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(54) NONWOVEN WIPER LAMINATE
NICHTGEWEBTES WISCHTUCHLAMINAT
STRATIFIE DE TORCHON NON TISSE

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(56) References cited:
EP-A- 0 205 242
US-A- 4 041 203

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Description

The present invention relates to a wiper of the type as described in the preamble of claim 1. A wiper of this type is described in EP-A-205 242. The known wiper comprises a laminate having a central layer of melt-blown polymeric microfibres inter-mixed with fibres of absorbent material and/or superabsorbent particles. The opposite sides of this central layer are each covered by a thermoplastic microfibre layer in order to form a three-layered laminate. The two outer melt-blown microfibre layers are described to be identical and to have a basis weight of at least 10 grams per square metre, with specific embodiments described to have 15 or 20 grams per square metre. The three layers are bonded together ultrasonically or by the application of heat or heat and pressure in a predetermined pattern.

Disposable wiper products are useful for a wide variety of industrial and consumer applications including those in the automotive, food services, and electrical industries as well as for general purpose household wiping. Such wipers must be low-cost and yet provide the strength, absorbency, cloth-like characteristics and other properties desirable for such wiping applications. Non-woven fabrics, in general, have received wide acceptance as nonwoven disposable wipers both for specific applications and general purpose wiping. For many such applications, nonwoven wipers can out-perform traditional cloth and paper wiping products. However, for some applications, it is desired to even further improve certain nonwoven wiper properties such as resistance to linting and streaking, and it is generally desirable to increase wiper absorbency and strength.

US-A-4,307,143 to Meitner issued December 22, 1981 describes meltblown microfibre wipers treated with a surfactant and embossed. Such wipers are demonstrated to have improved absorbency and wiping properties when compared with traditional wiper materials. US-A-4,298,649 to Meitner dated November 3, 1981 describes a multi-component nonwoven wiper having a layer of meltblown microfibres combined with a split film or fibrillated foam layer. This wiper exhibits low metal chip pick-up characteristics of particular interest in automotive finishing applications. This property is obtained without significant deterioration in wiping properties. US-A-4,328,279 to Meitner and Englebert dated May 4, 1982 relates to a meltblown nonwoven wiper treated with certain surfactants to result in low sodium content of particular interest in electronics industry wiping applications. US-A-4,041,203 to Brook and Meitner dated August 9, 1977 relates to nonwoven fabrics and sterile wrapper materials made by combining layers of meltblown thermoplastic fibres with one or more continuous thermoplastic filament layers. The disclosure recognizes that such materials can be treated for absorbency and used in wiper applications. US-A-4,196,245 to Kitson, Gilbert, Jr., and Israel dated April 1, 1980 relates to a composite nonwoven fabric useful in disposable surgical items and which can comprise one or more meltblown layers loosely bonded to one or more spunbonded layers.


The present invention as claimed in claim 1 relates to an improved nonwoven wiper having low lint and reduced streaking characteristics while also demonstrating improved absorbency. The wiper is a combination of a relatively high basis weight center layer of meltblown thermoplastic microfibres having other fibers or particles mixed therein. On one side thereof there is a relatively lightweight layer of continuous filament thermoplastic fibers of larger diameter. On the other side there is a lightweight meltblown microfiber layer. Preferably all components are treated with a surfactant for wettability, and the combination is preferably bonded by a patterned application of heat and pressure. The resulting wiper is fabric-like, conformable, and useful for many industrial applications as well as general purpose wiping. Preferred thermoplastic materials are polyolefins, and the individual components are preferably made from the same polymer or polymers having similar melt temperatures. Preferred surfactants include ionic and nonionic surfactants such as diocetyl ether of sodium sulfosuccinic acid (Aerosol OT).
An embodiment of the present invention is hereinafter described with reference to the figures, wherein...

FIG. 1 schematically illustrates a process for making the wipes of the present invention; and
FIG. 2 illustrates the multi-component wiper of the present invention.

Microfiber webs produced for the wipes of the present invention are characterized by an average fiber diameter in the range of up to about 10 microns and are preferably manufactured in accordance with the process described in US-A-3,978,165 to Buntin et al., dated August 31, 1976 which is incorporated herein by reference in its entirety and to which reference may be made for details of the meltblown process. Although the example below was carried out with polypropylene, it will be understood that the invention is not limited thereto and that other thermoplastic polymers capable of meltblowing, including polyethylene, polyesters, and polyamides, may be utilized as well. To produce the meltblown web with fibers or particles mixed therein the method and apparatus described in US-A-4,100,324 to Anderson, Sokolowski and Ostermeier dated July 11, 1978 may be used. For best results, in accordance with this invention, the webs contain at least about 30% by weight microfibers, preferably 50% by weight microfibers, and the preferred additional fibers comprise wood pulp.

The continuous filament webs may be produced as described in the above-identified patents relating to spunbonded processes. Suitable polymers include the same ones useful for the meltblowing process. Preferably, polymers used for the component layers are the same.

In a preferred embodiment, the spunbonded layers are individually pattern bonded prior to combining with the meltblown layer. For example, a pattern as illustrated in U.S. Design Patent No. 239,566 to Vogt dated April 13, 1976 having about 153 bonds/6.45 cm² (153 bonds/in²) and about 25% bonded surface area may be employed as may be illustrated in U.S. Design Patent No. 264,512 to Rogers dated May 18, 1982. Such prebonding permits the use of lower overall bonded area when bonding the laminate.

In accordance with the invention, the meltblown web (including added fibers) will have a relatively high basis weight in the range of from about 17 to 170 gsm, preferably in the range of from about 30 to 60 gsm. In contrast, the individual continuous filament layer will have a relatively low basis weight in the range of from about 7 gsm to 34 gsm and preferably 10 gsm to 20 gsm. The exposed meltblown web will have a basis weight generally in the range of from about 5 gsm to 30 gsm with a preferred range of from 10 gsm to 20 gsm.

Any of a wide variety of surfactants, ionic and nonionic may be employed with the individual component layers. These include, for example, diocylsteaer of sodium sulfosuccinic acid (Aerosol OT), isoctyl phenylpoly-

ethoxy ethanol (Triton X-100 and X0102), and others. When the continuous filament layer already contains a surfactant, preferably the surfactant is added only to the meltblown and meltblown with added fiber layers and in an amount of about 0.1 to 1.0% each layer by weight, preferably about 0.2 to 0.6%. Alternatively, the laminate may be treated as a whole by dipping or the like.

Combining of the component webs is preferably accomplished by patterned application of heat and pressure. The particular bonding conditions will depend on the specific material, but in general, it is preferred to use a bond pattern employing about 10 to 250 bonds/6.45 cm² (10 to 250 bonds/in²) (more preferably 20 to 110 bonds/6.45 cm² or 20 to 110 bonds/in²) for coverage of about 5 to 25% (more preferably 10-15%) of the surface area. The bonding temperature, for polypropylene, for example, is preferably in the range of from about 82°C (180°F) to 166°C (330°F), with a pressure preferably in the range of from about 26.8 Kg/cm (150 pli) to about 71.4 Kg/cm (400 pli). Reference may be had to U.S. Design Patent No. 239,566 to Vogt dated April 13, 1976 and US-A-3,655,046 to Hansen and Pennings dated December 17, 1974 for illustrations of bonding patterns. The basis weight of the composite laminate is generally in the range of from about 30 to 150 gsm, preferably about 50 to 105 gsm.

Turning to Fig. 1, a process for forming the wiper material of the invention will be briefly described. Other forming and combining operations that may be utilized will be apparent to those skilled in the art, and it is not intended to limit the invention to the operation specifically set forth.

As shown, meltblowing die 10 deposits microfibers 12 including other fibers 13 supplied from picker 15 onto spunbond web 17 from parent roll 19 carrier by a moving wire 14 supported by rolls 16, one or more of which may be driven. A loose batt 18 is formed to which is added wetting agent 20 by spray nozzle 22. Meltblown microfiber web 26 is deposited by meltblown die 11 onto the middle layer 18 and a wetting agent 23 added by spray nozzle 25. The combination is compacted by turning rolls 27 and 29 and bonded by heat and pressure at pattern calender nip 30 between patterned roll 33 and anvil roll 35, and laminate 37 is wound into parent roll 32 which may be slit into individual wipers shown, for example, in Fig. 2. Turning to Fig. 2, a three-ply laminate wiper 34 is illustrated including microfiber with fibers added layer 18 between continuous filament layer 36 and microfiber layer 40 with pattern bond areas 42.

The invention will now be described in terms of a specific example.

**EXAMPLE**

A laminate wiper material was made as illustrated in Fig. 1. A spunbond polypropylene web having a basis weight of 14 gsm and pattern bonded with a diamond pattern of 225 bond per 6.45 cm² (225 bonds per in²)
covering 25% of the surface area generally made in accordance with US-A-3,855,046 to Hansen and Penning dated December 17, 1974 was unwound onto a forming wire. A meltblown polypropylene web including 70% wood pulp fibers was formed directly onto the spunbonded web at a basis weight of 45 gsm and rate of 5.4 PIH polymer, generally as described in US-A-4,100,324 to Anderson, Sokolowski, and Ostermeier dated July 11, 1978. To the meltblown matrix was added 0.6% by weight of a diocylester of sodium sulfosuccinic acid surfactant (Aerosol OT available from Cyanamid U K). Using a second meltblowing die, a polypropylene microfiber web having a basis weight of 15 gsm was deposited onto the meltblown matrix side opposite the spunbonded layer at a rate of 6 PIH polymer. This microfiber layer was treated with the same surfactant added at 0.6% by weight. The combined layers were bonded by passing through a nip between a heated (107°C or 225°F) diamond engraved roll and a heated (100°C or 212°F) plain anvil roll. The pattern was 30 bonds per 6.45 cm² (30 bonds per in²) and covered 12% of the surface area.

Wipers formed from this laminate were tested with the following results:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lint:</td>
<td>16 mg/m²</td>
</tr>
<tr>
<td>Water Absorbency Rate:</td>
<td>0.7 sec.</td>
</tr>
<tr>
<td>Water Absorbency Capacity:</td>
<td>710%</td>
</tr>
<tr>
<td>Oil Absorbency Rate:</td>
<td>15 sec.</td>
</tr>
<tr>
<td>Oil Absorbency Capacity:</td>
<td>670%</td>
</tr>
<tr>
<td>Grab Tensile:</td>
<td>MD 3392 g peak</td>
</tr>
<tr>
<td>Bulk:</td>
<td>CD 3458 g peak</td>
</tr>
<tr>
<td></td>
<td>1.15 mm</td>
</tr>
</tbody>
</table>

Lint was determined by weight released upon shaking. A piece of masking tape about 76 mm long and a sample of the material to be tested (about 25 cm by 40 cm) were weighed. Grasping opposite edges between thumb and two fingers of each hand, the sample was oscillated vertically up and down vigorously over a black glass plate 559 mm x 457 mm 50 times with opposite motion of each hand. The sample was turned and the procedure repeated grasping the opposite edges. Any particles released were scraped to the center of the plate using a straight edge scraper. The particles were then collected by lightly wiping with the sticky side of the tape after which the tape was folded upon itself and weighed. The weight of particles was calculated as milligrams per square meter of sample, and an average of five tests reported.

Water absorbency and rate were determined by saturation with distilled water at room temperature. In preparation, a piece of standard felt (The British Paper and Board Industry Federation (per Test RTM29:1980) approximately 15 cm by 30 cm was saturated by immersion for at least 24 hours in a tray (30 cm by 40 cm by 6 cm) half full of distilled water at room temperature. After weighing, a 10 cm by 10 cm sample of test material was gently placed on the water surface over the submerged felt, and the time recorded. The sample was observed until it had completely changed color, and that time recorded with the time differential reported as the water absorption rate. The sample was then gently pressed, under the water surface with forceps and located on the top half of the felt. After being submerged for at least a minute the felt and sample were removed by holding the top edge of the felt and avoiding movement of the sample on the felt. The felt with the sample was suspended above the tray until the sample attained a uniform overall color after which the sample was removed from the felt and reweighed. The percent absorptive capacity was calculated as 100 times the difference in sample weights divided by the original sample weight.

Oil absorbency and rate were determined in the same manner as for water by substituting SAW 20W/50 motor oil (e.g. CASTROL GTX) for water.

Grab tensile was determined by measuring peak load using an Instron tester in accordance with Method 5100 Federal Test Methods Standard No. 191A.

Bulk was determined by the use of a Starrett dial guage Model 25-581, 0-100 dial units with 0.01 mm graduation having a full span of 25 cm. A 100 mm x 100 mm Lucite block was selected with thickness adjusted to give a total force exerted on the sample by the block and the spring of 225g (125g). Each sample was 100 mm by 100 mm and free of creases or wrinkles. The platen was raised and a sample centered on the bed plate as far as possible under the platen. The platen was released onto the sample, and the bulk read 10 to 20 seconds after release. The results were reported to the nearest 0.01 mm, and an average of tests on at least three samples reported.

As shown, the wiper of the present invention exhibits improved characteristics for wipers for oil and water, particularly in the features of absorbency and streak-free wiping. These results are particularly advantageous in food service wipers applications, for example, where leaving a streak-free stainless steel surface is often very important. Furthermore, the low lint characteristics are important for electronics and other applications where a dust-free environment is considered necessary. Other applications for high quality wiper products will be apparent such as, for example, in healthcare as surgeons' hand towels and the like.

While it is not desired to limit the invention to any theory, it is believed that the lightweight continuous filament outside webs provide strength and wicking action which rapidly draws liquid through to the highly absorbent microfiber and fiber mixture layer. This microfiber layer then aggressively holds the liquid within its interstices and resists streaking. The opposite microfiber layer provides streak-free, clean wiping.

Thus it is apparent that there has been provided, in accordance with the invention, a wipe material that fully satisfies the objects, aims and advantages set forth above. While the invention has been described in conjunction with specific embodiments thereof, it is evident
that many alternatives, modifications, and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alternatives, modifications and variations as fall within the broad scope of the appended claims.

Claims

1. Wiper (34) comprising a pattern bonded and surfactant containing laminate (37) which includes a central, high absorbency layer (18) comprising a matrix of thermoplastic microfibers having mixed therein other fibers or particles, a thermoplastic microfiber layer (40) on one side of said central layer (18), and a further layer (36) on the opposite side of said central layer (18), characterised in that

   the relatively lightweight thermoplastic microfiber layer (40) has a basis weight from about 5 g/m² to about 30 g/m² and the further layer is a relatively lightweight layer (36) of spunbonded continuous filaments having a basis weight from about 7 g/m² to about 34 g/m² with filaments larger in diameter than the microfibers.

2. Wiper of claim 1 wherein the continuous filament layer (36) comprises a spunbond polypropylene web.

3. Wiper of claim 1 or 2 wherein the central layer (18) comprises a matrix of polypropylene microfibers having distributed therein up to 70% by weight of wood pulp fibers.

4. Wiper of claim 3 wherein the central layer (18) has a basis weight in the range of from about 17 to 170 gsm.

5. Wiper of any one of claims 1 to 4 wherein said thermoplastic microfiber surface layer (40) comprises polypropylene microfibers.

6. Wiper of any one of claims 1 to 5 wherein the surfactant is selected from the group consisting of dioctyl esters of sodium sulfo succinic acids and isocetyl phenylpolyethoxetanol.

7. Wiper of any one of claims 1 to 6 wherein the surfactant is included in an amount of between about 0.1 to 1.0% by weight in each of the exposed microfiber and central layers (19,40).

8. Wiper of any one of claims 1 to 7 wherein the laminate is bonded in a pattern of about 10 to 250 bonds / cm² (10 to 250 bonds/m²) and occupying about 5 to 25% of the surface area.

9. Wiper of any one of claims 1 to 8 having a total basis weight in the range of from about 30 to 150 gsm.

Patentansprüche

1. Wischtuch (34) mit einem mustergebundenen und ein oberflächenaktives Mittel enthaltenden Laminat (37), das eine zentrale Schicht (18) hoher Absorptionsfähigkeit, die eine Matrix aus thermoplastischen Mikrofasern mit eingeschichtenen anderen Fasern oder Partikeln umfaßt, eine thermoplastische Mikrofaserschicht (40) auf einer Seite der zentralen Schicht (18) und eine weitere Schicht (36) an der gegenüberliegenden Seite der zentralen Schicht (18) aufweist, dadurch gekennzeichnet, daß die relativ leichtgewichtige, thermoplastische Mikrofaserschicht (40) ein Basisgewicht von etwa 5 g/m² bis etwa 30 g/m² aufweist, und daß die weitere Schicht eine relativ leichtgewichtige Schicht (36) aus spinnegebundenen, kontinuierlichen Filamenten ist, die ein Basisgewicht von 7 g/m² bis etwa 34 g/m² aufweist, wobei die Filamente größer im Durchmesser als die Mikrofasern sind.

2. Wischtuch nach Anspruch 1, wobei die Schicht (36) aus kontinuierlichen Filamenten eine spinnegebundene Polypropylenbahn enthält.

3. Wischtuch nach Anspruch 1 oder 2, wobei die zentrale Schicht (18) eine Matrix aus Polypropylenmikrofasern umfaßt, in der bis zu 70 Gew.-% Holz pulpefasern verteilte sind.

4. Wischtuch nach Anspruch 3, wobei die zentrale Schicht (18) ein Basisgewicht im Bereich von etwa 17 bis 170 g/m² aufweist.

5. Wischtuch nach einem der Ansprüche 1 bis 4, wobei die Oberflächenschicht (40) aus thermoplastischen Mikrofasern Polypropylenmikrofasern enthält.

6. Wischtuch nach einem der Ansprüche 1 bis 5, wobei das oberflächenaktive Mittel ausgewählt ist aus der Gruppe, die besteht aus Dioctylester der Natriumsulfoberstearinsäure und Isocetyl-Phenylpolyethoxetanol.

7. Wischtuch nach einem der Ansprüche 1 bis 6, wobei das oberflächenaktive Mittel in einem Anteil zwischen etwa 0,1 bis 1,0 Gew.-% sowohl in der offengelegten Mikrofasernetz- als auch der zentralen Schicht (19,40) enthalten ist.

8. Wischtuch nach einem der Ansprüche 1 bis 7, wobei das Laminat in einem Muster von etwa 10 bis 250
Verbindungen/6,45 cm² (10 bis 250 Verbindungen/inch²) gebunden ist und etwa 5 bis 25% des Oberflächenbereichs einnimmt.

9. Wischtuch nach einem der Ansprüche 1 bis 8 mit einem Gesamtbasismgewicht im Bereich von etwa 30 bis 105 g/m².

Revendications

1. Torchon (34) comprenant un stratifié (37) lié selon un motif et contenant un tensioactif, qui comprend une couche centrale (18) fortement absorbante comprenant une matrice de microfibres thermoplastiques dans lesquelles sont méliées d'autres fibres ou particules, une couche de microfibres thermoplastiques (40) sur une face de ladite couche centrale (18), et une autre couche (36) sur la face opposée de ladite couche centrale (18), caractérisé en ce que la couche relativement légère (40) de microfibres thermoplastiques a une masse surfacique d'environ 5 g/m² à environ 30 g/m², et l'autre couche est une couche relativement légère (36) de filaments continus non tissés ayant une masse surfacique d'environ 7 g/m² à environ 34 g/m² avec des filaments de plus grand diamètre que les microfibres.

2. Torchon selon la revendication 1, dans lequel la couche de filaments continus (36) comprend une nappe de polypropylène non tissé.

3. Torchon selon la revendication 1 ou 2, dans lequel la couche centrale (18) comprend une matrice de microfibres de polypropylène dans lesquelles sont réparties, jusqu'à 70% en poids de fibres de cellulose.

4. Torchon selon la revendication 3, dans lequel la couche centrale (18) a une masse surfacique dans le domaine d'environ 17 à 170 g/m².

5. Torchon selon l'une quelconque des revendications 1 à 4, dans lequel ladite couche de surface (40) en microfibres thermoplastiques comprend des microfibres de polypropylène.

6. Torchon selon l'une quelconque des revendications 1 à 5, dans lequel le tensioactif est choisi dans le groupe constitué des esters dioctyliques d'acides sodium sulfosucciniques et des isocétyle phénolpoxyéthanol.

7. Torchon selon l'une quelconque des revendications 1 à 6, dans lequel le tensioactif est compris en une quantité comprise entre environ 0,1 et 1 % en poids dans chacune des couches centrale et de microfibres exposées (19, 40).

8. Torchon selon l'une quelconque des revendications 1 à 7, dans lequel le stratifié est lié selon un motif d'environ 10 à 250 liaisons / 6,45 cm² (10 à 250 liaisons/pouce carré) et occupant environ 5 à 25 % de la surface.

9. Torchon selon l'une quelconque des revendications 1 à 8, ayant une masse surfacique totale comprise dans le domaine d'environ 30 à 150 g/m².