absorbed oil or water involves wiping the surface with the non-woven substrate.

10 Embodiment 18: The method of embodiment 16, wherein the composition is provided in a liquid form, the method further comprising: allowing the composition to dry after the composition is applied to the surface to form a thermoplastic elastomeric film; and wherein the composition is removed from the surface by peeling the thermoplastic elastomeric film from the surface.

15 Embodiment 19: The method of any one of embodiments 16-18, wherein the thermoplastic elastomeric copolymer is selected from the group consisting of: polystyrene-polyisoprene-polystyrene, polystyrene-block-polybutadiene-block-polystyrene, polystyrene-block-poly(ethylene-ran-polybutylene)-block-polystyrene, polystyrene-block-polybutadiene-block-polystyrene, alpha-methylstyrene-vinyltoluene-copolymer, and ethylene-octene-1 copolymer.

Embodiment 20: The method of any one of embodiments 16-19, wherein the solvent is selected from the group consisting of: mineral spirits, methylethylketone, toluene, p-xylene, tetrahydrofuran, and dimethoxymethane.

20 When introducing elements of the present disclosure or the preferred embodiment(s) thereof, the articles "a", "an", "the" and "said" are intended to mean that there are one or more of the elements. The terms "comprising", "including" and "having" are intended to be inclusive and mean that there may be additional elements other than the listed elements. Many modifications and variations of the present disclosure can be made without departing from the spirit and scope thereof. Therefore, the
25 exemplary embodiments described above should not be used to limit the scope of the invention.

WHAT IS CLAIMED IS:

1. A composition comprising:

a thermoplastic elastomeric copolymer;

a superabsorbent material; and

5 a solvent, the thermoplastic elastomeric copolymer being dissolved in the solvent.
2. The composition of claim 1, wherein the thermoplastic elastomeric copolymer is oleophilic.
3. The composition of claim 1 or claim 2, wherein the thermoplastic elastomeric copolymer is
selected from the group consisting of: polystyrene-polyisoprene-polystyrene, polystyrene-
block-polybutadiene-block-polystyrene, polystyrene-block-poly(ethylene-ran-polybutylene)-
10 block-polystyrene, polystyrene-block-polybutadiene-block-polystyrene, alpha-methylstyrene-
vinyltoluene-copolymer, and ethylene-octene-1 copolymer.
4. The composition of claim 1 or claim 2, wherein the thermoplastic elastomeric copolymer is
polystyrene-polyisoprene-polystyrene.
5. The composition of claim 4, wherein a styrene content of the polystyrene-polyisoprene-
15 polystyrene is at least about 10%.
6. The composition of claim 4, wherein a styrene content of the polystyrene-polyisoprene-
polystyrene is no greater than about 25%.
7. The composition of claim 1 or claim 2, wherein the solvent is selected from the group
consisting of: mineral spirits, methylethylketone, toluene, p-xylene, tetrahydrofuran, and
20 dimethoxymethane.
8. The composition of claim 1 or claim 2, wherein the superabsorbent material comprises
between about 5% to about 50% by weight of the composition.
9. The composition of claim 1 or claim 2, wherein a weight percentage of the thermoplastic
elastomeric copolymer by weight of the composition is at least 50% greater than a weight
25 percentage of the superabsorbent material by weight of the composition.

10. A non-woven substrate comprising:

a non-woven material comprising a plurality of fibers; and

a composition applied to the non-woven material, the composition comprising:

a thermoplastic elastomeric copolymer;

5 a superabsorbent material; and

a solvent.

11. The non-woven substrate of claim 10, wherein the thermoplastic elastomeric copolymer is oleophilic.

10 12. The non-woven substrate of claim 10 or claim 11, wherein the thermoplastic elastomeric copolymer is selected from the group consisting of: polystyrene-polyisoprene-polystyrene, polystyrene-block-polybutadiene-block-polystyrene, polystyrene-block-poly(ethylene-ran-polybutylene)-block-polystyrene, polystyrene-block-polybutadiene-block-polystyrene, alpha-methylstyrene-vinyltoluene-copolymer, and ethylene-octene-1 copolymer.

15 13. The non-woven substrate of claim 10 or claim 11, wherein the thermoplastic elastomeric copolymer is polystyrene-polyisoprene-polystyrene.

14. The non-woven substrate of claim 10, wherein the solvent is selected from the group consisting of: mineral spirits, methylethylketone, toluene, p-xylene, tetrahydrofuran, and dimethoxymethane.

15. The non-woven substrate of claim 10 or claim 11, further comprising a tackifier.

20 16. A method of removing oil or water from a surface, the method comprising:

providing a composition, the composition including a thermoplastic elastomeric copolymer, a superabsorbent material, and a solvent, the thermoplastic elastomeric copolymer being dissolved in the solvent;

applying the composition to the surface to absorb the oil or water; and

25 removing the composition from the surface to remove the absorbed oil or water.

17. The method of claim 16, wherein the composition is provided as a coating on a non-woven material of a non-woven substrate, and wherein applying the composition to the surface to absorb the oil or water and removing the composition from the surface to remove the absorbed oil or water involves wiping the surface with the non-woven substrate.
- 5 18. The method of claim 16, wherein the composition is provided in a liquid form, the method further comprising:
- allowing the composition to dry after the composition is applied to the surface to form a thermoplastic elastomeric film; and
- wherein the composition is removed from the surface by peeling the thermoplastic
- 10 elastomeric film from the surface.
19. The method of any one of claims 16-18, wherein the thermoplastic elastomeric copolymer is selected from the group consisting of: polystyrene-polyisoprene-polystyrene, polystyrene-block-polybutadiene-block-polystyrene, polystyrene-block-poly(ethylene-ran-polybutylene)-block-polystyrene, polystyrene-block-polybutadiene-block-polystyrene, alpha-methylstyrene-
- 15 vinyltoluene-copolymer, and ethylene-octene-1 copolymer.
20. The method of any one of claims 16-18, wherein the solvent is selected from the group consisting of: mineral spirits, methylethylketone, toluene, p-xylene, tetrahydrofuran, and dimethoxymethane.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/064426**A. CLASSIFICATION OF SUBJECT MATTER****C08L 23/10(2006.01)i, C08L 53/02(2006.01)i, D04H 1/72(2006.01)i, A47L 13/16(2006.01)i, C09D 125/10(2006.01)i, C09D 153/02(2006.01)i, C09D 7/12(2006.01)i**

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)

C08L 23/10; A61F 13/53; B32B 5/26; D04H 1/64; B05C 5/02; C02F 1/40; E02B 15/04; D04H 5/02; A61K 33/38; A61K 33/34; C08L 53/02; D04H 1/72; A47L 13/16; C09D 125/10; C09D 153/02; C09D 7/12

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: nonwoven, SIS tri-block, superabsorbent, water, oil

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009-0036014 A1 (TORRES, MANEL et al.) 05 February 2009 See paragraphs [0026], [0028], [0044], [0046], [0053], [0089]-[0090], and [0123]; and claims 1-4, 7, 14, and 17.	1-15
Y		16-20
Y	US 4832852 A (WELLS, GARY G. et al.) 23 May 1989 See claim 1.	16-20
A	US 2012-0328862 A1 (FUKUDOME, SHINYA et al.) 27 December 2012 See paragraph [0047]; and claim 1.	1-20
A	WO 00-31331 A1 (KIMBERLY-CLARK CORPORATION, INC.) 02 June 2000 See claims 1, 9, and 11-13.	1-20
A	US 2010-0233273 A1 (BURTON, SCOTT A. et al.) 16 September 2010 See claims 1 and 19.	1-20



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

17 March 2017 (17.03.2017)

Date of mailing of the international search report

17 March 2017 (17.03.2017)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea

Facsimile No. +82-42-481-8578

Authorized officer

CHO, Han Sol

Telephone No. +82-42-481-5580



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2016/064426

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009-0036014 A1	05/02/2009	AT 501293 T EP 1910600 A1 EP 1910600 B1 ES 2362673 T3 PT 1910600 E US 8088315 B2 WO 2007-000599 A1	15/03/2011 16/04/2008 09/03/2011 11/07/2011 27/06/2011 03/01/2012 04/01/2007
US 4832852 A	23/05/1989	EP 0287264 A3	07/03/1990
US 2012-0328862 A1	27/12/2012	AU 2010-342024 A1 AU 2010-342024 B2 CN 102711697 A DK 2524678 T3 EP 2524678 A1 EP 2524678 A4 EP 2524678 B1 ES 2539727 T3 JP 5755151 B2 KR 10-2012-0115542 A TW 201134505 A TW I478736 B WO 2011-086841 A1	21/07/2011 28/05/2015 03/10/2012 20/04/2015 21/11/2012 20/11/2013 08/04/2015 03/07/2015 29/07/2015 18/10/2012 16/10/2011 01/04/2015 21/07/2011
WO 00-31331 A1	02/06/2000	AU 2000-16164 B2 BR 9916886 A BR 9916886 B1 CN 1222649 C CN 1367850 A EP 1144744 A1 EP 1144744 B1 JP 2002-539336 A JP 4778614 B2 KR 10-0722889 B1 RU 2227185 C2 US 6362389 B1 ZA 200103711 A	29/05/2003 16/07/2002 05/05/2009 12/10/2005 04/09/2002 17/10/2001 06/01/2010 19/11/2002 21/09/2011 30/05/2007 20/04/2004 26/03/2002 05/06/2002
US 2010-0233273 A1	16/09/2010	AT 546169 T AU 2004-296818 A1 AU 2004-296818 B2 CA 2548128 A1 CN 100540070 C CN 1901946 A EP 1689456 A1 EP 1689456 B1 JP 2007-513252 A KR 10-2006-0123419 A US 2005-0124724 A1	15/03/2012 23/06/2005 01/07/2010 23/06/2005 16/09/2009 24/01/2007 16/08/2006 22/02/2012 24/05/2007 01/12/2006 09/06/2005

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2016/064426Patent document
cited in search reportPublication
datePatent family
member(s)Publication
date

US 7745509 B2	29/06/2010
US 8193267 B2	05/06/2012
WO 2005-056070 A1	23/06/2005
ZA 200605529 A	27/12/2007