

ABSORBENT ARTICLE HAVING SURFACE VISUAL TEXTURE

FIELD OF THE INVENTION

The present invention relates to absorbent articles. More particularly, the present
5 invention relates to a sanitary napkin having an improved surface visual texture.

BACKGROUND OF THE INVENTION

Absorbent articles such as sanitary napkins, pantliners, tampons, absorbent interlabial
devices, disposable diapers, incontinence products, and bandages are designed to absorb and
10 retain liquid and other discharges from the human body and to prevent body and clothing soiling.

Through the use of innovative topsheet materials, secondary topsheet materials, absorbent
gelling materials and breathable backsheets, the technology in absorbent articles, and particularly
sanitary napkins, has drastically advanced to provide women with products that absorb menses
and other fluids away from a woman's body. However, much of this technology is often hidden
15 and therefore not viewable by a user. Even when viewable, absorbent components often do not
readily or visually communicate to a user the existence of this enhanced technology.

Many different materials are used for the top surfaces of absorbent articles, such as
nonwovens and apertured films. A typical topsheet made of apertured polyethylene film has
been successfully used in sanitary articles and adult incontinence products. Such topsheets can
20 typically have a three dimensional texture that can be defined using techniques such as
profilometry to measure the relative elevation of any point on the surface.

One problem with such topsheets, however, is that the total amount of liquid capable of
passing through the topsheet under usual usage conditions depends on the amount of open area of
the apertures, which in turn depends upon the number, size, and shape of the individual
25 apertures. Exceptionally large apertures increase the liquid passage rate but pose the problem of
poor masking because liquids such as menses remain visible to the wearer through the apertures,
which is considered undesirable. In addition, large apertures promote a backflow of absorbed
liquid, so called rewet, which is also undesirable. Small individual apertures, on the other hand,
cannot provide the liquid passage characteristics required to let liquids of high viscosity and/or
30 solids content to pass through, resulting in too low a rate of liquid flow.

Certain absorbent articles can include a color signal that is visible from the top, or body-
facing, side of the absorbent article. Generally, the signal is viewed differently through the
apertured areas of the topsheet versus the non-apertured areas; however, the use of color

combined with aperture parameters visible from the top surface of a sanitary napkin that creates an improved visual texture of the surface has not previously been described. As such, there remains a need for absorbent articles having an improved visual texture.

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SUMMARY OF THE INVENTION

An absorbent article comprising an apertured topsheet having a body-facing side and a garment-facing side, a backsheet, an absorbent core positioned between the topsheet and the backsheet, and a colored area viewable through a topsheet by a user viewing the body-facing side is provided. The absorbent article comprises a visual texture composed of less than about 65 objects per cm^2 having an average mean areas greater than about 0.35 mm^2 .

Also provided is an absorbent article comprising an apertured topsheet having a body-facing side and a garment-facing side, a backsheet, an absorbent core positioned between the topsheet and the backsheet, and a colored area viewable through a topsheet by a user viewing the body-facing side. The absorbent article comprises a visual texture composed of less than less than about 55 objects per cm^2 of mean area dimension greater than about 0.35 mm^2

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a photograph of an absorbent article of the invention;

FIG. 2 is a 26x magnified image of the top surface of the absorbent article of FIG. 1;

10 FIG. 3 is a grayscale image of a portion of the top surface of the absorbent article of FIG. 1;

FIG. 4 is a thresholded image of the grayscale image of FIG. 3;

FIG. 5 is a photograph of an absorbent article;

FIG. 6 is a 26x magnified image of the top surface of the absorbent article of FIG. 5;

FIG. 7 is a grayscale image of a portion of the top surface of the absorbent article of FIG. 5;

15 FIG. 8 is a thresholded image of the grayscale image of FIG. 7;

FIG. 9 is a photograph of an absorbent article;

FIG. 10 is a 26x magnified image of the top surface of the absorbent article of FIG. 9;

FIG. 11 is a grayscale image of a portion of the top surface of the absorbent article of FIG. 9;

FIG. 12 is a thresholded image of the grayscale image of FIG. 11;

20 FIG. 13 is a photograph of an absorbent article;

FIG. 14 is a 26x magnified image of the top surface of the absorbent article of FIG. 13;

FIG. 15 is a grayscale image of a portion of the top surface of the absorbent article of FIG. 13;

FIG. 16 is a thresholded image of the grayscale image of FIG. 15;

FIG. 17 is a photograph of an absorbent article;

FIG. 18 is a 26x magnified image of the top surface of the absorbent article of FIG. 17;

FIG. 19 is a grayscale image of a portion of the top surface of the absorbent article of FIG. 17;

FIG. 20 is a thresholded image of the grayscale image of FIG. 19;

5 FIG. 21 is a photograph of an absorbent article;

FIG. 22 is a 26x magnified image of the top surface of the absorbent article of FIG. 21;

FIG. 23 is a grayscale image of a portion of the top surface of the absorbent article of FIG. 21;

FIG. 24 is a thresholded image of the grayscale image of FIG. 23;

FIG. 25 is a photograph of an absorbent article;

10 FIG. 26 is a 26x magnified image of the top surface of the absorbent article of FIG. 25;

FIG. 27 is a grayscale image of a portion of the top surface of the absorbent article of FIG. 25;

FIG. 28 is a thresholded image of the grayscale image of FIG. 27;

FIG. 29 is a photograph of an absorbent article;

FIG. 30 is a 26x magnified image of the top surface of the absorbent article of FIG. 29;

15 FIG. 31 is a grayscale image of a portion of the top surface of the absorbent article of FIG. 29;

FIG. 32 is a thresholded image of the grayscale image of FIG. 31;

FIG. 33 is a photograph of an absorbent article;

FIG. 34 is a 26x magnified image of the top surface of the absorbent article of FIG. 33;

FIG. 35 is a grayscale image of a portion of the top surface of the absorbent article of FIG. 33;

20 FIG. 36 is a thresholded image of the grayscale image of FIG. 35;

FIG. 37 is a photograph of an absorbent article;

FIG. 38 is a grayscale image of another example of the invention.

FIG. 39 is a thresholded image of the grayscale image of FIG. 38;

FIG. 40 is a magnified image of the topsheet of FIG. 37;

25 FIG. 41 is a magnified image of the topsheet of FIG. 1;

FIG. 42 is a magnified image of the topsheet of FIG. 5;

FIG. 43 is a magnified image of the topsheet of FIG. 37;

FIG. 44 is a magnified image of the topsheet of FIG. 1;

FIG. 45 is a magnified image of the topsheet of FIG. 5;

30 FIG. 46 is a perspective view of an absorbent article;

FIG. 47 is an enlarged partially segmented, perspective illustration of a resilient, three-dimensional, macroscopically expanded, fluid pervious, plastic web; and

FIG. 48 is field of view as described in Example 2.

DETAILED DESCRIPTION OF THE INVENTION

Absorbent articles having an improved visual texture are provided. Such improved absorbent articles can have fast liquid intake while maintaining the visual texture desirable for superior absorbent article. In certain embodiments, sanitary napkins having an improved surface texture that provides the benefits of large apertures in the topsheet while eliminating the problems associated with having large apertures on dryness during wear, are provided.

Generally, the visual texture of the absorbent article can depend upon both the patterns and designs of the colors used in the absorbent article and the patterns and designs formed in the top surface materials, including, for example, aperture size, aperture open area, sidewall height, sidewall collapse, sidewall opacity, land area, land opacity, microtexture on the land area and or apertured sidewalls, location and density of color on the various layers of the article, and amount of color visible through the apertures and other portions of the topsheet. The combination of these features can create a complex visual texture that is apparent upon viewing the surface of the napkin. As such, the visual texture can provide an integrated measure of the structural attributes of the top surface apertures and land areas, underlying absorbent characteristics, and the distance between the top surface and secondary layer that are visible upon viewing the top surface of the article.

In one embodiment, for macroscopically expanded film top surfaces, the visual texture depends upon the size of the aperture on the topside surface, the underside surface, and the side wall shapes. As a result, for some film formations, the top surface aperture size can be significantly greater than the amount of the absorbent core visible underneath the aperture.

The visual texture of an absorbent article also incorporates the effects of manufacturing on the article. For example, when apertured films are adhered to underlying absorbent materials by standard techniques, e.g., gluing or embossing, the aperture side walls may collapse and thereby change the apparent open diameter of the aperture. The amount of collapse may be different for different combining processing conditions.

Thus, the topsheet structure created results from multiple factors of material composition, color, opacity, conformation, and manufacturing process. Visual texture is a measure that integrates these factors to define a structure that provides the product performance features desired by consumers.

Accordingly, in certain embodiments, an absorbent article with a viewing surface comprising an apertured topsheet and colored areas visible through the viewing surface of the

topsheet providing a visual texture of less than about 65 objects per cm^2 having an average mean area greater than about 0.35 mm^2 is provided. In certain embodiments, an absorbent article with a viewing surface comprising an apertured topsheet and colored areas visible through the viewing surface of the topsheet providing a visual texture of less than about 50 objects per cm^2 of mean
5 area dimension greater than about 0.35 mm^2 is provided. Such improved visual texture can engender in a user the recognition of better protection and enhanced functioning.

"Absorbent articles" as referred to herein are primarily sanitary napkins, pantliners, or incontinence pads that are worn in the crotch region of an undergarment. It is even conceivable that baby diapers, adult incontinence diapers, and human waste management devices benefit from
10 the present invention even though they are conventionally not worn in conjunction with an undergarment.

The term 'color' as referred to herein include any non-white color, i.e., black, red, blue, violet, orange, yellow, green, and indigo as well as any declination thereof or mixture thereof. The term 'non-color' or 'non-colored' refers to the color white which is further defined as those
15 colors having an L^* value of at least 90, an a^* value equal to 0 ± 2 , and a b^* value equal to 0 ± 2 .

The term 'disposable' is used herein to describe absorbent articles that are not intended to be laundered or otherwise restored or reused as absorbent articles (i.e., they are intended to be discarded after a single use and, preferably to be recycled, composted or otherwise disposed of in an environmentally compatible manner).

20 The invention can be used in a variety of disposable absorbent articles, but is particularly useful in feminine hygiene products such as sanitary napkins and pantliners.

Figure 1 is a photograph of an absorbent article 10 of the invention. The absorbent article 10 herein has an upper surface, a lower surface and a periphery 12 comprising a topsheet 25 having a bottom surface and a viewing surface positioned opposite to the bottom surface. The
25 absorbent article comprises a topsheet 25, and an absorbent core 20. The absorbent core 20 has a top surface 21 and a bottom surface that is positioned opposite to the top surface. The absorbent core 20 is positioned between the topsheet 25 and a backsheet. The absorbent core 20 further comprises a colored portion 40 and a white portion 50. The colored portion 40 comprises of a first color 42 and a second color 44. Consumers desire the central region to be highly absorbent
30 and manufacturers of these products have learned that by locating darker colors for these regions, the performance of the product is highlighted.

Figure 2 is a magnified image of the main central fluid acquisition zone of the absorbent article. The web 11 is comprised of a continuum of fiber-like elements. The apertures 45 are

formed by a multiplicity of intersecting fiber-like elements, 46, 47, 48, 49 interconnected to one another in the first surface of the web. The intersecting fiber-like elements add texture to the surface of the web.

Figure 3 is a grayscale image of a portion of Figure 1. The image is converted to a gray
5 scale for the purposes of analysis.

Figure 4 is a threshold image of Figure 3. The image is converted for the purpose of analysis.

Figure 5 is a photograph of an absorbent article 110. The absorbent article 110 herein has an upper surface, a lower surface and a periphery 112 comprising a topsheet 125 having a bottom
10 surface and a viewing surface positioned opposite to the bottom surface. The absorbent article further comprises a topsheet 125, and an absorbent core 120. The absorbent core 120 has a top surface 121 and a bottom surface that is positioned opposite to the top surface. The absorbent core 120 is positioned between the topsheet 125 and a backsheet. The absorbent core 120 further comprises a colored portion 140 and a white portion 150. The colored portion 140 comprises of
15 a first color 142 and a second color 144.

Figure 6 is a magnified image of the main central fluid acquisition zone of the absorbent article. The web 111 contains multiple apertures 145.

Figure 7 is a grayscale image of a portion of Figure 5. The image is converted to a gray
scale for the purposes of analysis.

Figure 8 is a threshold image of Figure 7. The image is converted for the purpose of
20 analysis.

Figure 9 is a photograph of an absorbent article 210. The absorbent article 210 herein has an upper surface, a lower surface and a periphery 212 comprising a topsheet 225 having a bottom surface and a viewing surface positioned opposite to the bottom surface. The absorbent article
25 comprises a topsheet 225, and an absorbent core 220. The absorbent core 220 is positioned between the topsheet 225 and a backsheet. The absorbent core 220 further comprises a colored portion 240 and a white portion 250. The colored portion 240 comprises of a first color 242 and a second color 244.

Figure 10 is a magnified image of the main central fluid acquisition zone of the absorbent
30 article. The web 211 contains multiple apertures 245.

Figure 11 is a grayscale image of a portion of Figure 9. The image is converted to a gray scale for the purposes of analysis.

Figure 12 is a threshold image of Figure 11. The image is converted for the purpose of analysis.

Figure 13 is a photograph of an absorbent article 310. The absorbent article 310 herein has an upper surface, a lower surface and a periphery 312 comprising a topsheet 325 having a bottom surface and a viewing surface positioned opposite to the bottom surface. The absorbent article comprises a topsheet 325, and an absorbent core 320. The absorbent core 320 is positioned between the topsheet 325 and a backsheet. The absorbent core 320 further comprises a colored portion 340 and a white portion 350. The colored portion 340 comprises of a first color 342.

Figure 14 is a magnified image of the main central fluid acquisition zone of the absorbent article. The web 311 contains multiple apertures 345.

Figure 15 is a grayscale image of a portion of Figure 13. The image is converted to a gray scale for the purposes of analysis.

Figure 16 is a threshold image of Figure 15. The image is converted for the purpose of analysis.

Figure 17 is a photograph of an absorbent article 410. The absorbent article 410 herein has an upper surface, a lower surface and a periphery 412 comprising a topsheet 425 having a bottom surface and a viewing surface positioned opposite to the bottom surface. The absorbent article comprises a topsheet 425, and an absorbent core 420. The absorbent core 420 is positioned between the topsheet 425 and a backsheet. The absorbent core 420 further comprises a colored portion 440 and a white portion 450. The colored portion 440 comprises of a first color 442 and a second color 444.

Figure 18 is a magnified image of the main central fluid acquisition zone of the absorbent article. The web 411 contains multiple apertures 445.

Figure 19 is a grayscale image of a portion of Figure 17. The image is converted to a gray scale for the purposes of analysis.

Figure 20 is a threshold image of Figure 19. The image is converted for the purpose of analysis.

Figure 21 is a photograph of an absorbent article 510. The absorbent article 510 herein has an upper surface, a lower surface and a periphery 512 comprising a topsheet 525 having a bottom surface and a viewing surface positioned opposite to the bottom surface. The absorbent article comprises a topsheet 525, and an absorbent core 520. The absorbent core 520 is positioned between the topsheet 525 and a backsheet. The absorbent core 520 further comprises

a colored portion 540 and a white portion 550. The colored portion 540 comprises of a first color 542.

Figure 22 is a magnified image of the main central fluid acquisition zone of the absorbent article. The web 511 contains multiple apertures 545.

5 Figure 23 is a grayscale image of a portion of Figure 21. The image is converted to a gray scale for the purposes of analysis.

Figure 24 is a threshold image of Figure 23. The image is converted for the purpose of analysis.

10 Figure 25 is a photograph of an absorbent article 610. The absorbent article 610 herein has an upper surface, a lower surface and a periphery 612 comprising a topsheet 625 having a bottom surface and a viewing surface positioned opposite to the bottom surface. The absorbent article comprises a topsheet 625, and an absorbent core 620. The absorbent core 620 is positioned between the topsheet 625 and a backsheet. The absorbent core 620 further comprises a colored portion 640 and a white portion 650. The colored portion 640 comprises of a first color 15 642.

Figure 26 is a magnified image of the main central fluid acquisition zone of the absorbent article. The web 611 contains multiple apertures 645.

Figure 27 is a grayscale image of a portion of Figure 25. The image is converted to a gray scale for the purposes of analysis.

20 Figure 28 is a threshold image of Figure 27. The image is converted for the purpose of analysis.

Figure 29 is a photograph of an absorbent article 710. The absorbent article 710 herein has an upper surface, a lower surface and a periphery 712 comprising a topsheet 725 having a bottom surface and a viewing surface positioned opposite to the bottom surface. The absorbent 25 article comprises a topsheet 725, and an absorbent core 720. The absorbent core 720 is positioned between the topsheet 725 and a backsheet. The absorbent core 720 further comprises a colored portion 740 and a white portion 750. The colored portion 740 comprises of a first color 742.

30 Figure 30 is a magnified image of the main central fluid acquisition zone of the absorbent article. The web 711 contains multiple apertures 745.

Figure 31 is a grayscale image of a portion of Figure 29. The image is converted to a gray scale for the purposes of analysis.

Figure 32 is a threshold image of Figure 31. The image is converted for the purpose of analysis.

Figure 33 is a photograph of an absorbent article 810. The absorbent article 810 herein has an upper surface, a lower surface and a periphery 812 comprising a topsheet 825 having a bottom surface and a viewing surface positioned opposite to the bottom surface. The absorbent article comprises a topsheet 825, and an absorbent core 820. The absorbent core 820 is positioned between the topsheet 825 and a backsheet. The absorbent core 820 further comprises a colored portion 840 and a white portion 850. The colored portion 840 comprises of a first color 842.

Figure 34 is a magnified image of the main central fluid acquisition zone of the absorbent article. The web 811 contains multiple apertures 845.

Figure 35 is a grayscale image of a portion of Figure 33. The image is converted to a gray scale for the purposes of analysis.

Figure 36 is a threshold image of Figure 35. The image is converted for the purpose of analysis.

Figure 37 is a photograph of an absorbent article 910. The absorbent article 910 herein has an upper surface, a lower surface and a periphery 912 comprising a topsheet 925 having a bottom surface and a viewing surface positioned opposite to the bottom surface. The absorbent article comprises a topsheet 925, and an absorbent core 920. The absorbent core 920 is positioned between the topsheet 925 and a backsheet. The absorbent core 920 further comprises a colored portion 940 and a white portion 950. The colored portion 940 comprises of a first color 942 and a second color 944.

Figure 38 is a grayscale image of a portion of Figure 37. The image is converted to a gray scale for the purposes of analysis.

Figure 39 is a threshold image of Figure 38. The image is converted for the purpose of analysis.

One embodiment of a disposable absorbent article that uses the invention is the sanitary napkin 10 shown in FIG. 46. FIG. 46 provides a perspective view of the absorbent article 10. The absorbent article 10 herein has an upper surface, a lower surface and a periphery 12 comprising a topsheet 25 having a bottom surface and a viewing surface 28 positioned opposite to the bottom surface. The viewing surface 28 faces upwardly towards the upper surface of the absorbent article 10. The absorbent article 10 further comprises a backsheet having a garment facing

surface and a user facing surface positioned oppositely to the garment facing surface, the backsheet being joined to the topsheet 25.

The absorbent article 10 also comprises an absorbent core 20 having a top surface 21 and a bottom surface that is positioned opposite to the top surface 21. The absorbent core 20 is positioned between the topsheet 25 and the backsheet 15 and can have a perimeter 23. In the embodiment shown in FIG. 46, the absorbent article 10 has a colored portion 40 and a white portion 50. The colored portion 40 and the white portion 50 are viewable from the viewing surface 28 of the topsheet 25. In certain embodiments, the colored portion 40 can include two colors, a first color 42 and a second color 44. In some embodiments, the colored portion can include multiple colors.

The topsheet 24, the backsheet, and the absorbent core 20 can be assembled in a variety of well-known configurations, including, for example, configurations described generally in U.S. Pat. Nos. 4,321,924; 4,324,246; 4,342,314; 4,425,130; 4,463,045; 4,556,146; 4,589,876; 4,687,478; 4,950,264; 5,009,653; 5,267,992; 6,004,893; and Re. 32,649.

The backsheet and the topsheet can be secured together in a variety of ways. Adhesives manufactured by H. B. Fuller Company of St. Paul, Minn. under the designation HL-1258 or H-2031 have been found to be satisfactory. Alternatively, the topsheet and the backsheet can be joined to each other by heat bonding, pressure bonding, ultrasonic bonding, dynamic mechanical bonding, or a crimp seal. A fluid impermeable crimp seal can resist lateral migration ("wicking") of fluid through the edges of the product, inhibiting side soiling of the wearer's undergarments.

As is typical for sanitary napkins and the like, the sanitary napkin can have panty-fastening adhesive disposed on the garment-facing side of backsheet. The panty-fastening adhesive can be any of known adhesives used in the art for this purpose, and can be covered prior to use by a release paper, as is well known in the art. If flaps or wings are present, panty fastening adhesive can be applied to the garment facing side so as to contact and adhere to the underside of the wearer's panties.

The topsheet

To provide for softness next to the body, the topsheet can be formed from a soft, flexible, porous material that is non-irritating to the user's skin. The topsheet must be permeable to the body fluids to be collected by the article and thus, for a sanitary napkin, must be permeable to vaginal discharges.

Generally, topsheets for absorbent articles can be made from one or more of a wide range of materials such as woven and nonwoven materials; polymeric materials such as apertured

formed thermoplastic films, apertured plastic films, and hydroformed thermoplastic films; porous foams; reticulated foams; reticulated thermoplastic films; and thermoplastic scrims. Suitable woven and nonwoven materials can be comprised of natural fibers (e.g., wood or cotton fibers), synthetic fibers (e.g., polymeric fibers such as polyester, polypropylene, or polyethylene fibers) or from a combination of natural and synthetic fibers.

In certain embodiments, the topsheet can be a formed film topsheet. Suitable formed film topsheets are described in U.S. Pat. Nos. 3,929,135; 4,324,246; 4,342,314; 4,463,045; and 5,006,394. Other suitable topsheets are disclosed in U.S. Pat. Nos. 4,609,518; 4,629,643; 7,172,801; 7,270,861; 7,410,683; 7,507,459; 7,521,588; 7,553,532; 7,648,752; 7,670,665; 7,682,686; 7,718,243; and U.S. Patent Appln. Nos. 2004/0119208; 2005/0281976; 2005/0283129; 2008/0119807; 2009/0030390; 2009/0030391.

In certain embodiments, the absorbent article can include a suitable topsheet as shown in Figure 47.

FIG. 47 is an enlarged partially segmented, perspective illustration of a resilient, three-dimensional, macroscopically expanded, fluid pervious, plastic web 10 that has been found suitable for use as a topsheet on disposable absorbent articles, such as the sanitary napkin illustrated in FIG. 46. As utilized herein, the term "macroscopically expanded", when used to describe three-dimensional plastic webs, ribbons and films, refers to webs, ribbons and films which have been caused to conform to the surface of a three-dimensional forming structure so that both surfaces thereof exhibit the three-dimensional pattern of said forming structure, said pattern being readily visible to the naked eye when the perpendicular distance between the viewer's eye and the plane of the web is about 12 inches.

In certain embodiments, the web 10 is comprised of a continuum of fiber-like elements, the opposed ends of each of the fiber-like elements are interconnected to at least one another of the fiber-like elements to give the web 10 a fiber-like appearance. Apertures 45 are formed by a multiplicity of intersecting fiber-like elements, e.g., elements 46, 47, 48, 49, and 50, interconnected to one another in the first surface of the web. Each fiber-like element comprises a base portion, e.g., base portion 54, located in plane 42. Each base portion has a sidewall portion, e.g., sidewall portions 55, attached to each edge thereof. The sidewall portions 55 extend generally in the direction of the second surface 43 of the web. The intersecting sidewall portions of the fiber-like elements are interconnected to one another intermediate the first and second surfaces of the web and terminate substantially concurrently with one another in the plane 44 of the second surface.

In certain embodiments, the interconnected sidewall portions terminate substantially concurrently with one another in the plane of the second surface 44 to form apertures 39 in the second surface 43 of the web. The capillaries 40 formed by the interconnected sidewall portions allow for free transfer of fluids from the first surface 41 of the web directly to the second surface 43 of the web without lateral transmission of the fluid between adjacent capillary networks.

In certain embodiments, the topsheet is apertured. The apertures can be any suitable shape or size, including, for example, circular, pentagonal, hexagonal, oval, hourglass, or teardrop, and range in diameter from under 0.1 mm to over 2 mm.

The absorbent core

The absorbent core of an absorbent article serves to store bodily fluids discharged during use. The core can be manufactured in a wide variety of sizes and shapes, and may be profiled to have different thickness, hydrophilic gradients, superabsorbent gradients, densities, or average basis weights at different positions across the face of the product.

An absorbent core may have a fluid distribution layer as well as a fluid storage layer. The fluid distribution layer transfers received fluid both downwardly and laterally, and generally has more permeability and less capillarity than the fluid storage layer.

In addition to conventional absorbent materials such as creped cellulose wadding, fluffed cellulose fibers, wood pulp fibers also known as airfelt, and textile fibers, the fluid storage layer often includes superabsorbent material that imbibe fluids and form hydrogels. These materials are typically capable of absorbing large quantities of body fluids and retaining them under moderate pressures. The fluid storage layer of the absorbent core can be made solely of superabsorbent material, or can include such materials dispersed in a suitable carrier such as cellulose fibers in the form of fluff or stiffened fibers. Synthetic fibers including cellulose acetate, polyvinyl fluoride, polyvinylidene chloride, acrylics (such as Orlon), polyvinyl acetate, non-soluble polyvinyl alcohol, polyethylene, polypropylene, polyamides (such as nylon), polyesters, bicomponent fibers, tricomponent fibers, mixtures thereof and the like can also be used. The fluid storage layer can also include filler materials, such as Perlite, diatomaceous earth, Vermiculite, or other suitable materials, that lower rewet problems.

The Backsheet

The backsheet that covers the lower side of the absorbent core prevents the fluids in the absorbent core from wetting articles that contact the sanitary napkin, such as pants, pajamas and undergarments. Accordingly, the backsheet can be made from a liquid impervious thin film or a liquid impervious but vapor pervious film/nonwoven laminate, a microporous film, an apertured

formed film, or other polymer film that is vapor permeable, or rendered to be vapor permeable, but substantially impervious to fluid.

Optional secondary topsheet

In certain embodiments, the absorbent article can include a secondary topsheet that can be interposed between the absorbent core and the topsheet, and serves to rapidly draw discharged body fluids, in particular menstrual fluids, through the adjacent permeable (primary) topsheet. This allows the surface of the primary topsheet adjacent the wearer of the article pad to remain relatively clean and dry.

Colored Portion

The absorbent article includes a colored portion that can be positioned on any suitable surface of the absorbent article, as long as the surface is visible on and/or through areas of the topsheet. In certain embodiments, the colored portion may be provided on a secondary topsheet or on an insert positioned between the topsheet and the absorbent core. In another embodiment, the colored portion forms a part of the topsheet, such as for example, a part of the bottom of the topsheet. In yet another embodiment herein, the colored portion forms a part of the absorbent core whereby the colored portion is viewable from the viewing surface of the topsheet. Alternatively, the colored portion may be a multi-layered insert positioned beneath the topsheet.

In certain embodiments, the colored portion can be printed on a surface visible from the body-facing surface of sanitary napkin, including, for example, on a surface below the topsheet as long as it is visible to the user during placement and positioning of the article in the undergarment. Therefore, the colored portion can be ink or dye printed, coated, sprayed, or otherwise disposed on, secondary topsheets, surge layers, acquisition layers, absorbent cores, and the like. The colored portion can be configured as lines, line segments, curved lines, bands, arrows, words, pictures, or any other printed indicia.

In certain embodiments, the colored portion can be made by printing, such as, for example, by known processes, such as gravure printing, offset printing, inkjet printing, and combinations thereof. Alternatively, the colored portion can be made by dyeing, pigmenting, or any other suitable coloration techniques. In certain embodiments, the colored portion can be made by melt-adding a colorant during extrusion.

The colored portion can comprise a single colored area or a plurality of colored areas. A plurality of colored areas can be disposed as overlapping areas of color to define a color gradation or change in intensity by virtue of the overlapping nature of the areas. Colored or shaded areas can be any shape, including shapes, such as flower petals, sun rays, ocean waves,

and the like. The colors of colored or shaded areas can be uniform, or they can be varying shades or hues of one color, or they can be different colors.

Visual Texture

The absorbent article has a viewing surface comprising an apertured topsheet and colored areas visible through the viewing surface of the topsheet providing an improved visual texture. In certain embodiments, the visual texture has less than about 65 objects per cm^2 , for example, such as, about 50 objects per cm^2 . In addition, the visual texture can have an average mean area greater than about 0.35mm^2 , such as, for example, an average mean area greater than about 0.4mm^2 . In certain embodiments, the objects can have a mean area dimension greater than about 0.35mm^2 , such as, for example, greater than about 0.375mm^2 , such as, for example, greater than about 0.42mm^2 . Such improved visual texture can engender in a user the recognition of better protection and enhanced functioning.

Without being bound by any theory, the visual texture of the absorbent article can depend upon a complex set of factors, including, for example, aperture size, aperture open area, sidewall height, sidewall collapse, sidewall opacity, land area, land opacity, microtexture on the land area and or apertured sidewalls, location and density of color on the various layers of the article, and amount of color visible through the apertures. The combination of these features can create a visual texture that is apparent upon viewing the surface of the napkin.

Visual texture of the top surface of an absorbent article is measured as follows.

Digital images of the article are captured and quantitatively analyzed to measure product top surface visual texture in the largest colored area in the main central fluid absorbent acquisition zone of the absorbent article.

The imaging system includes a light-tight imaging booth equipped with top-mounted, diffused lighting, simulating CIE D65 standard daylight, and a top-mounted digital RGB color camera with lens system, capable of providing images of the article at a spatial resolution of 40 micrometers per pixel, or fewer than 40 μm per pixel. The camera body and light sources are oriented so that they are directly above and on a surface or plane parallel to the article being imaged, such that shadowing effects and variations in illumination intensity are both minimized in the captured image. An example of a suitable light booth system is the DigiEye Imaging System (VeriVide Ltd., Leicester, UK), with a Nikon D3 camera and 105mm Nikkor Lens, yielding 4256 x 2832 pixel, 8Bit, RGB images.

The imaging system is white balanced prior to use using a spectral standard Grey Card (21.6cm x 27.9cm X-Rite Color Checker White Balance Card). A standard reference chart of

various grey levels and colors is used to further calibrate the system for grey level intensity and contrast, and may also be use to calibrate color balance (X-Rite Gretag Macbeth Mini Color Checker Chart, 7.6cm x 12.7cm). All image capture settings used in the system, including illumination intensity, camera exposure time, contrast gamma, etc., when used together in
5 combination are set such that the 3 lightest grey level areas on the Color Checker Chart Standard are clearly distinguishable from each other in captured images of the chart. Image capture settings are set such that any color or intensity details observable in the article under the naked eye are equally or more observable in the captured images. Spatial calibration of the system to determine the number of micrometers per pixel in captured images is achieved by imaging a
10 certified linear reference scale or rule (American National Institute of Standards and Technology (NIST)).

The intact, unused article to be measured is spread out flat inside the imaging system, with its body-facing side / absorptive side, upwards toward the camera. The article is secured in place to maintain the article's surface flat and level relative to the camera lens.

15 After all calibrations are complete, the imaging system is used to capture images of the article in the largest colored or printed area in main central fluid absorbent acquisition zone of test articles. Typically this zone will lie near the center of the article, along the center line of the article's longest axis. An image of each article is captured such that 6 square cm of this area(s) is imaged on each article. If less than 6 square cm of colored or printed areas are present in the
20 article's loading zone, then an image covering at least 1 square cm of these areas should be captured.

Three to five replicate articles of any specific type are imaged and analyzed.

Captured RGB images are converted to grayscale prior to further processing and analysis. One or more regions of interest (ROI) are selected within each image, so that as much of the
25 image as possible is within ROI(s), and so that each ROI is as large as possible, while excluding areas of the image that were not within a colored or printed zone on the article.

Each Region(s) of Interest (ROI) is thresholded and binarized, thus designating each pixel into one of two classes (termed Background and Foreground). Thresholding should be achieved using Otsu's Gray Thresholding Method, which is a widely used method of automatic
30 thresholding to binarize grayscale images. Otsu's method is a reiterative computation which independently determines the threshold value for each image that minimizes the weighted within-class variances for two classes. Many image analysis software packages can be used to perform Otsu's Thresholding, including Image J, Matlab, Image Pro Plus and others. The mathematic

algorithm can be found at http://en.wikipedia.org/wiki/Otsu's_method or in Nobuyuki Otsu (1979). "A threshold selection method from gray-level histograms". IEEE Trans. Sys., Man., Cyber. 9: 62–66.

The binary images are then analyzed to identify objects using Connected Component Labeling Analysis. Connected Component Labeling groups pixels into components / objects / blobs based on pixel connectivity, i.e. all pixels in a connected component share similar pixel intensity values and are in some way connected with each other.

Some of the objects found may be spatially located in contact with the edges of the image ROI, and therefore are likely partially cropped by the edge of the ROI. Such objects are to be excluded from subsequent object measurements.

Measurements are then made on the number and area of objects in each ROI, from each article. These measurements include:

- The total number of objects found, expressed on a per area basis within the ROI(s) (e.g., 20 objects per square cm).
- The mean area for the objects in each ROI.
- The percentage of the total ROI area that is classified as being objects (e.g, 20%).

Example 1: Measure of visual texture.

Example 1 shows the visual texture of the following sanitary napkin products:

Table 1: Products tested

Product	Name	Date of Purchase	Country	Figure
1	Inventive Sample 1			1
2	Always Ultrathin with DriWeave	2010	Russia	5
3	Always Ultrathin with DriWeave	2010	USA	9
4	StayFree DryMax Ultrathin	2009	USA	13
5	U by Kotex Regular	2010	USA	17
6	Kotex Supreme	2007	Colombia	21
7	Nosotras Invisible	2008	Colombia	25
8	ABC with Supsoft Topsheet	2006	China	29
9	Femline Maxi Long	2009	Canada	33

10	Inventive Sample 2			37
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Each product was tested as set forth in the visual texture method above. For samples 1-6 and 9-10, five duplicate samples were tested. For samples 7 and 8, three duplicate samples were tested.

- 5 The data were collected from ROIs which were 400 x 1,000 pixels in size at a resolutions of 39 microns per pixel, covering 15.6mm x 39mm of the topsheet in each image, (which is 608.4 square mm or 6.084 square cm).

Table 2: Visual texture measurement of Products 1-10

Sample	Average Number of Objects per cm ²	Average Mean Area (mm ²)	% Total Object Area in ROI
Inventive Topsheet Sample I0 Ultrathin Fusion Bonded I	36	0.61	22%
Inventive Topsheet Sample I0 Ultrathin Fusion Bonded II	47	0.42	20%
Inventive Topsheet Sample I0 Ultrathin Glued	42	0.53	22%
Inventive Topsheet Sample I Ultrathin Fusion Bonded II	49	0.56	27%
Always DriWeave Ultrathin Sample 2 Fusion Bonded	96	0.32	30%
Always Soft Driweave Ultrathin Sample 3 Glued	263	0.08	22%
ABC with Supsoft Topsheet Sample 8	96	0.29	28%
Femline Maxi Long Sample 9	85	0.23	20%
Kotex Supreme Sample 6	89	0.20	18%
Nosotras Invisible Sample 7	149	0.14	21%
StayFree DryMax Ultrathin Sample 4	70	0.23	16%
U by Kotex Regular Sample 5	284	0.10	28%

- 10 As shown in Table 2, the inventive samples have a visual texture of less than about 65 objects per cm², such as, for example, less than about 60 objects per cm², such as, for example,

less than about 55 objects per cm^2 , such as, for example, less than about 50 objects per cm^2 , the objects having an average mean area greater than about 0.35 mm^2 , such as, for example, greater than about 0.40 mm^2 . In certain embodiments, the objects can have an average mean area greater than about 0.45 mm^2 , greater than about 0.50 mm^2 , greater than about 0.55 mm^2 , or greater than about 0.60 mm^2 .

Example 2: Sample parameters.

Aperture, microtexture, thickness, open area, land area, porosity, titanium dioxide level, and land area width for samples 1, 2, 3, and 10 were determined as set forth in Table 3.

Table 3: Sample Parameters

Parameter / Topsheet	Sample 10	Sample 1	Sample 2	Sample 3
Macro Aperture Dimensions				
Height	0.8 – 1.1 mm	0.6 mm	0.65 mm	1.40 mm
Maximum diameter in top surface	1.6 mm – 1.9 mm	1.2 mm – 1.4 mm	0.8 – 0.9 mm	Hard to define
Spacing (Center-to-Center)	2.2 mm	1.8 mm	1.0 mm	2.1 mm
#/sq in	160	225	625	150
Microtexture Dimensions				
Height	0.060 mm	0.060 mm	0.020 – 0.025 mm	0.100 – 0.150 mm
Aspect ratio (height/diameter)	0.6	0.6	0.3 - 0.4	1.1 - 2
Spacing (Center-to-Center)	0.20 mm	0.20 mm	0.12 mm	0.25 mm
#/sq in	16000	16000	46000	10000
Film Thickness (gauge)	0.9 mil	0.9 mil	1.0 mil	1.05 mil
Open Area	3%	20%	24%	Not Determined
Land Area	37%	34%	31%	Not Determined
Porosity (ASTM 737-96)	100 - 220 $\text{m}^3/\text{m}^2/\text{min}$	154 - 265 $\text{m}^3/\text{m}^2/\text{min}$	275 $\text{m}^3/\text{m}^2/\text{min}$	184 $\text{m}^3/\text{m}^2/\text{min}$
TiO ₂ Level	4%	4%	4%	4%
Land Area Width	21 mil	18 mil	7 mil	Not Determined

Dimension measurements were made by computer aided scanning electron microscopy and data processing. Open area and land area were measured as set forth in Example 3, and porosity was measuring using ASTM 737-96. Aspect ratio height and diameter was measured at set forth in U.S. Patent No. 6,852,475. When necessary due to material variability, an average value was measured over a homogenous area of the web.

Example 3: Measure of open area and land area

The open area and land area of formed-film topsheets was measured using light microscopy and image analysis.

Samples 1, 2, and 10 of Example 1 were analyzed. A portion of topsheet from the
5 feminine pad having an area of 2 to 5 cm² was removed without damaging or deforming the structure. Areas of the topsheet with thermal bond sites were avoided. The topsheet sample was placed flat with the body-facing surface upward on the glass stage of a stereo zoom light microscope (Nikon SMZ-U). The microscope was fitted with a camera for digital image acquisition of a 5 megapixel or greater (2560 x 1920 pixels) image, and the microscope
10 magnification was adjusted so that the field of view to the camera was approximately 7 mm by 10 mm as shown in Figure 47.

For measurements of open area, the topsheet was backlit so that the apertures were bright and all the rest of the topsheet area is dark. The image was focused and the lighting was adjusted to maximize the contrast difference between the apertured and non-apertured area as shown in
15 Figures 40-42. The image was saved as a JPEG file, opened in ImageJ (NIH), and converted to 8-bit grayscale. The grayscale threshold level was adjusted up and down to best highlight only the open, unobstructed areas and the image analysis program was used to count the highlighted pixels divided by total pixels to give the open area as a percent.

As shown in Figure 40, the percent open area of a topsheet removed from inventive
20 sample 10 was approximately 3%. As shown in Figure 41, the percent land area of a topsheet removed from sample 2 was approximately 20%. As shown in Figure 42, the percent land area of topsheet removed from inventive sample 1 was approximately 24%.

Land area was measured using low-angle top lighting using a common bifurcated fiber optic illuminator (Fostec) to shine light almost parallel to the upper plane of the topsheet surface.
25 The light was adjusted to strike the upper surface (land area), but not go into the cones. The image was focused and the lighting was adjusted to maximize the contrast difference between the non-apertured and apertured areas. The image was saved as a JPEG file, opened in ImageJ (NIH), and converted to 8-bit grayscale. The grayscale threshold level was adjusted up and down to best highlight only the upper land area surface and the image analysis program was used to
30 count the highlighted pixels divided by total pixels to give the land area as a percent.

As shown in Figure 43, the percent land area of a topsheet removed from sample 10 was approximately 37%. As shown in Figure 44, the percent land area of a topsheet removed from

sample 2 was approximately 34%. As shown in Figure 45, the percent land area of topsheet removed from sample 1 was approximately 31%.

As can be seen by comparing aperture size and open area data with the inventive parameters, number and size of objects, the visual texture is not simply bigger holes or more open area. For example, inventive sample 10 has much less area (3%) than prior art sample 2 (20%).

The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as “40 mm” is intended to mean “about 40 mm.”

Every document cited herein, including any cross referenced or related patent or application, is hereby incorporated herein by reference in its entirety unless expressly excluded or otherwise limited. The citation of any document is not an admission that it is prior art with respect to any invention disclosed or claimed herein or that it alone, or in any combination with any other reference or references, teaches, suggests or discloses any such invention. Further, to the extent that any meaning or definition of a term in this document conflicts with any meaning or definition of the same term in a document incorporated by reference, the meaning or definition assigned to that term in this document shall govern.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

CLAIMS

What is claimed is:

1. An absorbent article comprising an apertured topsheet having a body-facing side and a garment-facing side, a backsheet, an absorbent core positioned between the topsheet and the backsheet, and a colored area viewable through a topsheet by a user viewing the body-facing side,
the absorbent article comprising a visual texture composed of less than about 65 objects per cm^2 having an average mean area greater than about 0.35 mm^2 .
2. The absorbent article of claim 1, wherein the visual texture is composed of less than about 55 objects per cm^2 , preferably less than about 50 objects per cm^2 .
3. The absorbent article of claims 1 or 2, wherein the objects have an average mean area greater than about 0.40 mm^2 , preferably greater than about 0.50 mm^2 .
4. The absorbent article of any of claims 1 to 3, wherein the topsheet comprises an apertured formed film.
5. The absorbent article of any of claims 1 to 4, wherein the absorbent article comprises a secondary topsheet and the colored area is provided on the secondary topsheet.
6. The absorbent article of any of claims 1 to 5, wherein the topsheet has apertures having a shape that is circular, pentagonal, hexagonal, oval, hourglass, or teardrop.