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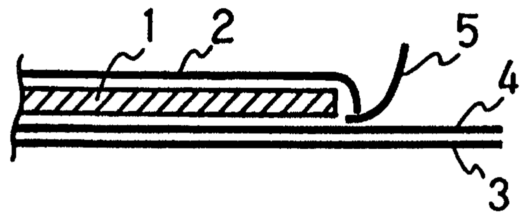
(54) Title: LIQUID IMPERMEABLE NONWOVEN SHEET FOR ABSORBENT ARTICLE

(57) Abstract

A liquid impermeable sheet comprising a melt blown non woven fabric and an absorbent article using the liquid impermeable sheet are provided. The melt blown non woven fabric comprises ultra fine fibers of thermoplastic polymer spun by a melt blowing method, and the fiber diameter is 10 μm or less. The melt blown non woven fabric satisfies the following Formulas (A): $2 \leq W/D^2 \leq 200$ and (B): $0.05 \leq d \leq 0.2$ where W is basis weight (g/m^2), D is fiber diameter (μm) and d is apparent density of the non woven fabric (g/cc), and thus, the fabric is excellent in feeling, flexibility and air permeability, while it keeps its liquid impermeability.



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DESCRIPTION

LIQUID IMPERMEABLE NONWOVEN SHEET FOR ABSORBENT ARTICLE

Technical Field

This invention relates to a liquid impermeable sheet and an absorbent article using the same. Such absorbent articles include medical and sanitary materials such as disposable diapers and sanitary napkins. More specifically, this invention relates to a liquid impermeable sheet and an absorbent article comprising the liquid impermeable sheet that is excellent in air permeability and feeling while keeping the desired liquid impermeability.

Background Art

Absorbent articles such as disposable diapers and sanitary napkins for medical and sanitary materials have been used to absorb body fluid like urine and blood and to prevent them from leaking. For this purpose, such an absorbent article comprises at least a liquid absorbent layer for absorbing and holding body fluid such as urine and blood, a liquid permeable surface cover that made of a non-woven fabric, a woven fabric, a knitted fabric etc. and that is provided at the skin side of the article, and a liquid impermeable back sheet that is provided at the back side in order to prevent the absorbed body fluid from leaking outside. Also, such an absorbent article usually comprises water repellent side sheets of a non-woven fabric or the like provided on both sides of the absorbent article in addition to the back sheet in order to prevent the liquid such as the absorbed body fluid from leaking when the position of the absorbent article is displaced from a predetermined position for wear by the movement of the body or when the wearer lies on his side. (In disposable diapers or the like, the side sheet is often gathered, and therefore it is called side gathers or a leg cuff. In disposable diapers, the side sheets are provided in such a position that they surround and hold the groin or the thighs when the disposable diaper is worn). Also, in disposable diapers, a water repellent round sheet of a non-woven fabric or the like is further provided on the skin sides of the portion covering the abdominal region and the portion covering the upper hips at the opposite side so as to prevent the liquid such as the absorbed body fluid from leaking outside the absorbent article on the abdominal region or the upper hips as the wearer moves, for example, falls down, lies down, or turns his body. Furthermore, in some disposable diapers, band-like waist gathers or the like are provided on the waist position skin side, and these also comprises a water repellent sheet of a non-woven fabric or the like.

Several kinds of liquid absorbent layers comprising cellulose fibers such as fluff pulp, highly-absorbing polymer and, if necessary, a mixture of synthetic fibers are used.

In general, liquid impermeable sheets are used for back sheets of such absorbent articles since comparatively good liquid impermeability is required for back sheets. Water repellent sheets used for side sheets, round sheets and waist gathers, and have less water impermeability compared to the back sheets.

Thermoplastic films are used for the conventional back sheets of absorbent articles. The thermoplastic films are formed with countless micropores in order to prevent the inside of the film from getting sticky in wearing and for air permeability. In some cases, the film is combined with a non-woven fabric to improve the appearance and feeling of the film and also to improve the strength. Non-woven fabrics provided with water repellency and some other properties are used for side sheets, round sheets and waist gathers.

As mentioned above, liquid impermeable sheets and water repellent sheets are often used for absorbent article components.

Thermoplastic films having air permeability are used generally for back sheets of absorbent articles. However, the conventional back sheets are still unsatisfactory in providing two opposite properties, namely, liquid impermeability and air permeability. Thermoplastic films are not sufficient in air permeability though they provide good liquid impermeability. Water repellent non-woven fabric is used for side sheets, round sheets and waist gathers. However, it would be more preferable if the liquid impermeability could be improved without sacrificing air permeability.

In Japanese Patent No. 2533253 (Japanese Patent Application Tokkai-Hei 4-226658), a liquid impermeable baffle layer is provided between the back sheet of plastic films and an absorbent so that a cloth-like touch is provided while leakage is prevented. However, the article will be heavy due to its complicated configuration.

Japanese Patent Application Tokkai-Hei 6-14949 discloses an impermeable sheet provided between an absorbent and a plastic film, but the function is still unsatisfactory.

This invention aims to provide a liquid impermeable sheet with good air permeability and feeling while keeping its liquid impermeability, and an absorbent article using the same. Another aim of this invention is to provide a liquid impermeable sheet for an absorbent article with excellent strength as well as the above properties and an absorbent article using the same.

Disclosure of the Invention

In order to achieve the above-mentioned objects, a liquid impermeable sheet for an absorbent article of this invention comprises a melt blown non-woven fabric comprising ultra fine fibers of thermoplastic polymer whose diameter is 10 μ m at most, and the ultra fine fiber is spun by a melt blowing method. The melt blown non-woven fabric satisfies the following Formulas A and B.

$$2 \leqq W/D^2 \leqq 200 \ldots (A)$$

$$0.05 \leqq d \leqq 0.2 \ldots (B)$$

W: basis weight (g/m^2)

D: fiber diameter (μ m)

d: apparent density of the non-woven fabric (g/cc)

It is preferable in the sheet that a fiber non-woven fabric comprising a thermoplastic polymer is further laminated.

It is preferable in the sheet that the melt blown non-woven fabric comprises thermoplastic ultra fine conjugated fibers having a diameter of 10 μ m at most, where a low melting point polymer and a high melting point polymer are conjugated and the melting point difference between the polymers is at least

15℃.

It is preferable in the sheet that the melt blown non-woven fabric comprises thermoplastic ultra fine combined fibers having fiber diameter of 10 μm at most, where a low melting point polymer and a high melting point polymer are combined and the melting point difference between the polymers is at least 15℃.

It is preferable in the sheet that the liquid impermeable sheet is at least one sheet selected from the group consisting of a back sheet, a side sheet, a round sheet and a waist gather for an absorbent article.

It is preferable in the sheet that the melt blown non-woven fabric comprises at least one polymer selected from the group consisting of polyolefin polymer and polyester polymer.

It is preferable in the sheet that the fiber composing the melt blown non-woven fabric is at least one fiber selected from the group consisting of single fiber of a single composition, conjugated fiber formed by conjugating a low melting point polymer and a high melting point polymer, and combined fiber formed by combining a low melting point polymer and a high melting point polymer.

It is preferable in the sheet that the average fiber diameter of the melt blown fabric as 0.1-9 μm.

It is preferable in the sheet that the basis weight of the melt blown non-woven fabric is 4-50 g/m^2.

It is preferable in the sheet that the thermoplastic fiber non-woven fabric comprises filament and/or staple fiber.

It is preferable in the sheet that the thermoplastic non-woven fabric comprises two-composition conjugated fiber formed by conjugating a low melting point polymer and a high melting point polymer.

It is preferable in the sheet that the difference of the melting points between the high melting point polymer and the low melting point polymer is at least 15℃.

It is preferable in the sheet that the fiber is at least one conjugated fiber selected from the group consisting of sheath-core type fiber, eccentric sheath-core type fiber, parallel type fiber, multilayer type fiber and sea-island type fiber.

It is preferable in the sheet that the polymer composition composing the conjugated fiber is at least one polymer selected from the group consisting of polyolefins, polyesters and polyamides.

It is preferable in the sheet that the fineness of the single fiber composing the non-woven fabric is 0.5-10d/f.

It is preferable in the sheet that the length of the staple fiber composing the non-woven fabric is 3-51mm.

It is preferable in the sheet that the staple fiber composing the non-woven fabric is at least one fiber selected from the group consisting of crimped fiber and uncrimped fiber.

It is preferable in the sheet that the cross section of the fiber has at least one shape selected from the group consisting of circular, modified, and hollow.

It is preferable in the sheet that the melt blown non-woven fabric and a fiber non-woven fabric for lamination are laminated by using at least one bonding method selected from the group consisting of a heat bonding by embossed rollers, ultrasonic welding, a hot air cycle bonding using hot air blow at a temperature within the range between the melting points of a high melting point polymer and a low melting point polymer, and a hot melt bonding using a hot melt polymer.

An absorbent article of this invention comprises, for at least one of its portions, the liquid impermeable sheet of this invention.

A non-woven fabric of this invention, composing a liquid impermeable sheet for an absorbent article, is a thermoplastic ultra fine fiber non-woven fabric comprising fibers spun in a melt blowing method, and the fiber diameter is 10 μm or less. The non-woven fabric satisfies the Formulas A and B, and thus, a liquid impermeable sheet comprising the non-woven fabric has good air permeability while maintainig liquid impermeability, and excellent feeling and flexibility. Such sheets are preferably used for absorbent articles.

Furthermore, a laminate comprising the melt blown non-woven fabric and another thermoplastic fiber non-woven fabric is preferably used in the embodiments of this invention. As a result, a liquid impermeable sheet that has good non-woven fabric strength and good feeling can be provided, and such sheets are preferably used for absorbent articles.

The melt blown non-woven fabric of this invention preferably comprises thermoplastic ultra fine conjugated fiber made of a low melting point polymer and a high melting point polymer, the difference of the melting points between the polymers being at least 15℃, and the fiber diameter being 10 μm at most.

As a result, liquid impermeable sheets with less fuzz, which are preferably used for absorbent articles, are provided.

The melt blown non-woven fabric of this invention preferably comprises thermoplastic ultra fine fibers formed by combining a low melting point polymer and a high melting point polymer, the difference of the melting points between the polymers being at least 15℃, and the fiber diameter being 10 μ m at most. As a result, liquid impermeable sheets with less fuzz, which are preferably used for absorbent articles, are provided.

A thermoplastic fiber non-woven fabric to be laminated on the melt blown non-woven fabric is preferably a filament non-woven fabric in this invention. As a result, liquid impermeable sheets comprising the non-woven fabric have less fuzz, and thus, the sheets have good strength and are preferably used for absorbent articles.

The liquid impermeable sheet in the preferable embodiments of this invention is at least one selected from the group consisting of a back sheet, a side sheet, a round sheet and a waist gather, so that good air permeability and liquid impermeability are effectively used, and absorbent articles having excellent feeling and flexibility can be manufactured.

An absorbent article comprising the liquid impermeable sheet of this invention does not cause a problem of body fluid leakage from the article to the outside, while air permeability and feeling of the same absorbent article are good.

Brief Description of Drawings

FIG. 1 is a plan view showing one example of a disposable diaper partially using a liquid impermeable sheet of this invention, in unwapped form, as seen from the skin side.

FIG. 2 is a schematic cross sectional end view taken on line X-X' of FIG. 1.

FIG. 3 is a schematic cross sectional end view taken on line Y-Y' of FIG. 1.

FIG. 4 is a plan view showing one example of a sanitary napkin partially using a liquid impermeable sheet of this invention, in unwapped form, as seen from the skin side.

FIG. 5 is a schematic cross sectional end view taken on line X-X' of FIG. 4.

Best Mode for Carrying Out the Invention

A non-woven fabric used for a liquid impermeable sheet for an absorbent article of this invention is a non-woven fabric spun by a melt blowing method.

A melt blown non-woven fabric is produced by the following steps, though the details are omitted as this fabric is well known. A thermoplastic polymer is melted and extruded to be a fiber from a melt blowing spinneret. At the same time, a hot gas is injected at a high speed from a slit formed around the spinning orifice in order to blow the gas to the extruded fiber melted polymer flow. The fiber flow is deposited on a scavenger such as collecting endless net conveyor to obtain an ultra fine fiber web. The web is processed to be a non-woven fabric by heat-sealing if necessary. (see Japanese Patent Application Tokkai Hei 1-156561; *Industrial and Engineering Chemistry* No. 8, Vol. 48, 1956, p.1342-1346; *Basic and Application of Non-woven Fabric* (issued on August 25, 1993) p.119-127 etc., edited by the Non-woven Fabric Research Society in Japan Fiber Machine Academy (incorporated association).

In this melt blowing method, fiber is produced in the following process: extruding melted fiber from a spinneret; injecting a hot, high speed gas to blow the flow of the fiber melted polymer in order to draw the extruded fiber melted polymer and to provide a ultra fine fiber flow. The fiber is drawn in melted condition so generally it is not oriented due to the drawing. Therefore, the non-woven fabric comprises fibers that are substantially undrawn. The non-woven fabric typically comprises ultra fine staple fibers since the melted fibers are torn off by the hot, high speed air flow.

Air is generally used for the hot, high speed gas, however, any other gases such as steam can be used as long as they do not react with and deteriorate the melted polymer. The gas temperature ranges from 300 to 400℃, though it depends on the kinds of the melt-extruded polymers, and the gas pressure ranges, for example, 1-5 kg/cm^2. The condition, however, is not limited to these ranges.

Polyolefin polymers and polyester polymers are preferably used for the polymers to be the thermoplastic fibers used in the melt blown non-woven fabric. The polyolefin polymers include polypropylene, high density polyethylene, linear low density polyethylene, ethylene/propylene binary copolymer, and ethylene/butene-1/propylene ternary copolymer. The polyester polymers include polyethylene terephthalate and polybutylene terephthalate. Pigments, flame retarders, deodorants, antistatic agents and antioxidants can be added to the thermoplastic fibers in an amount such that the additives do not deteriorate the effects of the invention.

The fibers composing the melt blown non-woven fabric can be selected from the group consisting of single fiber comprising a single composition, conjugated fiber formed by conjugating a low melting point polymer and a high melting point polymer, and combined fiber formed by combining a low melting point polymer and a high melting point polymer. In a non-woven fabric comprising conjugated or combined fibers, the difference of the melting points between a high melting point polymer and a low melting point polymer is preferably at least 15℃. Otherwise, the high melting point polymer will also be softened or melted and easily lose its fiber shape when a non-woven fabric is produced by the hot air cycle bonding method. Such a non-woven fabric will look like a film and its feeling will deteriorate. A non-woven fabric comprising conjugated or combined fibers is preferable since it can provide a liquid impermeable sheet with less fuzz for an absorbent article. An article comprising the conjugated or combined fibers is preferred to an article comprising single fiber having a single composition, since the fibers can be heat-bonded to each other easily without using additives and thus the strength of the non-woven fabric can be improved.

The average fiber diameter of the melt blown fabric of this invention is preferably 10 μm or less, more preferably, 0.1-9 μm. It is further preferable that the diameter range is 0.2-8 μm. Fiber with a diameter from 10 to 0.1 μm is preferred since it provides excellent feeling, and it is easily produced at a low cost.

The apparent density (d(g/cc)) of the melt blown non-woven fabric for this invention is $0.05 \leqq d \leqq 0.2$. When the apparent density (d) of the melt blown non-woven fabric is less than 0.05, the texture of the fabric becomes ununiform. As a result, the liquid impermeability required for the liquid impermeable sheet for the absorbent article cannot be maintained even if the basis weight is high, and liquid will be leaked. When the apparent density (d) exceeds 0.2, the feeling and appearance will deteriorate due to the bad air permeability and compression, although sufficient liquid impermeability is maintained. Such a fabric is improper for a liquid impermeable sheet for an absorbent article.

The basis weight of the melt blown non-woven fabric for this invention is preferably 4-50g/m^2, more preferably, 4-30 g/m^2. When the basis weight is too small, the liquid impermeability will deteriorate, and the cost of providing finer fibers for keeping liquid impermeability will rise. When the basis weight is too big, the fabric will be thick and the feeling will deteriorate, and such a fabric is not proper for a liquid impermeable sheet for an absorbent article. A non-woven fabric having the above range of basis weight is preferably used to avoid the above-identified problems.

The melt blown non-woven fabric for this invention should meet the requirement: $2 \leqq W/D^2 \leqq 200$ when W : basis weight (g/m^2), D: fiber diameter (μ m).

This formula indicates that a thin non-woven fabric basis weight can be used if the fibers composing the melt blown non-woven fabric are fine, while the basis weight should be thick if the fiber diameter is big. No melt blown non-woven fabric with sufficient air permeability and liquid impermeability can be obtained when the fabric does not meet the above formula even if the apparent density (d) of the fabric is within the range of $0.05 \leqq d \leqq 0.2$.

A melt blown non-woven fabric for this invention can be used without processing after it is spun and scavenged. Or it can be compressed by using smooth rollers in order to control its apparent density. The smooth rollers can be heated to a degree such that the melt blown non-woven fabric will not be like a film, and unheated smooth rollers also can be used.

Some other methods can be used for bonding the fibers: emboss roll heat bonding, ultrasonic welding and hot air cycle bonding (a method to use hot air in a temperature range between the melting points of two kinds of polymers).

The melt blown non-woven fabric for this invention can be used by laminating with other kinds of thermoplastic fiber non-woven fabrics in order to improve strength and touch, and to prevent fuzz. The thermoplastic fiber fabrics can comprise staple fibers or filaments.

The thermoplastic fiber non-woven fabric can be a carded non-woven fabric or an air laid non-woven fabric, etc., if the fabric comprises staple fibers. The staple fibers composing the staple fiber non-woven fabric can contain a single composition, or they can be conjugated fibers comprising at least two compositions, for example, three or four compositions. Considering cost, however, a two-composition conjugated fiber comprising a high melting point polymer and a low melting point polymer will be sufficient for most general purposes.

Preferable polymer compositions that can be used for the above thermoplastic non-woven fabric comprising staple fibers are, for example, polyolefin polymers, polyester polymers and polyamide polymers. The polyolefin polymers include polypropylene, high density polyethylene, linear low density polyethylene, ethylene/propylene binary copolymer, and ethylene/butene-1/propylene ternary copolymer. The polyester polymers include polyethylene terephthalate and polybutylene terephthalate. The polyamide polymers include nylon 6 and nylon 66. Pigments, flame retarders, deodorants, antistatic agents and antioxidants can be added to the thermoplastic fiber in the range such that the additives do not deteriorate the effects of the invention.

In a non-woven fabric comprising conjugated staple fiber, the difference of the melting points between a high melting point polymer and a low melting point polymer is preferably at least 15℃. For the conjugated staple fiber, sheath-core type fiber, eccentric sheath-core type fiber, parallel type fiber, multilayer type fiber and sea-island type fiber can be used.

The cross section of the fibers for the staple fiber non-woven fabric used for a laminating layer can be circular or various modified shapes such as polygonal, flat and stellate. The fibers can be hollow. Or the non-woven fabric can be produced by combining these fibers.

Though the fineness of the fiber composing the staple fiber non-woven fabric for lamination is not specifically limited, it is preferably 0.5-10d/f. If the fineness is too small, a needle of a hopper feeder will merely thread when the staple fibers are opened. As a result, an uneven staple fiber non-woven fabric with neps will be produced. On the other hand, the staple fiber will be stiff if the fineness is too big. In this case, flexibility of the staple fiber non-woven fabric will deteriorate. The length of the staple fiber is preferably 3-51mm, since a non-woven fabric balanced in bulkiness, openness and homogeneity will be obtained.

Moreover, crimped or uncrimped staple fibers can be used. Specifically, crimped fibers such as spiral type, zigzag type and U-shape type are preferable due to the good bulkiness.

Several methods can be used to laminate the melt blown non-woven fabric and the staple fiber non-woven fabric for lamination, for instance, heat-bonding by using embossed rollers, ultrasonic welding, hot air cycle bonding with hot air blown at a temperature in the range between a low melting point and a high melting point of two kinds of polymers, and a hot melt method using hot melt polymer.

By using a staple fiber non-woven fabric to laminate with the hot blown non-woven fabric of this invention, a liquid impermeable sheet for an absorbent article can be provided. The sheet is not deteriorated in air permeability and liquid impermeability, is improved in feeling, and is excellent in bulkiness and flexibility.

When a thermoplastic fiber non-woven fabric laminated with a melt blown non-woven fabric of this invention comprises filaments, the filaments can contain a single composition, or it can be a conjugated fiber comprising at least two compositions, for example, three or four compositions. Considering cost, however, a two-composition conjugated fiber comprising a high melting point polymer and a low melting point polymer will be sufficient for most general purposes.

Preferable polymer compositions that can be used for the above thermoplastic non-woven fabric comprising filaments are, for example, polyolefin polymers, polyester polymers and polyamide polymers. The polyolefin polymers include polypropylene, high density polyethylene, linear low density polyethylene, ethylene/propylene binary copolymer, and ethylene/butene-1/propylene ternary copolymer. The polyester polymers include polyethylene terephthalate and polybutylene terephthalate. The polyamide polymers include nylon 6 and nylon 66. Pigments, flame retarders, deodorants, antistatic agents and antioxidants can be added to the thermoplastic fiber in a range such that the additives do not deteriorate the effects of the invention.

When conjugated fibers are used for laminating the filament non-woven fabric, the difference of the melting points between a high melting point polymer and a low melting point polymer is preferably at least 15℃.

For the conjugated filaments, sheath-core type, eccentric sheath-core type, parallel type, multilayer type and sea-island type can be used.

The cross section of the filaments can be circular or various modified shapes such as polygonal, flat, and stellate. The fiber can be hollow. Or the non-woven fabric can be produced by combining these fibers.

A “spun bond” method is preferably used for producing the filament non-woven fabric for lamination in this invention, though there is no limitation.

The spun bond method is as follows:

providing polymer in an extruder;

melt-spinning the polymer by using a spinneret;

introducing a group of fibers spewed from the spinneret into an air sucker for drawing to obtain filaments;

charging the group of filaments from the air sucker by a proper charging device such as a corona discharging device; and

opening the group of filaments by passing the filaments through a pair of vibrating flaps or by impacting them on a proper reflecting board etc.; and

depositing the opened group of filaments as a filament fleece on a collecting endless net conveyor provided with a sucking device on the backside.

It is possible to use a non-woven fabric that is provided by opening converged tows obtained by a typical melt-spinning, instead of the spun bond method.

For producing this filament non-woven fabric, conjugated fibers comprising two kinds of polymers whose melting points are different by at least 15℃ can be used. When using conjugated fibers, polymers of the compositions are introduced to respective extruders and melt-spun by using a conjugating spinneret.

It is also possible that the filament non-woven fabric is formed by combining low melting point polymer filaments and high melting point polymer filaments, where the difference in the melting points is at least 15℃.

Though there is no specific limitation, the fineness of the filament non-woven fabric for lamination in this invention is preferably 0.5-10d/f. Too small fineness will raise cost, and too big fineness will deteriorate the feeling.

Several methods can be used to laminate the melt blown non-woven fabric and the filament non-woven fabric for lamination, for instance, heat-bonding by using embossed rollers, ultrasonic welding, hot air cycle bonding where hot air is blown at a temperature in the range between a low melting point and a high melting point of two kinds of polymers, and a hot melt method using hot melt polymer.

If a filament non-woven fabric is used for laminating with a melt blown non-woven fabric of this invention, fuzz is reduced while the air permeability and liquid impermeability do not deteriorate, and strength is improved while keeping good flexibility and feeling. As a result, a specifically preferable liquid impermeable sheet for an absorbent article can be provided.

A typical example of the liquid impermeable sheet of this invention is explained below by referring to the drawings, in which the sheet is used for parts of absorbent articles. It should be noted that the shown configurations of the absorbent articles are just some examples, and the drawings do not limit the configuration of the absorbent article. The liquid impermeable sheet of this invention can be used for parts of various absorbent articles, where liquid impermeable sheets or water repellent sheets are used, but the whole configuration of the absorbent articles is not specifically limited.

FIG. 1 is a plan view of one example of a disposable diaper of this invention in unwrapped form, as seen from the skin side. FIG. 2 is a schematic cross-sectional end view taken on line X-X' of FIG. 1. FIG. 3 is a schematic cross-sectional end view taken on line Y-Y' of FIG. 1.

In FIGs. 1-3, 1 denotes a liquid absorbent layer to absorb and hold body fluid. The liquid absorbent layer comprises cellulose fiber such as fluff pulp, resin of highly water-absorbing polymer, and a mixed synthetic fiber as required, though the materials are not limited thereto. The liquid absorbent layer 1 can be wrapped with tissue paper as required. Numeral 2 denotes a liquid permeable surface cover provided at the surface (the skin side), comprising a non-woven fabric, a woven fabric or a knitted fabric etc. Numeral 3 denotes a back sheet that should be liquid impermeable. A round sheet 4 is not always necessary. In FIGs. 2-3, the round sheet 4 is provided between the liquid absorbent layer 1 and the back sheet 3. Numerals 5 and 5' denote side sheets provided on both sides of the absorbent article in order to prevent liquid such as absorbed body fluid from leaking when the position of the absorbent article is displaced from a predetermined position for wear by the movement of the body or when the wearer lies on his side as mentioned above. In disposable diapers or the like, the side sheets are often gathered, and therefore they are called side gathers or a leg cuff. In disposable diapers, the side sheets are provided in such a position that they surround and hold the groin or the thighs. Band-like waist gathers may be provided on the waist position skin sides as denoted by 7 and 7' in FIG. 1, though they are not shown in FIGs. 2 and 3. Suitable parts of these members are bonded so that they do not drop, though such description is omitted in the drawings. In conventional products, liquid impermeable sheets have been used for back sheets, and water-repellent sheets have been used for side sheets, round sheets and waist gathers. The liquid impermeable sheet of this invention can provide disposable diapers, a kind of absorbent article, which have good air permeability and feeling while keeping liquid impermeability, by using the present sheets for at least one part selected from the group consisting of back sheets, side sheets, round sheets and waist gathers of conventional absorbent articles. It is specifically effective to use the sheet for a back sheet of an absorbent article since it covers a comparatively large surface, and it has a liquid impermeability sufficient for a back sheet and good air permeability and feeling.

FIG. 4 shows a plan view of an example of a sanitary napkin seen from the skin side; and FIG. 5 shows a schematic cross-section end view taken on line X-X' of this figure. Numeral 1 denotes a liquid absorbent layer. Numeral 2 denotes a liquid permeable front cover located on the surface side of the liquid absorbent layer (the side to contact the skin), and the cover is selected from the group consisting of a mesh sheet, a non-woven fabric, a woven fabric and a knitted fabric. 3 denotes a back sheet requiring liquid impermeability; 5 and 5' denote side sheets. Suitable parts of these members are bonded so that they do not drop, though such description is omitted in the drawings. The liquid impermeable sheet of this invention can provide sanitary napkins, a kind of absorbent article, which have good air permeability and feeling while keeping liquid impermeability, by using the sheets for at least one part selected from the group consisting of a back sheet and a side sheet etc. It is specifically effective to use the sheet for a back sheet of an absorbent article such as a sanitary napkin since it covers a comparatively large surface, and it has a liquid impermeability sufficient for a back sheet and good air permeability and feeling.

Examples

This invention will be specifically explained by referring to following Examples, however, this invention is not limited to the scope of these Examples.

The physical property values in the Examples were measured in the following way.

[Fiber diameter]

Ten pieces approximately 1cm square were cut out from a melt blown non-woven fabric, though there was no specific limitation as to the location. The pieces were photographed by using a scanning electron microscope (SEM) with a magnifying power of 100-5000. Average value of the fiber diameter (unit: μ m) was obtained by measuring the diameter of total 100 fibers (10 in each of the ten sample pieces).

[Non-woven fabric strength]

A non-woven fabric with 5cm width was prepared. Longitudinal and vertical breaking strength (kg/5cm) of the fabric were measured by using a tensile strength tester (AUTOGRAPH AG-500D by Shimadzu Corporation). The average value from five samples was substituted in the following formula and calculated.

(Longitudinal breaking strength × Vertical breaking strength)$^{1/2}$

The data were divided by (basis weight × 5cm) so that non-woven fabric strength (unit: kg/cm(g/m^2)) was obtained.

[Apparent density of non-woven fabric]

Weight per 1m^2 of a melt blown non-woven fabric was measured, and the thickness of the melt blown non-woven fabric was measured by using a SEM, in order to calculate weight per 1cc (unit: g/cc).

[Air permeability]

The average value was calculated from five samples by using an air permeability tester made by Toyoseiki Seisakusho CO., LTD., based on JISL 1004, 1018 (unit: cc/cm^2/second).

[Hydraulic resistance]

An average value was obtained from five samples by using a hydraulic resistance measuring instrument made by Toyoseiki Seisakusho CO., LTD. The unit was mm.

(Example 1)

A web of a melt blown non-woven fabric was obtained by the following steps:

melting polypropylene at 330℃;

providing the polypropylene to a spinneret having circular cross section heated at 300℃ in order to melt spin;

blowing the polymer extruded from the spinneret with a hot, high temperature air flow (temperature: 350℃; gas pressure: 3.2kg/cm^2);

depositing a web of a melt blown non-woven fabric on a collecting endless net conveyor; and

passing the web in a compression processor comprising smooth rollers that are heated at 120℃.

The web was passed though compressed rollers of a point bond processor comprising embossed and smooth rollers and being heated at 130℃, so that the fibers were partially heat-bonded with each other.

The melt blown non-woven fabric had a fiber diameter (D) of 1.5 μm, and a basis weight (W) of 27g/m^2. The apparent density (d) of the non-woven fabric (abbreviated as non-woven fabric density in the Tables) was 0.09g/cc, and the value in the Formula A (Formula A value in Table 1) was 12.

The melt blown non-woven fabric was proper for a liquid impermeable sheet for an absorbent article since it was excellent in feeling, flexibility and air permeability while keeping its hydraulic resistance. The condition is shown in Table 1, and the result is shown in Table 2.

The liquid impermeable sheet was used for back sheets of various absorbent articles shown in FIGs. 1-5, including disposable diapers and sanitary napkins, for wearer evaluation. As a result, there was no leakage of body fluid to the outside of the absorbent articles, while both air permeability and feeling were highly evaluated.

(Example 2)

A melt blown non-woven fabric was obtained in the same way as in Example 1, except that the fiber diameter (D) was 1.0 μm and the Formula A value was 27.

The melt blown non-woven fabric was proper for a liquid impermeable sheet for an absorbent article since it was excellent in feeling, flexibility and air permeability while keeping its hydraulic resistance. The condition is shown in Table 1, and the result is shown in Table 2.

The liquid impermeable sheet was used for back sheets of various absorbent articles shown in FIGs. 1-5, including disposable diapers and sanitary napkins, for wearer evaluation. As a result, there was no leakage of body fluid to the outside of the absorbent articles, while both air permeability and feeling were highly evaluated.

(Example 3)

A melt blown non-woven fabric was obtained in the same way as in Example 1, except that the density (d) was 0.08g/cc, the basis weight (W) was $10g/m^2$ and the Formula A value was 4.4.

A melt blown web whose fiber diameter (D) was $1.0\,\mu m$ and basis weight (W) was $10g/m^2$ was obtained in the same way as Example 1.

Another thermoplastic fiber non-woven fabric for lamination was obtained in the following steps:

melting polypropylene at 300℃ and melting polyethylene at 220℃;

providing the polypropylene and polyethylene from respective extruders to a sheath-core type conjugating spinneret heated at 280℃;

melt-spinning the composition so that the polypropylene composes the core and the polyethylene composes the sheath;

passing the core-sheath type conjugated fibers through an air sucker by using a spun bond method and taking it in at 2500m/min.;

opening the fibers by forcibly charging using a charging device;

forming a filament fleece deposited on a collecting conveyor; and

laminating the filament fleece on the melt blown non-woven fabric web.

The laminate was passed through compressed rollers of a point bond processor having embossed and smooth rollers heated at 128℃, so that the fibers were partially heat-bonded.

The part of the laminated melt blown non-woven fabric had an apparent density (d) of 0.08g/cc, and the Formula A value was 4.4.

The melt blown non-woven fabric was proper for a liquid impermeable sheet for an absorbent article since it was excellent in feeling, flexibility and air permeability while keeping its hydraulic resistance. The non-woven fabric strength was also improved by laminating a filament non-woven fabric. The condition is shown in Table 1, and the result is shown in Table 2.

The liquid impermeable sheet comprising the laminated non-woven fabric was used for back sheets of various absorbent articles shown in FIGs. 1-5, including disposable diapers and sanitary napkins, for wearer evaluation. As a result, there was no leakage of body fluid to the outside of the absorbent articles, while both air permeability and feeling were highly evaluated.

(Example 4)

A web of a melt blown non-woven fabric with fiber diameter (D) of 1.5 μm and basis weight (W) of 10g/m^2 was obtained by the following steps:

melting polyethylene at 220℃ and melting polypropylene at 330℃;

providing the polyethylene and polypropylene from respective extruders to a combination type spinneret heated at 300℃ for melt-spinning;

blowing the polymer extruded from the spinneret with a hot, high speed air flow of 350℃, 3kg/cm^2 (gas pressure);

depositing a web of a melt blown non-woven fabric on a collecting endless net conveyor; and

compressing the web in the same way as Example 1.

A thermoplastic non-woven fabric for lamination was obtained in the same way as Example 3.

The filament fleece was laminated on the above melt blown non-woven fabric, and the fibers of the laminate were partially heat-bonded to each other by passing the laminate through compressed rollers of a point bond processor comprising embossed and smooth rollers heated at 126℃.

The apparent density (d) of the melt blown non-woven fabric was 0.08/cc and Formula A value was 4.4 after the lamination.

The melt blown non-woven fabric was proper for a liquid impermeable sheet for an absorbent article since it was excellent in feeling, flexibility and air permeability with less fuzz, while keeping its hydraulic resistance. The non-woven fabric strength was also improved by laminating filament non-woven fabric. The condition is shown in Table 1, and the result is shown in Table 2.

The liquid impermeable sheet comprising the laminated non-woven fabric was used for back sheets of various absorbent articles shown in FIGs. 1-5, including disposable diapers and sanitary napkins, for wearer evaluation. As a result, there was no leakage of body fluid to the outside of the absorbent articles, while both air permeability and feeling were highly evaluated.

(Example 5)

A web of a melt blown non-woven fabric fiber with diameter (D) of 1.5 μm and basis weight (W) of $10 g/m^2$ was obtained by the following steps:

melting propylene-ethylene-butene-1 ternary copolymer (copolymerization ratio of ethylene was 2.5 wt% and butene-1 was 4.5 wt%, and this ternary copolymer is indicated as COPP in Table 1) at 250℃ and melting polypropylene at 330℃;

providing the polymers from respective extruders to a sheath-core type conjugating spinneret heated at 300℃ for melt-spinning in order to obtain sheath-core type conjugated fibers (the sheath is the ternary copolymer and the core is polypropylene);

blowing the polymer extruded from the spinneret with a hot, high speed air flow of 350℃, 3kg/cm^2 (gas pressure);

depositing a web of a melt blown non-woven fabric on a collecting endless net conveyor; and

compressing the web in the same way as Example 1.

A filament fleece of conjugated fibers for thermoplastic fiber non-woven fabric to be laminated was prepared in the same way as Example 3 except that polyethylene (a low melting point composition) was replaced by propylene-ethylene-butene-1 ternary copolymer extruded at 240℃.

Next, the filament fleece was laminated on the melt blown non-woven fabric, and the fibers of the laminate were partially bonded to each other by passing the laminate through compressed rollers of a point bond processor comprising embossed and smooth rollers heated at 128℃.

The apparent density (d) of the melt blown non-woven fabric was 0.08/cc and Formula A value was 4.4 after the lamination.

The melt blown non-woven fabric was proper for a liquid impermeable sheet for an absorbent article since it was excellent in feeling, flexibility and air permeability with less fuzz, while maintaining its hydraulic resistance. The non-woven fabric strength was also improved by laminating filament non-woven fabric. The condition is shown in Table 1, and the result is shown in Table 2.

The liquid impermeable sheet comprising the laminated non-woven fabric was used for back sheets of various absorbent articles shown in FIGs. 1-5, including disposable diapers and sanitary napkins, for wearer evaluation. As a result, there was no leakage of body fluid to the outside of the absorbent articles, while both air permeability and feeling were highly evaluated.

(Example 6)

A web of a melt blown non-woven fabric with fiber diameter (D) of 1.5 μm and basis weight (W) of 10g/m^2 was obtained by the following steps:

melting polyethylene at 220℃ and melting polypropylene at 330℃;

providing the polyethylene and polypropylene from respective extruders to a parallel type spinneret heated at 300℃ for melt-spinning;

blowing the polymer extruded from the spinneret with a hot, high speed air flow of 350℃, 3.2kg/cm^2 (gas pressure);

depositing a web of a melt blown non-woven fabric on a collecting endless net conveyor; and

compressing the web in the same way as Example 1.

Fibers of 2.5d/f were prepared for a thermoplastic fiber non-woven fabric used for lamination by the following steps:

melting polypropylene at 300℃ and melting polyethylene at 220℃;

providing the polypropylene and polyethylene from respective extruders to an eccentric sheath-core type conjugating spinneret heated at 280℃ for melt-spinning;

winding the spun eccentric sheath-core type fibers (sheath composition is polyethylene and core composition is polypropylene) around a bobbin;

drawing the fibers to four times the original length by using 100℃ drawing rollers; and

providing the fibers with zigzag crimps by using a stuffer box type crimper. The fibers were cut to be 38mm long, being passed through a carding machine, so that a web of a staple fiber non-woven fabric was prepared.

The staple fiber non-woven fabric web was laminated on the melt blown non-woven fabric, and the fibers of the laminate were partially bonded to each other by passing the laminate through compressed rollers of a point bond processor comprising embossed and smooth rollers heated at 126℃.

The apparent density (d) of the melt blown non-woven fabric was 0.08g/cc and Formula A value was 4.4 after the lamination.

The melt blown non-woven fabric was proper for a liquid impermeable sheet for an absorbent article since it was excellent in feeling, flexibility and air permeability while keeping its hydraulic resistance. The non-woven fabric strength was also improved by laminating a staple fiber non-woven fabric. The condition is shown in Table 1, and the result is shown in Table 2.

The liquid impermeable sheet comprising the laminated non-woven fabric was used for back sheets of various absorbent articles shown in FIGs. 1-5, including disposable diapers and sanitary napkins, for wearer evaluation. As a result, there was no leakage of body fluid to the outside of the absorbent articles, while both air permeability and feeling were highly evaluated.

(Example 7)

A melt blown non-woven fabric web was obtained in the same way as

Example 5, except that a combination type spinneret was used. In other words, a melt blown non-woven fabric web comprising combined fibers of polypropylene ultra fine fibers and propylene-ethylene-butene-1 ternary copolymer ultra fine fibers was obtained.

An eccentric sheath-core type conjugated filament fleece (sheath composition is propylene-ethylene-butene-1 ternary copolymer and core composition is polypropylene) for a thermoplastic fiber non-woven fabric used for lamination was obtained in the same way as Example 5 except that an eccentric sheath-core type spinneret was used.

The filament fleece was laminated on the melt blown non-woven fabric, and the fibers of the laminate were partially bonded to each other by passing the laminate through compressed rollers of a point bond processor comprising embossed and smooth rollers heated at 128℃.

The apparent density (d) of the melt blown non-woven fabric was 0.08/cc and Formula A value was 4.4 after the lamination.

The melt blown non-woven fabric was proper to a liquid impermeable sheet for an absorbent article since it was excellent in feeling, flexibility and air permeability with less fuzz while keeping its hydraulic resistance. The non-woven fabric strength was also improved by a filament non-woven fabric. The condition is shown in Table 1, and the result is shown in Table 2.

The liquid impermeable sheet comprising the laminated non-woven fabric was used for back sheets of various absorbent articles shown in FIGs. 1-5, including disposable diapers and sanitary napkins, for wearer evaluation. As a result, there was no leakage of body fluid to the outside of the absorbent articles, while both air permeability and feeling were highly evaluated.

(Comparative Example 1)

A melt blown non-woven fabric web was prepared in the same way as Example 1 except that the basis weight (W) was 20g/m^2 and compressing treatment was not carried out.

The fibers of the melt blown non-woven fabric web were partially bonded to each other by passing the laminate through compressed rollers of a point bond processor comprising embossed and smooth rollers heated at 130℃.

The apparent density (d) of the melt blown non-woven fabric was only 0.03g/cc though Formula A value was 9.

The melt blown laminated non-woven fabric had good air permeability, however, it was not appropriate for a liquid impermeable sheet used in an absorbent article, as it did not keep its hydraulic resistance. The condition is shown in Table 1, and the result is shown in Table 2.

The liquid impermeable sheet was used for back sheets of various absorbent articles shown in FIGs. 1-5, including disposable diapers and sanitary napkins, for wearer evaluation. As a result, the evaluation was bad due to body fluid leakage to the outside of the absorbent articles, although the air permeability and feeling were good.

(Comparative Example 2)

A melt blown non-woven fabric was produced in the same way as Example 7 except that the basis weight of the non-woven fabric was 4g/m^2, and a filament fleece for a thermoplastic fiber non-woven fabric to be laminated on the melt blown non-woven fabric web was produced in the same way as Example 7.

The filament fleece was laminated on the melt blown non-woven fabric, and the fibers of the laminate were partially bonded to each other by passing the laminate through compressed rollers of a point bond processor comprising embossed and smooth rollers heated at 128℃.

The apparent density (d) of the melt blown non-woven fabric was 0.09g/cc, but Formula A value was 1.8 after the lamination.

The melt blow laminated non-woven fabric had good air permeability, however, it was not appropriate for a liquid impermeable sheet used in an absorbent article, as it did not keep its hydraulic resistance. The condition is shown in Table 1, and the result is shown in Table 2.

The liquid impermeable sheet comprising the laminated non-woven fabric was used for back sheets of various absorbent articles shown in FIGs. 1-5, including disposable diapers and sanitary napkins, for wearer evaluation. As a result, the evaluation was bad due to body fluid leakage to the outside of the absorbent articles, although the air permeability and feeling were good.

(Comparative Example 3)

A web of a melt blown non-woven fabric with 2.0 μm of fiber diameter (D) and 7g/m^2 of basis weight (W) was obtained by the following steps:

melting polyethylene at 220℃ and melting polypropylene at 330℃;

providing the polyethylene and polypropylene from respective extruders to a parallel type conjugating spinneret heated at 300℃ for melt-spinning;

blowing the polymer extruded from the spinneret with a hot, high speed air flow of 350℃, 2.8kg/cm^2 (gas pressure);

depositing a web of a melt blown non-woven fabric on a collecting endless net conveyor; and

compressing the web in the same way as Example 1.

Fibers of 2.5d/f were prepared for a thermoplastic fiber non-woven fabric to be laminated, by the following steps:

melting polypropylene at 300℃ and melting polyethylene at 220℃;

providing the polypropylene and polyethylene from respective extruders to an eccentric sheath-core type conjugating spinneret heated at 280℃ for melt-spinning;

winding the spun eccentric sheath-core type conjugated fibers (sheath composition is polyethylene and core composition is polypropylene) around a bobbin;

drawing the fibers to four times the original length by using 100℃ drawing rollers; and

providing the fibers with zigzag crimps by a stuffer box type crimper. The fibers were cut to be 38mm long, being passed through a carding machine, and webs of a staple fiber non-woven fabric were prepared.

The staple fiber non-woven fabric web was laminated on the melt blown non-woven fabric, and the fibers of the laminate were partially bonded to each other by passing the laminate through compressed rollers of a point bond processor comprising embossed and smooth rollers heated at 126℃.

The apparent density (d) of the melt blown non-woven fabric was 0.1g/cc while Formula A value was 1.8 after the lamination.

The melt blow laminated non-woven fabric had good air permeability, however, it was not appropriate for a liquid impermeable sheet used in an absorbent article, as it did not keep its hydraulic resistance. The condition is shown in Table 1, and the result is shown in Table 2.

The liquid impermeable sheet comprising the laminated non-woven fabric was used for back sheets of various absorbent articles shown in FIGs. 1-5, including disposable diapers and sanitary napkins, for wearer evaluation. As a result, the evaluation was bad due to body fluid leakage to the outside of the absorbent articles, although the air permeability and feeling were good.

Table 1

	Melt blown non-woven fabric						Non-woven fabric for lamination		
	Fiber Diameter (μ m)	Fabric Density (g/cc)	Basis Weight (g/m^2)	Type	Resin Compo-sition	Formula A Value	Fiber type	Type	Resin Compo-sition
Example 1	1.5	0.09	27	Single	PP	12	–	–	–
Example 2	1.0	0.09	27	Single	PP	27	–	–	–
Example 3	1.5	0.08	10	Single	PP	4.4	Filament	Sheath-core	PE/PP
Example 4	1.5	0.08	10	Combined	PE/PP	4.4	Filament	Sheath-core	PE/PP
Example 5	1.5	0.08	10	Sheath-core	COPP/PP	4.4	Filament	Sheath-core	COPP/PP
Example 6	1.5	0.08	10	Parallel	PE/PP	4.4	Staple Fiber	Eccentric sheath-core	PE/PP
Example 7	1.5	0.08	10	Combined	COPP/PP	4.4	Filament	Eccentric sheath-core	COPP/PP
Comparative Example 1	1.5	0.03	20	Single	PP	8.9	–	–	–
Comparative Example 2	1.5	0.09	4	Combined	COPP/PP	1.8	Filament	Eccentric sheath-core	COPP/PP
Comparative Example 3	2.0	0.1	7	Parallel	PE/PP	1.8	Staple Fiber	Eccentric sheath-core	PE/PP

(Note)

PE: polyethylene

PP: Polypropylene

COPP: Propylene-ethylene-butene-1 copolymer

Table 2

	Non-woven fabric physical value			
	Basis Weight (g/m^2)	Air Impermeability ($cc/cm^2 \cdot sec.$)	Hydraulic Resistance (mm)	Non-woven Fabric strength kg/cm(g/m^2)
Example 1	27	9	350	0.007
Example 2	27	10	350	0.007
Example 3	30	50	280	0.042
Example 4	28	50	280	0.042
Example 5	28	50	280	0.043
Example 6	28	50	280	0.048
Example 7	28	50	280	0.042
Comparative Example 1	20	90	150	—
Comparative Example 2	26	80	120	—
Comparative Example 3	28	90	110	—

CLAIMS

1. A liquid impermeable sheet for an absorbent article, comprising a melt blown non-woven fabric comprising ultra fine fibers of thermoplastic polymer, the polymer being spun by a melt blowing method and the fiber diameter being 10 μ m at most, the melt blown non-woven fabric satisfying the following Formulas A and B,

$2 \leqq W/D^2 \leqq 200$...(A)

$19.05 \leqq d \leqq 0.2$... (B)

where W is basis weight (g/m^2), D is fiber diameter (μ m), and d is apparent density of the non-woven fabric (g/cc).

2. The liquid impermeable sheet for an absorbent article according to claim 1, further comprising a fiber non-woven fabric of thermoplastic polymer laminated on the melt blown non-woven fabric.

3. The liquid impermeable sheet for an absorbent article according to claim 1, wherein the melt blown non-woven fabric comprises thermoplastic ultra thin conjugated fibers whose diameter is 10 μ m at most, and the fiber is provided by conjugating a low melting point polymer and a high melting point polymer, the difference in the melting points between the polymers being at least 15℃.

4. The liquid impermeable sheet for an absorbent article according to claim 1, wherein the melt blown non-woven fabric is a combined material of thermoplastic ultra fine fibers whose diameter is 10 μ m at most, and the fibers comprise a low melting point polymer and a high melting point polymer, the difference in the melting points between the polymers being at least 15℃.

5. The liquid impermeable sheet for an absorbent article according to claim 1, wherein the liquid impermeable sheet is formed as a sheet selected from the group consisting of a back sheet, a side sheet, a round sheet and a waist gather for an absorbent article.

6. The liquid impermeable sheet for an absorbent article according to claim 1, wherein the melt blown non-woven fabric comprises at least one polymer selected from the group consisting of a polyolefin polymer and a polyester polymer.

7. The liquid impermeable sheet for an absorbent article according to claim 1, wherein the fibers composing the melt blown non-woven fabric are at least one fiber selected from the group consisting of single fiber, fiber formed by conjugating a low melting point polymer and a high melting point polymer, and fiber formed by combining a low melting point polymer and a high melting point polymer.

8. The liquid impermeable sheet for an absorbent article according to claim 1, wherein the average fiber diameter of the melt blown non-woven fabric is 0.1-9 μ m.

9. The liquid impermeable sheet for an absorbent article according to claim 1, wherein the basis weight of the melt blown non-woven fabric is 4-50g/m^2.

10. The liquid impermeable sheet for an absorbent article according to claim 2, wherein the thermoplastic fiber non-woven fabric is a non-woven fabric comprising at least one fiber selected from the group consisting of filament and staple fiber.

11. The liquid impermeable sheet for an absorbent article according to claim 10, wherein the thermoplastic fiber non-woven fabric comprises a two-composition conjugated fiber formed by conjugating a low melting point polymer and a high melting point polymer.

12. The liquid impermeable sheet for an absorbent article according to claim 11, wherein the difference in the melting points between the high melting point polymer and the low melting point polymer is at least 15℃.

13. The liquid impermeable sheet for an absorbent article according to claim 11, wherein the conjugated fiber is at least one fiber selected from the group consisting of sheath-core type fiber, eccentric sheath-core type fiber, parallel type fiber, multilayer type fiber and sea-island type fiber.

14. The liquid impermeable sheet for an absorbent article according to claim 11, wherein the polymer composition composing the conjugated fiber is at least one polymer selected from the group consisting of polyolefins, polyesters and polyamides.

15. The liquid impermeable sheet for an absorbent article according to claim 10, wherein the fineness of the single fiber composing the non-woven fabric is 0.5-10d/f.

16. The liquid impermeable sheet for an absorbent article according to claim 10, wherein the length of the staple fiber composing the non-woven fabric is 3-51mm.

17. The liquid impermeable sheet for an absorbent article according to claim 10, wherein the staple fiber composing the non-woven fabric is at least one fiber selected from the group consisting of crimped fiber and uncrimped fiber.

18. The liquid impermeable sheet for an absorbent article according to claim 2, wherein the cross section of the fiber is at least one shape selected from the group consisting of circular, modified, and hollow.

19. The liquid impermeable sheet for an absorbent article according to claim 2, wherein the melt blown non-woven fabric and the fiber non-woven fabric for lamination are laminated by using at least one bonding method selected from the group consisting of a heat bonding by embossed rollers, an ultrasonic welding, a hot air cycle bonding using hot air blown at a temperature within the range between the melting points of the high melting point polymer and the low melting point polymer, and a hot melt bonding using a hot melt polymer.

20. An absorbent article comprising the liquid impermeable sheet according to claim 1.

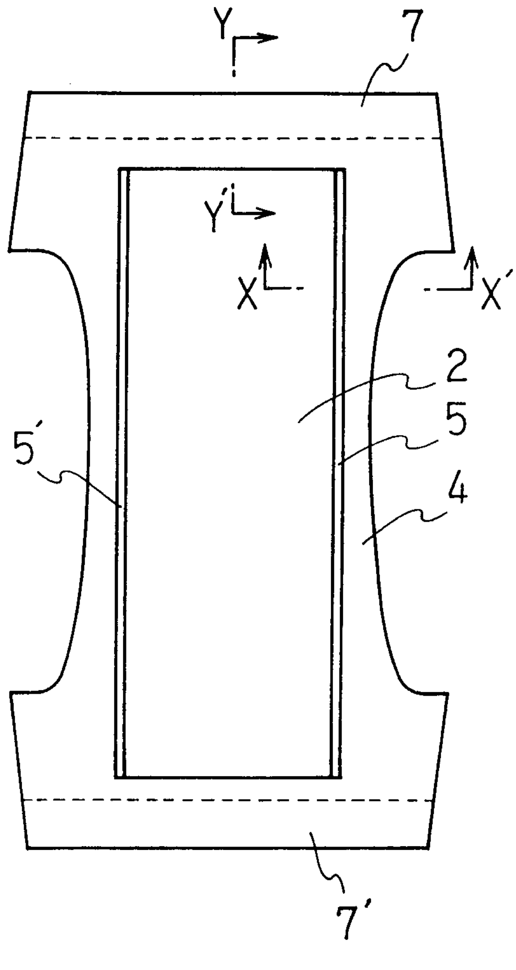

FIG. 1

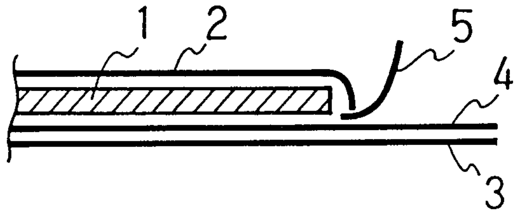

FIG. 2

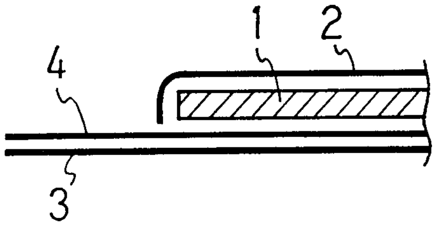

FIG. 3

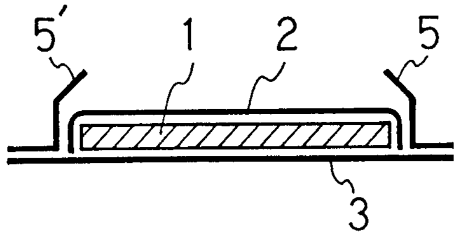

FIG. 5

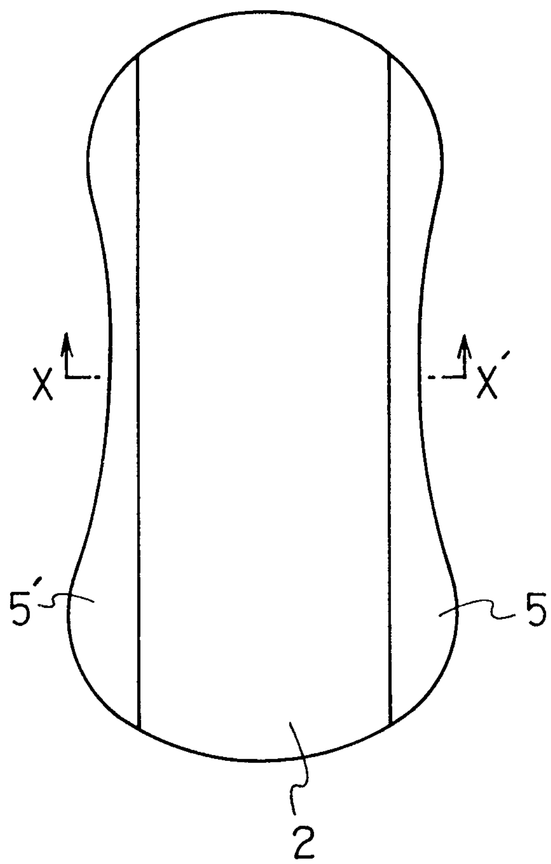

FIG. 4

INTERNATIONAL SEARCH REPORT

Intern: al Application No
PCT/JP 97/04134

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61F13/15

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 6 A61F

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 96 07376 A (KIMBERLY CLARK CO) 14 March 1996 see page 7, line 26 - page 8, line 1 see page 15, line 15 - line 21 see page 12, line 21 - line 24 see the whole document ---	1-20
A	US 4 713 068 A (WANG KENNETH Y ET AL) 15 December 1987 see claim W ---	1-20
A	EP 0 640 329 A (HERCULES INC) 1 March 1995 see the whole document -----	1-20

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

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

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

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

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

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"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
2 March 1998	11/03/1998
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Douskas, K

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/JP 97/04134

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9607376 A	14-03-96	AU 685987 B	29-01-98
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		EP 0782419 A	09-07-97
		PL 319253 A	04-08-97
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		FI 943804 A	24-02-95
		JP 7145541 A	06-06-95
		US 5683809 A	04-11-97