(54) Title: FOLDED SUBSTRATE WITH APPLIED CHEMICALS

(57) Abstract: A chemical is applied to a substrate in discrete areas, and then the substrate is folded in such a manner as to cause the discrete chemical areas to become interior surfaces after folding to reduce or eliminate chemical residues when the exterior surfaces of the substrate contact other surfaces or objects. By applying the chemical to discrete areas of the substrate, degradation or delamination of the substrate can also be minimized or reduced. Additionally, by including either a chemical free edge strip, a chemical free fold strip, or both further improvements in dispensing, preventing delamination, or reduced residue transfer are possible.
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FOLDED SUBSTRATE WITH APPLIED CHEMICALS

BACKGROUND

Often chemicals are applied to substrates to enhance their functionality. A wide variety of chemicals or lotions can be applied to a substrate, which is then folded and packaged for sale. For example, a surfactant can be applied to a nonwoven substrate and then the substrate dried of any moisture. The resulting wipe is suitable for cleaning surfaces, human skin, or hair, and eliminates the need to separately apply cleansers to the wipe prior to using, since the wipe is ready for use after wetting with water.

However, the chemical applied to the surface of the substrate may leave a residue on a person’s skin or hands when handling the wipe. For example, removing a wipe from a larger package to take along for future use can leave an undesirable residue on hands. Furthermore, the chemical can leave a residue on other objects such as diaper bags or purses where an individual wipe may be placed after being removed from a larger package for future use. Therefore, a need exists for a substrate having an applied chemical that does not leave a residue during handling or contact with other objects and surfaces.

Additionally, the chemical applied to the substrate may interfere with proper dispensing of the substrate. For example, the chemicals applied to the wipe may have a slippery or oily feel that can make grabbing and removing an individual wipe difficult since the chemical can interfere with obtaining a good grip on the substrate. Other chemicals may have a tacky or sticky effect that can cause blocking where the individual wipes become stuck together interfering with proper dispensing. Therefore, a need exists for a substrate having an applied chemical that does not interfere with proper dispensing of the substrate.

Additionally, the chemical applied to the substrate may degrade the substrate in an unacceptable manner. For example, many substrates are laminates of two or more layers held together by an appropriate fastening means such as thermal bonding, adhesive/chemical, or other physical bonding, ultrasonic bonding or combinations thereof. The chemical applied to the wipe may degrade the adhesive weakening the bond strength or causing the substrate’s layers to delaminate. Additionally, the applied chemical may change the surface texture of
the substrate. For example, the chemical when coated onto the substrate may reduce or eliminate a desirable texture of the substrate. Therefore, a need exists for a substrate having an applied chemical that minimizes degradation of the substrate.

SUMMARY

The inventors have discovered that if the chemical is applied to the substrate in discrete areas and then the substrate is folded in such a manner as to cause the discrete chemical areas to become interior surfaces after folding, chemical residues from the substrate can be minimized or eliminated. Furthermore, the inventors have discovered that by applying the chemical to discrete areas of the substrate, degradation of the substrate can be minimized or reduced. Additionally, the inventors have discovered that by including either a chemical free edge strip or a chemical free fold strip, or both, further improvements in dispensing, preventing delamination, or residue reduction are possible.

Hence, in one aspect, the invention resides in a product comprising: a substrate having a first and a second opposing sides; a discrete chemical area applied onto, adjacent to, or impregnated into either the first or the second opposing side; a chemical free edge strip on either the first or the second opposing sides; and wherein the substrate is folded such that after folding the discrete chemical area becomes an interior surface.

In another aspect, the invention resides in a product comprising: a substrate having a first and a second opposing sides; a discrete chemical area applied onto, adjacent to, or impregnated into either the first or the second opposing side; a chemical free fold strip; and wherein the substrate is folded along the chemical free fold strip forming a folded edge.

In yet another aspect, the invention resides in a product comprising: a plurality of individual folded substrates having a first side, a second side, and at least one interior surface created by folding; a discrete chemical area applied onto, adjacent to, or impregnated into the interior surface; and wherein the exterior surfaces of the folded substrate are free of the applied chemical.
BRIEF DESCRIPTION OF THE DRAWINGS

The above aspects and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims, and accompanying drawings in which:

Figure 1 illustrates one embodiment of the invention.
Figure 2 illustrates the substrate of Figure 1 partially folded.
Figure 3 illustrates the embodiment of Figure 1 completely folded.
Figure 4 illustrates another embodiment of the invention.
Figure 5 illustrates the substrate of Figure 4 partially folded.
Figure 6 illustrates a package containing a plurality of folded substrates.
Figure 7 illustrates another embodiment of the invention partially folded.
Figure 8 illustrates another embodiment of the invention partially folded.
Figure 9 illustrates another embodiment of the invention.

Repeated use of reference characters in the specification and drawings is intended to represent the same or analogous features or elements of the invention.

DEFINITIONS

As used herein forms of the words "comprise", "have", and "include" are legally equivalent and open-ended. Therefore, additional non-recited elements, functions, steps or limitations may be present in addition to the recited elements, functions, steps, or limitations.

As used herein "substrate" is a flexible sheet or web material, which is useful for household chores, personal care, health care, food wrapping, and cosmetic application or removal. Non-limiting examples of suitable substrates of the present invention include nonwoven substrates, woven substrates, hydroentangled substrates, air-entangled substrates, paper substrates such as tissue, toilet paper, or paper towels, waxed paper substrates, coform substrates, wet wipes, film or plastic substrates such as those used to wrap food, and metal substrates such as aluminum foil. Furthermore, laminated or plied together multi-layer substrates of two or more layers of any of the preceding substrates are suitable.

Further examples of suitable substrates include a substantially dry substrate (less than 10% by weight of water) containing lathering surfactants and
conditioning agents either impregnated into or applied to the substrate such that wetting of the substrate with water prior to use yields a cleansing product. Such substrates are disclosed in U.S. patent 5,980,931 entitled *Cleansing Products Having A Substantially Dry Substrate* issued to Fowler et al. on November 9, 1999, and herein incorporated by reference in a manner consistent with the present disclosure.

Other suitable substrates may have encapsulated ingredients such that the capsules rupture during dispensing or use. Examples of encapsulated materials include those disclosed in U.S. patents 5,215,757 entitled *Encapsulated Materials* issued to El-Nokaly on June 1, 1993, and 5,599,555 entitled *Encapsulated Cometic Compositions* issued to El-Nokaly on February 4, 1997, and herein incorporated by reference in a manner consistent with the present disclosure.

Other suitable substrates include dry substrates that deliver liquid when subjected to in-use shear and compressive forces. Such substrates are disclosed in U.S. 6,121,165 entitled *Wet-Like Cleaning Articles* issued to Mackey et al. on September 19, 2000, and herein incorporated by reference in a manner consistent with the present disclosure.

As used herein "substantially dry" means that the substrate contains less than about 25 percent water as tested under ASTM D1744-92 entitled "Standard Test Method for Determination of Water in Liquid Petroleum Products by Karl Fischer Reagent" modified as follows: A 500 milligram ± 100 milligram sample is cut from the substrate and weighed on an analytical balance to the nearest 0.1 milligram. Adjust the size of the sample as needed to obtain the specified sample weight. Introduce the sample to the titration vessel and stir approximately 5 minutes to extract the water from the sample. After stirring the sample, titrate as described in the above test procedure and calculate the percent water as described in the above test procedure. In other embodiments of the invention, the substantially dry substrate can contain less than about 20 percent water, less than about 15 percent water, or less than about 10 percent water as tested above.

If the substrate is coated with a chemical or has variations in moisture content depending upon the sample location, a sufficient number of samples from all areas of the substrate should be tested and averaged together to establish within ± 1 percent the average moisture content for the entire substrate. For
example, if the chemical coating comprises 30 percent of the surface area of the substrate, numerous samples should be taken from the substrate in both the coated and non-coated areas and tested. To establish the average moisture content of the entire substrate, 30 percent of the samples used in the final average should be from the coated area and the remaining 70 percent of the samples used in the final average should be from the uncoated area.

**DETAILED DESCRIPTION**

It is to be understood by one of ordinary skill in the art that the present discussion is a description of exemplary embodiments only, and is not intended as limiting the broader aspects of the present invention, which broader aspects are embodied in the exemplary construction.

Referring now to Figure 1, one embodiment of a substrate 20 having a first 22 and a second 24 opposing surface with a chemical 26 either applied onto, adjacent to, or impregnated into the substrate is illustrated. The chemical is applied non-uniformly to the substrate such that it resides only in discrete areas with other discrete areas of the substrate free of the chemical. The chemical may be applied in a zoned application to the substrate that includes without limitation, strips; stripes; geometric figures such as squares, rectangles, circles, or dots; lines; wavy lines; or patches. In the illustrated embodiment, the chemical is applied in a first chemical strip 28 located on the first surface 22 and in a second chemical strip 30 located on the second surface 24 as illustrated by the dashed lines. One means of achieving a non-uniform chemical application is to slot coat the chemical onto the first and second sides of the substrate.

In one embodiment, the chemical is applied in such a manner as to leave a chemical free edge strip 31 present on the first and second surfaces. It is not necessary for the chemical free edge strip to run the entire length of the edge. For example, the chemical free edge strip could be intermittent along the edge with portions of the substrate adjacent the edge having the applied chemical and other portions free of the applied chemical.

One function or advantage of the chemical free edge strip is to provide a finger tab for grasping the substrate in order to open or remove the substrate from its packaging. By leaving at least a portion of the edge chemical free, it can be
easier to grasp or open the substrate, especially when the applied chemical causes the substrate to become slippery, wet, or oily to the touch. Additionally, if the applied chemical is prone to blocking or sticking to the other surface when folded, the chemical free edge strip provides a free surface to grab that is not stuck, adhered, or held down. Another function or advantage of the chemical free edge strip is to prevent or minimize delamination, also known as ply separation, of a multi-layer substrate. As mentioned, the applied chemical can sometimes interfere with the bonding between layers of a multi-layer substrate. By leaving at least a portion of the edges of the substrate chemical free, the individual layers are less likely to delaminate. Ensuring a strong bond between the layers of the multi-layer substrate at the edges lessens or eliminates complete delamination of the layers even when other portions of the substrate become delaminated.

In various embodiments of the invention, the width of the chemical free edge strip 31 can be about 1 mm wide or greater, about 5 mm wide or greater, about 10 mm wide or greater, between about 1 mm to about 50 mm wide, between about 5 mm to about 25 mm wide, or between about 10 mm to about 20 mm wide.

In various embodiments of the invention, the width of the chemical strip can be about 1 mm wide or greater, about 5 mm wide or greater, about 10 mm wide or greater, about 20 mm wide or greater, between about 1 mm to about 150 mm wide, between about 5 mm to about 100 mm wide, or between about 10 mm to about 50 mm wide.

Illustrated in Figure 1 is a plurality of fold axes 32 that mark where the substrate is folded upon itself after applying the chemical strips. Referring now to Figures 2 and 3, the substrate of Figure 1 is illustrated in a sequence of folding steps. As seen in Figure 2, the substrate is first folded into a Z fold such that the first and second chemical strips become interior surfaces 34 after folding the substrate. As such, the chemical is no longer exposed on either the first or second surfaces of the substrate after folding. By folding the substrate such that the chemical is hidden from the exterior surfaces of the folded substrate, the possibility of the chemical leaving a residue on surfaces, or hands is minimized or eliminated when handling or storing the substrate. Thus, an individual wipe can be removed from a package and placed directly into a purse or diaper bag without worrying
about the chemical leaving a residue or having to place the wipe into a plastic bag for storage.

Although not needed to hide the applied chemical, the substrate is then folded in half after Z folding as illustrated in Figure 3. The resulting folded substrate is approximately one-quarter the size of the original substrate before folding. The quarter fold, Z-folded substrate illustrated in Figure 3 is a convenient size for packaging and transport. Furthermore, the folded substrate is easily opened by simply grasping the chemical free edge strip 31 on an exterior folded panel 36 and shaking or allowing the weight of the substrate to open the other folds.

Referring now to Figures 4 and 5, an alternative embodiment of the invention is illustrated. Instead of two chemical strips, the substrate 20 has four chemical strips (two on the first side and two on the second side) where the chemical is applied. Similar to the embodiment of Figure 1, the substrate has an edge strip 31 on each side that is left chemical free. Additionally, the substrate has at least one chemical free fold strip 38 that is left chemical free. The fold strip coincides with one or more of the substrate’s fold axes 32. After folding as illustrated in Figure 5, the chemical free fold strip becomes a folded edge 40. As illustrated, the substrate can be folded along the chemical free fold strip such that the applied chemical becomes an interior surface after folding. The chemical free fold strip can help reduce chemical residue on surfaces that come into contact with the folded edge.

Referring now to Figure 6, a package 42 having a cover 44 and a body 46 is illustrated. In one embodiment, the package comprised a carton made from a paperboard or cardboard material. The package contains a plurality of folded substrates 20 having an applied chemical. The cover 44 includes a top 48 and a cover sidewall 50. The cover sidewall 50 in one embodiment includes four generally rectangular panels that intersect at approximately 90 degree angles. The body 46 includes a bottom 52, a body sidewall 54, and a clear window 56. The body sidewall 54 in one embodiment includes four generally rectangular panels that intersect at approximately 90 degree angles. The clear window 56 can be located anywhere in the package. In one embodiment, the clear window 56
spanned a corner of the body sidewall 54 such that a portion of the clear window was present on each of two intersecting panels of the body sidewall.

For an embodiment where the applied chemical after folding is not on the interior surfaces but instead resides on the exterior surfaces (not illustrated), it is still possible to have the edges of the substrate chemical free by use of the chemical free fold strip. Such an embodiment would help minimize any residue from the folded edges on the inside of a package containing a stack of several individual folded substrates. For example, if the package has a clear window for seeing into the interior of the package, the chemical free fold strip can prevent or minimize chemical residue being transferred onto the window that could reduce visibility through the window. Alternatively, the substrate can be folded with the applied chemical placed on an interior surface and placed into the package. If the applied chemical is prone to wicking through the substrate, the chemical free fold strip can prevent or minimize chemical residue on the window.

One of the functions or advantages of the chemical free fold strip is to further minimize or reduce the chances of the chemical leaving any residue on surfaces. For example, after folding, the individual substrates may be assembled into a stack, and the stack may be placed into a package such as a cardboard carton. During the folding process, the compressive forces exerted on the substrate can squeeze or transfer the chemical 26 from the interior surface 34 through the substrate to either the folded edge 40 or another portion of the exterior surface. When the folded substrate is placed into the carton, the folded edge can come into contact with the carton’s interior surfaces. If the applied chemical is prone to wicking or migration, the chemical can leach from the folded edge of the substrate into the cardboard and become visible on the carton’s interior surface, exterior surface, or clear window reducing the attractiveness of the packaging. A consumer may be hesitant to buy and/or use the packaged product with a stained interior, exterior, or window thinking the product is somehow damaged. By utilizing one or more chemical free fold strips 38 the problem is eliminated or reduced.

Another advantage of the chemical free fold strip is to minimize or reduce degradation of the substrate. For example, a plurality of chemical free fold strips can help prevent delamination of a multi-layer substrate by providing additional areas that are free of the applied chemical, which could interfere with bonding
between the layers. Additionally, leaving areas of the substrate free of the applied chemical can allow for a different texture or physical surface feel between the chemical free areas and the areas where the chemical has been applied. Depending on the nature of the applied chemical, it can be desirable to leave uncoated areas of the substrate adjacent or near coated areas of the substrate.

In various embodiments of the invention, the width of the chemical free fold strip can be about 1 mm wide or greater, about 5 mm wide or greater, about 10 mm wide or greater, between about 1 mm to about 50 mm wide, between about 5 mm to about 25 mm wide, or between about 10 mm to about 20 mm wide.

Referring now to Figure 7, an additional embodiment of the invention is illustrated. Rather than a Z-folded substrate, the substrate can be C-folded as illustrated to position the applied chemical to the interior surfaces 34. Thereafter, the substrate may be optionally folded in half to become approximately one-quarter the size of the original substrate.

Referring now to Figure 8, an additional embodiment of the invention is illustrated. Rather than a Z-folded substrate, the substrate can be V-folded, as illustrated, to position the applied chemical to the interior surfaces 34. Thereafter, the substrate may be optionally folded in half to become approximately one-quarter the size of the original substrate.

While the invention has been illustrated with C-, V-, and Z-folding and then optionally quarter-folding by folding the substrate in half, any manner of folding the substrate to hide the applied chemical from the exterior surfaces of the substrate after folding is possible. For example, after C-, V-, or Z-folding, the substrate could be folded three, four, or more times instead of just once in half as illustrated. Variations of C-, V-, or Z-folds are possible such that the folded portions of the substrate are not symmetrical after folding. For example, J- or S-folds are possible by changing the location of the fold axis.

Referring now to Figure 9, another embodiment of the invention is illustrated. In this embodiment, the applied chemical residing on the second side 24 and the fold axes 32 are not illustrated for clarity. In the illustrated embodiment, the chemical 26 is sprayed, coated, or printed in a discrete pattern onto both sides of the substrate 20 by using a mask, a grating, a printing roll, or other means to form four generally rectangular areas on each side of the substrate having the applied
chemical. Instead of rectangles, other geometric shapes can be used or simply irregularly shaped patches.

The applied chemical does not extend to the edges of the substrate, such that the chemical free edge strip 31 runs around the entire perimeter of both sides of the substrate. The quadrant placement of the discrete chemical areas also ensures that for each of the three fold axes, there is a chemical free fold strip 38 present. Thus, after folding, all of the substrate’s folded edges are unlikely to have any of the applied chemical present, reducing any chance of the chemical leaving a residue from contact with the folded edge. After applying the chemical to both the first and the second sides, the substrate can be folded as illustrated in Figures 2 and 3.

The chemical applied to the substrate can be any useful chemical or mixture of various chemicals that enhances the functionality of the substrate for its intended purpose. Possible chemical additives include, without limitation, strength additives, absorbency additives, softener additives, surfactant additives, conditioning additives, aesthetic additives such as fragrances or dyes. Other additives include, without limitation, anti-acne additives, antimicrobial additives, antifungal additives, antiseptic additives, antioxidants, cosmetic astringents, drug astringents, deodorants, detergents, emollients, external analgesics, binders, film formers, skin moisturizing ingredients as known in the art, opacifiers, skin conditioning agents, skin exfoliating agents, skin protectants, sunscreens, vapor rubs and the like. Suitable chemicals are disclosed in U.S. patent No. 5,400,403 issued to Troken et al. on Nov. 24, 1998, entitled Multi-Elevational Tissue Paper Containing Selectively Disposed Papermaking Additive, and herein incorporated by reference in a consistent manner. Additional suitable chemicals are disclosed in the previous incorporated references.

In one embodiment, the chemical applied to the substrate was a surfactant formulation comprising a concentrated (60 percent active ingredients) detergent system of a nonionic alkylpolyglucoside and zwitterionic amido betaine. High levels of a polyol, such as glycerin, allow the surfactant formulation to remain at a low viscosity for improved slot-coating capability during manufacturing. The lathering surfactants utilized in the surfactant formulation are Decyl Glucoside and Cocamidopropyl Betaine. Decyl Glucoside, from about 5 percent to about 40
percent of the total active ingredients of the surfactant formulation, is a mild, nonionic alkylpolyglycoside used for detergency and foam volume properties. Cocamidopropyl Betaine, from about 0.5 percent to about 25 percent of the total active ingredients of the surfactant formulation, is a high-foaming amphoteric detergent to deliver "quick" flash foam with minimal agitation upon dilution. Glycerin (a polyol), from about 0.5 percent to about 40 percent of the total active ingredients of the surfactant formulation, and PEG-7 Glyceryl Cocoate (a glyceryl ester), from about 0.5 percent to about 25 percent of the total active ingredients of the surfactant formulation, are both water-soluble conditioning agents or humectants/emollients designed to deliver moisture to the skin. Glycerin has a secondary function in the surfactant formulation as a diluent to lower the surfactant formulation's viscosity for improved slot-coating capability when applying the surfactant formulation to the substrate manufacturing. DMDM Hydantoin as a bactericide, about 0.4 percent of the total active ingredients of the surfactant formulation, and Iodopropynyl Butylcarbamate as a fungicide, about 0.03 percent of the total active ingredients of the surfactant formulation, act together as a preservative system for the surfactant formulation. A fragrance (Shaw Mudge 62526M) containing lavender and chamomile extracts, from about 0.1 percent to about 1 percent of the total active ingredients of the surfactant formulation, provides a lavender and chamomile baby scent. The remaining component was approximately 40 percent water, which serves as a diluent or solvent to keep the surfactant formulation in a pourable/pumpable, fluid state. Other formulations can comprise from about 30 percent to about 90 percent active ingredients with the balance water.

The chemical may be applied onto, adjacent to, or impregnated into the substrate by any means known in the art. The chemical may also be placed between or adjacent to any of the layers within a multi-layer substrate, or applied to or impregnated into any of the layers. The chemical may be applied to the substrate, the substrate folded, and then the substrate allowed to dry after being packaged. Since the chemical can be placed onto an interior surface after folding, it is not necessary to dry the substrate prior to either folding or packaging, saving a processing step. Alternatively, the substrate can be dried after the chemical is applied, folded, and then packaged.
Suitable chemical application methods include, but are not limited to, flexographic printing, rotogravure printing, offset printing, letterpress, direct gravure coating, offset gravure coating, reverse roll coating, flexographic coating, slot coating, dip coating, rod coating, knife coating, air knife coating, blade coating, slide coating, curtain coating, spraying, hot melt spraying, foam application, and extrusion. Further information on coating methods is disclosed in *Modern Coating and Drying*, Edward Cohen and Edgar Gutoff, 1992 VCH Publishers, Inc.

The chemical may be added or applied to the substrate in any effective amount. The addition rate will depend to some degree on the chemical being applied and the type of substrate that the chemical is applied to. In various embodiments of the invention, the chemical addition rate can be between about 1 percent to about 400 percent based on the substrate’s weight or between about 10 percent to about 200 percent based on the substrate’s weight.

**EXAMPLE 1**

A 115 gsm (grams per square meter) multi-layer substrate comprising three layers with an applied chemical was manufactured. Each of the substrate’s two outer surface layers comprised a 34.5 gsm coform material having 60 percent pulp fiber identified as CF405 fiberized southern softwood pulp available from Weyerhauser and 40 percent polymeric fibers identified as PF-015 polypropylene meltblown available from Basell. The substrate’s inner layer comprised a 23 gsm elastomeric material comprised of a mixture of polyethylene materials that are sold by Dow Chemical. Seventy percent (70%) of the inner layer comprised Dow Affinity XUS59400.03L, a metallocene-catalyzed polyethylene. Thirty percent (30%) of the inner layer comprised a mixture of 80 percent Dow Affinity XUS59400.03L, 15 percent Regalrez 1126 Tackifier, and 5 percent Dow DNDN 1077, a linear low density polyethylene.

The substrate’s outer surface layers and inner layer were laminated together. The inner layer is stretched by approximately 2.2 times its original length and then laminated to the outer layers using an embossing pattern. The multi-layer substrate is then allowed to retract approximately 30 percent to achieve a final basis weight of approximately 115 gsm. U.S. patent application 09/751,329 entitled *Composite Material With Cloth-Like Feel* filed on December 29, 2000, and herein incorporated by reference, provides more details on the process used to
make the multi-layer substrate. Another multi-layer substrate is disclosed in U.S. patent no. 4,720,415 entitled *Composite Elastomeric Material and Processing for Making the Same* issued to Vander Wielen et al. on January 19, 1988, and herein incorporated by reference.

After the substrate was made, the substrate was slot coated with four chemical strips (two on each side of the substrate) as shown in Figure 4. The substrate measured approximately 216 mm in width by 216 mm in length. The chemical free edge strips on the first and second opposing surfaces were approximately 12 mm wide. The four chemical strip widths measured approximately 36 mm wide. The chemical free fold strips between the chemical strips measured approximately 12 mm wide. The chemical free strip between the inner two chemical strips on opposite sides of the substrate was approximately 24 mm wide.

The above recited surfactant formulation was applied at a rate of about 4 grams per sheet. After slot coating, the substrate was folded as illustrated in Figure 5 and then quarter-folded as illustrated in Figure 3. The folded substrate was stacked with other identically prepared folded substrates. A stack of approximately fourteen (14) individually folded substrates was then packaged into a paperboard carton as illustrated in Figure 6. The folded substrates were allowed to dry due to evaporation occurring during manufacturing and from the carton after packaging. Due to either evaporation or by applying a reduced moisture content formulation, the coated substrate can be a substantially dry substrate for certain applications. If desired, the interior of the carton can be coated with a coating to make the carton more impervious to liquids during the drying phase or to provide increased resistance to the chemicals contained in the formulation.

The substrate produced by the above process is useful for a disposable washcloth. By placing the washcloth in water, the surfactant formulation is activated. The chemical free edge strip enabled ready dispensing by providing a chemical free edge to grab when removing the wipe. The folding method ensured that the applied chemical became interior surfaces, thereby reducing any chemical residue on hands or surfaces in contact with the wipe prior to activating the applied chemical. The chemical free fold strip further reduced any chemical residue on surfaces such as the interior surfaces, the exterior surfaces, or the clear window of
the paperboard carton used as a package. By folding the substrate with the applied chemical towards the interior surfaces, the chances of the individual folded substrates sticking together within the packaging were also minimized.

After slot coating with the applied surfactant formulation, the multi-layer substrate was tested for its delamination force as tested by the Small Angle Peel Test. In areas of the substrate having the applied chemical, the delamination force as tested below was determined to be approximately 2.5 g/cm. In areas of the substrate free of the applied surfactant formulation, the delamination force was determined to be approximately 45.4 g/cm. Even though the delamination force was found to be relatively low due to the applied surfactant formulation, the multi-layer substrate did not delaminate in use. The inventive chemical application pattern and utilization of the chemical free edge strips and fold strips helped to ensure that the multi-layer substrate remained intact during use.

**TEST METHODS**

Small Angle Peel Test

All testing is done in a standard laboratory atmosphere of 23 +/- 1°C and 50 +/- 2% relative humidity. All test specimens must be conditioned for at least 4 hours prior to testing.

The Small Angle Peel Test measures the amount of force required to delaminate one layer from another layer in a multi-layer substrate. The test is conducted by delaminating a portion of the substrate by hand, inserting a peel arm test fixture between the delaminated layers, and then measuring the peak force needed to further delaminate the substrate using a tensile tester. To determine the small angle peel force, a tensile tester is utilized such as a Sintech tensile tester manufactured by Sintech Inc., Research Triangle Park, N.C. 27709.

The peel arm test fixture is a C-shaped test fixture having an upper delaminating arm and a lower base leg that is constructed from 0.25" (6.35 mm) thick stainless steel. The base leg of the test fixture is 0.75" high (19.0 mm) by 3.5" long (88.9 mm). A small plate can be T welded to the top of the base leg to ensure that the test fixture is aligned parallel to the lower jaws of the tensile tester by resting the plate against the top of the jaws and then clamping the jaws together. The upper delaminating arm is 0.38" high (9.65 mm) by 4.25" long (108 mm).
upper delaminating arm is beveled for a length of 3.25" (82.6 mm) from its free end to a symmetric V shape with the point of the V facing the base leg. The overall height of the test fixture is 4.84" (122.9 mm) and the width of the vertical support bracket supporting the upper delaminating arm above and parallel to the base leg is 0.75" (19.05 mm).

Insert the peel arm test fixture into the lower jaws of the tensile tester ensuring that the upper delaminating arm is parallel to the upper jaw. The gage length between the upper arm and the upper jaws of the tensile tester is set to 1.0 inches (25.4 mm).

The test specimen is cut to 1.0 cm (0.4") in width along the machine direction. After cutting the test specimen, delaminate the test specimen by hand for about 1.5" (38.1 mm). If necessary to ensure that a test strip having the applied chemical and a chemical free test strip can be tested, a narrower test strip can be utilized. Ensure that the layer having the applied chemical is delaminated from the rest of the multi-layer substrate. In the event that multiple chemicals are applied to multiple layers, the force required to separate each layer from an adjacent layer is separately tested.

Place the test specimen into the tensile tester by clamping the delaminated portion in the upper jaws after inserting the upper delaminating arm of the test fixture between the separated layers. Calibrate the tensile tester and load cell according to the manufacturer’s directions. The maximum capacity of the load cell should be chosen such that the majority of the measured peak tensile values fall between 10% and 90% of the load cell’s capacity. Ensure that the crosshead speed of the tensile tester is set to 0.25 inch per minute (6.35 mm/min), the break sensitivity is set to 95%, and the extension limit high is set to 3.5 inches (88.9 mm).

During the test, the upper jaws of the tensile tester pull the test specimen upwards causing further delamination of the test specimen as it is split in two by the upper delaminating arm of the test fixture. The upper jaw moves a total of 3.5 inches (88.9 mm) while the force data from the load cell is measured. The maximum load for each specimen at the test speed during the 3.5 inches of delamination is determined using a data acquisition program having a sufficient sampling rate to accurately record the maximum load. At least five (5) or more samples are tested to obtain a reliable average for the maximum load.
delamination force is calculated by dividing the average maximum load in grams by the test specimen width in centimeters to obtain the average delamination force expressed in g/cm.

Other modifications and variations to the present invention may be practiced by those of ordinary skill in the art, without departing from the spirit and scope of the present invention, which is more particularly set forth in the appended claims. It is understood that aspects of the various embodiments may be interchanged in whole or part. All cited references, patents, or patent applications in the above application for letters patent are herein incorporated by reference in a consistent manner. In the event of inconsistencies or contradictions between the incorporated references and this application, the information present in this application shall prevail. The preceding description, given by way of example in order to enable one of ordinary skill in the art to practice the claimed invention, is not to be construed as limiting the scope of the invention, which is defined by the claims and all equivalents thereto.
CLAIMS

We Claim:

1. A product comprising:
   a substrate having a first and a second opposing sides;
   a discrete chemical area applied onto, adjacent to, or impregnated into
   either the first or the second opposing side;
   a chemical free edge strip on either the first or the second opposing sides;
   and
   wherein the substrate is folded such that after folding the discrete chemical
   area becomes an interior surface.

2. A product comprising:
   a substrate having a first and a second opposing sides;
   a discrete chemical area applied onto, adjacent to, or impregnated into
   either the first or the second opposing side;
   a chemical free fold strip; and
   wherein the substrate is folded along the chemical free fold strip forming a
   folded edge.

3. A product comprising:
   a plurality of individual folded substrates having a first side, a second side,
   and at least one interior surface created by folding;
   a discrete chemical area applied onto, adjacent to, or impregnated into
   areas of the substrate that become interior surfaces after folding; and
   wherein a discrete chemical area is not applied to areas of the substrate
   that become exterior surfaces after folding.

4. The product of claim 1, 2, or 3 wherein the discrete chemical area comprises
   a first chemical strip on the first side and a second chemical strip on the
   second side.

5. The product of claim 1, 2, or 3 wherein the discrete chemical area comprises
   at least two chemical strips on the first side and at least two chemical strips
   on the second side.
6. The product of claim 1, 2, or 3, wherein the discrete chemical area comprises a plurality of patches.

7. The product of claim 6 wherein the patches comprise four generally rectangular areas on the first side and four generally rectangular areas on the second side.

8. The product of claim 1, 2, or 3 wherein the substrate is C folded.

9. The product of claim 1, 2, or 3 wherein the substrate is Z folded.

10. The product of claim 9 wherein the substrate is folded in half after Z folding.

11. The product of claim 1 comprising:

   a first chemical strip on the first side;
   a second chemical strip on the second side;
   the chemical free edge strip adjacent each of the first and second chemical strips; and
   wherein the substrate is Z folded and then quarter folded such that the first and second chemical strips become interior surfaces.

12. The product of claim 2 comprising:

   two chemical strips on the first side separated by the chemical free fold strip;
   two chemical strips on the second side separated by the chemical free fold strip;
   two chemical free edge strips, with one of the chemical free edge strips adjacent each of the outer most chemical strips on the first and second sides; and
   wherein the substrate is Z folded along the chemical free fold strips and then the substrate is quarter folded such that all four chemical strips become interior surfaces.

13. The product of claim 1 wherein the substrate comprises a multi-layer substrate and the delamination force for the chemical free edge strip is greater than or equal to the delamination force for the discrete chemical area.

14. The product of claim 2 wherein the substrate comprises a multi-layer substrate and the delamination force for the chemical free fold strip is greater than or equal to the delamination force for the discrete chemical area.
15. The product of claim 1 wherein the width of the chemical free edge strip is between about 1 mm to about 50 mm wide.

16. The product of claim 2 wherein the width of the chemical free fold strip is between about 1 mm to about 50 mm.

17. The product of claim 1, 2, or 3 wherein the substrate is substantially dry.

18. The product of claim 1, 2, or 3 comprising a plurality of the folded substrates contained in a package comprising a clear window.

19. The product of claim 18 wherein the package comprises a carton having a cover and a body and the clear window is located in the body.

20. The product of claim 19 wherein the body comprises a body sidewall and a bottom, the body sidewall comprised of four generally rectangular panels intersecting at approximately 90 degree angles, and wherein the clear window spans a corner of the body sidewall such that a portion of the clear window is present on each of two intersecting panels of the body sidewall.
FIG. 9


**INTERNATIONAL SEARCH REPORT**

**US2004/029343**

A. CLASSIFICATION OF SUBJECT MATTER

| IPC | A61K7/00 | A61K7/48 |

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)

| IPC | A61K | B32B | D04H | A47K | C11D |

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

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

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Date of the actual completion of the international search

25 May 2005

Date of mailing of the international search report

06/06/2005

Name and mailing address of the ISA

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