METHOD FOR MANUFACTURING A WATERTIGHT, BREATHABLE SHOE STRUCTURE

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ABSTRACT
Method for manufacturing a watertight, breathable shoe structure in which the shoe structure comprises an exterior upper with a lower end, an interior upper with a lower end, an insole with a continuous outer edge and an outsole, with the interior upper having a watertight, water vapour permeable functional layer on the side facing towards the exterior upper, characterised in that at least one of the sewn seam joints relating to the interior upper with the watertight, water vapour permeable functional layer is formed such that a tape made from a thermoplastic material is first placed between the parts of the shoe structure to be joined, in the area of the intended sewn seam, said tape having a melting temperature in the range from 60° C. to 85° C., that the parts are then sewn together and that after sewing the tape is caused to melt at least in the area of the sewn seam.
METHOD FOR MANUFACTURING A WATERTIGHT, BREATHABLE SHOE STRUCTURE

[0001] The invention relates to a method for manufacturing a watertight, breathable shoe structure and to a watertight and breathable shoe structure.

[0002] A watertight, breathable shoe structure commonly consists of an exterior upper that is air-permeable and hence water-permeable, e.g., made from leather or a textile material, an interior upper comprising a lining material and a watertight, water vapour permeable functional layer, an insole that is joined along its outer edge to the interior upper and the exterior upper by a sewn seam, and an outsole that is injection moulded to the insole and the joined ends of the interior upper and exterior upper in such a way that both the sewn seam joining insole, interior upper and exterior upper together, and the end of the upper proper are surrounded by the outsole material.

[0003] A critical feature of such a watertight, breathable shoe structure is a complete and durable sealing of the sewn seams joining together parts of the interior upper, which contains a water vapour permeable functional layer, and of the sewn seams joining interior upper to exterior upper and/or insole.

[0004] Although a sewn seam joining insole, interior upper and exterior upper together is surrounded by the injection moulded outsole, it has been discovered that the exterior upper used for such shoes, which can be made of leather or a textile material, conducts water. As a result, water can enter the exterior upper or pass through the exterior upper on the side facing the interior upper down to the lower end of the exterior upper to the sewn seam joining insole, interior upper and exterior upper together and pass through the holes in the functional layer produced by the sewn seam to the lining of the interior upper, in other words into the inside of the shoe.

[0005] Numerous measures have been described for preventing such water bridges. EP 0 298 360, for example, discloses a shoe structure whose exterior upper, which is shorter than the interior upper, is joined to a continuous, porous or net-like material, with the upper end of this material being sewn to the exterior upper and the lower end to the lower end of the interior upper and the insole. Water reaching the joining sewn seam between exterior upper and porous material cannot penetrate through to the joining sewn seam between insole, interior upper and porous tape, as during the injection moulding of the outsole the liquid sole material passes through the porous tape and thus reaches the functional layer. This suppresses the water conductivity to the joining sewn seam between insole, interior upper and porous tape. Since, however, the sewn seam between porous tape and exterior upper has to be covered by the injection moulded outsole, this results in an outsole edge that has to have a relatively high form. Furthermore, such porous tapes are relatively rigid and result in additional creasing.

[0006] EP 1 197 158 B1 also discloses a shoe structure with a shorter exterior upper than the interior upper and a connecting element that is sewn at its upper end to the exterior upper, and at its lower end to the lower end of the interior upper and the insole. However, the connecting element is not a net-like material through which the sole material passes during injection moulding, but a two-layer sheet material made from fusible polymers with different melting points, with the side of the two-layer sheet material facing towards the functional layer having a lower melting point than the temperature generated during injection moulding of the outsole. During the injection moulding process, this part of the two-layer textile element melts, thus sealing the functional layer and suppressing the water conductivity to the joining sewn seam between insole, interior upper and two-layer connecting element. The manufacture of the connecting element, however, is relatively expensive. Furthermore, the heat transfer from the one side of the two-layer connecting element that is in contact with the sole material during injection moulding, to the other side facing towards the functional layer, can prove to be problematic, so that melting of the side of the two-layer connecting element facing towards the functional layer is not always assured during the injection moulding process.

[0007] A further measure for preventing a water bridge is disclosed in EP 0 544 270, which discloses a watertight, breathable shoe structure with a shorter exterior upper than the interior upper, i.e., the lower end of the interior upper protrudes beyond the lower end of the exterior upper towards the insole. In this shoe structure the insole is sewn only to the interior upper. The lower end of the exterior upper is glued to the interior upper and the outsole is directly injection moulded to the lower end of the interior upper protruding beyond the lower end of the exterior upper. As a result of the shortened exterior upper, the liquid sole material spreads unhindered to the interior upper with the functional layer and thus seals the sewn seam between insole and interior upper. This measure again creates a separation between exterior upper and insole, so that only interior upper and insole are joined together by a sewn seam and no sewn seam joint is necessary between interior upper, exterior upper and insole. This structure does without a connecting element that is joined at the upper end to the exterior upper and at the lower end to the insole and the interior upper, and joins the lower end of the exterior upper to the interior upper by means of a glued joint. Although this shoe structure prevents a water bridge between exterior upper and interior upper, the lack of a sewn seam and the gluing only of the lower end of the exterior upper to the interior upper also has disadvantages.

[0008] Gluing is far more time-consuming than sewing. A suitable glue first has to be applied, activated and then pressed until the glue has set. Compared with a sewn seam, the glued joint between the lower end of the exterior upper and the interior upper no longer allows the position of the exterior upper to be corrected relative to the interior upper in order to prevent possible creasing. In the case of a glued joint a correction, i.e. a shift in the position of the exterior upper relative to the interior upper, would result in the functional layer being destroyed. Such corrections are possible during the course of a sewing process.

[0009] EP 1 743 536 discloses a shoe structure comprising a watertight, water vapour permeable functional layer where the joints here affecting the functional layer are formed as a sewn seam and not as a glued joint. It is therefore not necessary to do without a sewn seam joining the functional layer to other parts of the shoe, such as exterior upper and/or insole, while sealing of the shoe structure along the sewn seam can still be assured. This is achieved by placing a tape between the parts to be joined in the area of the intended sewn seam, which tape after sewing is caused to melt by the application of heat and thus seals the openings created by the sewn seam.
[0010] The object of the present invention is to provide a further-improved method for manufacturing a watertight, breathable shoe structure and to provide a watertight, breathable shoe structure.

[0011] This object is achieved by a method for manufacturing a watertight, breathable shoe structure in which the shoe structure comprises an interior upper with a lower end, an interior upper with a lower end, an insole with a continuous outer edge and an outsole, with the interior upper having a watertight, water vapour permeable functional layer on the side facing towards the exterior upper, characterised in that at least one of the sewn seams joining the interior upper with the watertight, water vapour permeable functional layer is formed such that a tape made from a thermoplastic material is first placed between the parts of the shoe structure to be joined, in the area of the intended sewn seam, said tape having a melting temperature in the range from 60°C. to 85°C., that the parts are then sewn together and that after sewing the tape is caused to melt at least in the area of the sewn seam.

[0012] The tape preferably has a melting temperature in the range from 65°C. to 75°C.

[0013] A sewn seam in the context of the invention is a joint between flat materials using a thread.

[0014] The sewn seam sealing tape is known to a person skilled in the art that are used, for example, in clothing and are applied to the sewn seam by ironing having a melting temperature in the range from 120°C. to 150°C. The use of a material with a low melting temperature in the range from 60°C. to 85°C. makes it particularly easy to seal the sewn seams, even if the tape is positioned between the parts to be joined by the sewn seam. Particularly in a shoe structure, easy access to the sewn seams is not possible at all points so that ironing is therefore not always possible. Alternatively, the tape can be caused to melt by means of hot air or high frequency, but it cannot always be assured that the required melting temperature is achieved at all points of the tape and that the sewn seam is reliably sealed. With the very low melting temperature required in the inventive method in the range from 60°C. to 85°C., preferably in the range from 65°C. to 75°C., melting of the tape and sealing of the sewn seam, particularly even at poorly accessible points, is assured. Furthermore, it has been surprisingly discovered, that the temperatures prevailing in the shoe structure, which lie in the range of the body temperature due to the close contact between shoe structure and foot during wearing of the shoe structure, result in the tape remaining very soft and elastic and reliably and permanently sealing even at points with increased mechanical load.

[0015] The tape material with a melting temperature of 60°C. to 85°C. is selected from the group comprising co-polyamides, polyurethanes, polyurethane copolymers, olefinic copolymers, for example ethylene terpolymer, acrylate copolymers and ethylene vinyl acetate terpolymer.

[0016] The tape that is placed between the parts to be joined is preferably in contact with the watertight, water vapour permeable functional layer. The tape employed for the inventive method is preferably a film or flat textile structure, e.g. a non-woven, a woven or knitted fabric or combinations thereof.

[0017] The interior upper comprises a lining and a watertight, water vapour permeable functional layer, with the watertight, water vapour permeable functional layer preferably being a laminate with the lining.

[0018] The interior upper may consist of several individual parts or shaped parts that are joined by sewn seams. The invention comprises the sewn seams joining parts of the interior upper together and such sewn seams that join the interior upper, the exterior upper and/or the insole together.

[0019] The inventive method is preferably characterised in that the tape has a layer on at least one side that is tacky at room temperature. A tape with a layer that is tacky at room temperature facilitates handling as the tape does not slip during sewing.

[0020] In a preferred embodiment of the inventive method, the lower end of the exterior upper, the lower end of the interior upper and the outer edge of the insole are sewn together, with the tape being placed between exterior upper and interior upper before exterior upper, interior upper and insole are sewn together. After sewing of the exterior upper, the interior upper and the insole, heat is applied to the sewn seam causing the tape to melt and the openings created by the sewn seam to be sealed.

[0021] The outsole can then be glued or injection moulded to the shoe structure. In shoes with injection moulded sole, the heat of the melt that forms the sole material after injection moulding is sufficient to melt the tape positioned and sewn in between exterior upper and lining upper, thus causing the openings created by the sewn seam to be sealed.

[0022] Since in this preferred embodiment three parts, exterior upper, interior upper and insole, are joined by a sewn seam, the use of a tape with a layer on both sides that is tacky at room temperature is particularly advantageous, as the interior upper containing the functional layer is already separably prefixed with the exterior upper before sewing. Interior upper and exterior upper can therefore not slip relative to one another when interior upper, exterior upper and insole are sewn together, but at the same time it is still possible to correct the position of the exterior upper relative to the interior upper.

[0023] In a further preferred embodiment of the method for manufacturing a watertight, breathable shoe structure, the lower end of the interior upper protrudes beyond the lower end of the exterior upper, and the exterior upper is joined to the interior upper at the lower end of the exterior upper by a sewn seam. The tape is placed between exterior upper and interior upper in the area of the intended seam, and then exterior upper and interior upper are sewn together. The outer edge of the insole is joined to the lower end of the interior upper, and the outsole is injection moulded onto the insole and the lower ends of exterior upper and interior upper in such a way that the lower ends of exterior upper and interior upper are surrounded by the outsole and the outsole is injection moulded onto the end of the interior upper protruding beyond the lower end of the exterior upper. After sewing, the tape is caused to melt at least in the area of the sewn seam. The melting of the tape between interior upper and exterior upper seals the sewn seam holes created by the sewn seam between interior upper and exterior upper.

[0024] In this embodiment, too, the tape can be caused to melt by the heat during the injection moulding of the outsole and thus ensures sealing of the sewn seam between exterior upper and interior upper.

[0025] In a preferred embodiment of the inventive method, the tape that is inserted in the area of the sewn seam between interior upper and exterior upper is characterised in that it has a layer on one side that is tacky at room temperature. A layer on one side that is tacky is sufficient when sewing two flat materials as the tacky layer serves only to separably prefix the tape before sewing so that the tape does not slip during sewing.
In a properly formed taut sewn seam, the tape can be inserted with the tacky side on both the inside of the exterior upper and on the side of the interior upper facing towards the exterior upper, i.e. on the functional layer. If the shoe structure is a watertight, breathable shoe structure with an interior upper having a functional layer, it is preferable that the tape is inserted with the tacky side on the side of the interior upper facing towards the exterior upper, i.e. on the watertight, water vapour permeable functional layer. As the water tightness of the shoe structure is achieved by means of the functional layer, it is predominantly important to reliably seal the sewn seam holes through the functional layer; this is assured by placing the tape onto the functional layer before sewing.

In a further preferred embodiment of the inventive method, the tape extends from the area of the sewn seam between interior upper and exterior upper to the lower end of the interior upper. In this way the complete area of the interior upper that is not covered by the exterior upper is sealed watertight by the tape after melting.

The outer edge of the insole is preferably joined to the lower end of the interior upper by means of a sewn seam.

In a further preferred embodiment of the inventive method for manufacturing a watertight, breathable shoe structure, the interior upper and exterior upper have roughly the same length. The tape with a melting temperature in the range from 60°C to 85°C is inserted between interior upper and exterior upper, and interior upper and exterior upper are subsequently sewn together in the area in which the tape is located. The exterior upper now sewn to the interior upper is then lasted at the insole, i.e. joined to the insole by gluing, and then the tape is caused to melt at least in the area of the sewn seam. With this makeup, the sole can be glued or injection moulded to the shoe structure, with the melting of the tape during injection moulding of the sole being caused by the heat of the injection moulding.

Furthermore, the inventive method for manufacturing a watertight, breathable shoe structure can be used for a makeup in which the exterior upper extends beyond the lower end of the interior upper. The tape is inserted between interior upper and exterior upper, whereby with this makeup the tape must extend to the lower end of the exterior upper. Exterior upper, interior upper and the inserted tape are then sewn together and the lower end of the exterior upper that extends beyond the lower end of the interior upper is lasted or sewn to the insole. The tape is then caused to melt in the area of the sewn seam between interior upper and exterior upper and in the part of the exterior upper extending beyond the lower end of the interior upper. With this makeup, the sole can be glued or injection moulded to the shoe structure, with the melting of the tape during injection moulding of the sole in turn being caused by the heat of the injection moulding. With this makeup, the tape seals the sewn seam between interior upper and exterior upper, and seals the exterior upper down to the lower end of the exterior upper. The advantage of this makeup is that creasing of the upper during drawing or tucking of the upper over the last, to be observed particularly in the toe and heel areas, is reduced, as only the exterior upper has to be drawn over the last and not exterior upper and interior upper together.

The inventive method is also suitable for manufacturing a watertight, breathable shoe structure in a more lightweight makeup with a shell-shaped sole and without insole. With this makeup, interior upper and exterior upper can be of essentially the same length or the interior upper can extend beyond the lower end of the exterior upper. For the manufacture of this shoe structure, the interior upper is first folded back and the tape with a melting temperature in the range from 60°C to 85°C, preferably with a melting temperature in the range from 65°C to 75°C, is sewn to the exterior upper with the tape extending beyond the lower end of the exterior upper. When the exterior upper has been joined to the shell-shaped sole by means of a further sewn seam, the interior upper is folded towards the exterior upper and the tape is caused to melt. The tape thus seals the sewn seam between exterior upper and tape, and the sewn seam between exterior upper, tape and shell-shaped sole, and furthermore adheres the interior upper to the exterior upper.

A further makeup for which the inventive method can be used is a flexible shoe structure with sewn-on watertight insole or sewn-on watertight outsole. With this makeup, exterior upper and interior upper have essentially the same length or the interior upper is slightly shorter than the exterior upper, 'slightly shorter' here meaning approx. 2 mm to 8 mm shorter than the exterior upper. The tape is inserted between exterior upper and interior upper, with the lower end of the tape extending beyond the lower end of the interior upper. The tape is folded around the lower end of the interior upper so that the tape surrounds the lower end of the interior upper. A tape having a layer on at least one side that is tacky at room temperature is particularly advantageous in order that the tape does not slip in this position before sewing. After production of the sewn seam joint between exterior upper, interior upper, insole or outsole, where appropriate, and the tape lying between these parts, the tape is caused to melt in a known manner, thus sealing the sewn seam. The flexible makeup can also be performed in that the lower end of the exterior upper extends beyond the lower end of the interior upper. The tape, which extends to at least the lower end of the exterior upper, is then sewn to the interior upper in the areas of the lower end of the interior upper. A further sewn seam joins exterior upper, insole or outsole, where appropriate, and the tape lying between these parts before the tape is caused to melt in a known manner and seals the sewn seams described.

The inventive method is also suitable for manufacturing a watertight, breathable shoe structure of sewn-welted makeup. This makeup requires an insole with ribbing and a watertight layer on the underside. The ribbing is also of watertight material and is glued to the watertight layer of the insole. With this makeup, the lower end of the exterior upper extends below the lower end of the interior upper. The tape is sewn to the interior upper in the area of the lower end of the interior upper so that the tape extends to the lower end of the exterior upper or beyond. A welt that serves to increase the stability is laid along the lower perimeter of the exterior upper and subsequently sewn with a seam to the ribbing of the insole, tape and exterior upper. After sewing, the tape is caused to melt in turn. With this makeup, the sole is glued and possibly joined by means of a further sewn seam to the welt.

Furthermore, an object of the present invention is to provide a further-improved watertight, breathable shoe structure in which the disadvantages of the prior art are at least reduced.

This object is achieved with a watertight, breathable shoe structure comprising an exterior upper with a lower end, an interior upper with a lower end, an insole with a continuous outer edge and an outsole, in which the interior upper has a watertight, water vapour permeable functional layer on the side facing towards the exterior upper, characterised in that at
least one of the sewn seam joints relating to the interior upper with a watertight, water vapour permeable functional layer is formed such that a tape made from a thermoplastic material is located at least in the area of the sewn seam and is in contact with the watertight, water vapour permeable functional layer, that the tape extends into the sewn seam holes of the functional layer and fills the space between thread and sewn seam hole, and that the tape has a melting temperature in the range from 60°C to 85°C. The tape preferably has a melting temperature in the range from 65°C to 75°C.

[0036] In a preferred embodiment, the inventive watertight, breathable shoe structure is characterised in that the lower end of the exterior upper, the lower end of the interior upper and the outer edge of the insole are sewn together and that the tape is located between exterior upper and interior upper.

[0037] In a further preferred embodiment, the inventive watertight, breathable shoe structure is characterised in that the lower end of the interior upper extends beyond the lower end of the exterior upper and is joined to the insole by means of a sewn seam, that a plastic outsole is injection moulded to the insole and the lower ends of exterior upper and interior upper so that the lower ends of exterior upper and interior upper are surrounded by the outsole and that the tape is located between the exterior upper and the interior upper at least in the area of the sewn seam.

[0038] Further preferred embodiments relate to the make-ups disclosed in the context of the inventive method.

1. Method for manufacturing a watertight, breathable shoe structure in which the shoe structure comprises an exterior upper with a lower end, an interior upper with a lower end, an insole with a continuous outer edge and an outsole, with the interior upper having a watertight, water vapour permeable functional layer on the side facing towards the exterior upper, wherein at least one of the sewn seam joints relating to the interior upper with the watertight, water vapour permeable functional layer is formed such that a tape made from a thermoplastic material is placed between the parts of the shoe structure to be joined, in the area of the intended sewn seam, said tape having a melting temperature in the range from 60°C to 85°C, that the parts are then sewn together and that after sewing the tape is caused to melt at least in the area of the sewn seam.

2. Method according to claim 1, wherein the tape has a melting temperature in the range from 65°C to 75°C.

3. Method according to claim 1, wherein the tape is in contact with the watertight, water vapour permeable functional layer.

4. Method according to claim 1, wherein the tape has a layer on at least one side that is tacky at room temperature.

5. Method according to claim 1, wherein the lower end of the exterior upper, the lower end of the interior upper and the outer edge of the insole are sewn together, and that the tape is inserted between exterior upper and interior upper before exterior upper, interior upper and insole are sewn together.

6. Method according to claim 4, wherein the tape has a layer on both sides that is tacky at room temperature.

7. Method according to claim 1, wherein the lower end of the interior upper extends beyond the lower end of the exterior upper, that the exterior upper is joined to the interior upper at the lower end of the exterior upper by means of a sewn seam, that the tape is inserted between exterior upper and interior upper in the area of the intended sewn seam and then exterior upper and interior upper are sewn together, that the outer edge of the insole is joined to the lower end of the interior upper, that the outsole is injection moulded to the insole and to the lower ends of exterior upper and interior upper so that the lower ends of exterior upper and interior upper are surrounded by the outsole and the outsole is injection moulded to the end of the interior upper extending beyond the lower end of the exterior upper.

8. Method according to claim 7, wherein the tape has a layer on one side that is tacky at room temperature.

9. Method according to claim 7, wherein the tape extends from the area of the sewn seam between interior upper and exterior upper to the lower end of the interior upper.

10. Method for manufacturing a watertight, breathable shoe structure of a more lightweight makeup without insole, in which the shoe structure comprises an exterior upper with a lower end, an interior upper with a lower end and a shell-shaped sole, with the interior upper having a watertight, water vapour permeable functional layer on the side facing towards the exterior upper, and in which interior upper and exterior upper are of essentially the same length or with an interior upper extending beyond the lower end of the exterior upper, wherein the interior upper is first folded back and the tape with a melting temperature in the range from 60°C to 85°C, is sewn to the exterior upper with the tape extending beyond the lower end of the exterior upper, that the exterior upper is joined to the shell-shaped sole by means of a further sewn seam and then the interior upper is folded towards the exterior upper again and the tape is caused to melt.

11. Watertight, breathable shoe structure comprising an exterior upper with a lower end, an interior upper with a lower end, an insole with a continuous outer edge and an outsole, in which the interior upper has a watertight, water vapour permeable functional layer on the side facing towards the exterior upper, wherein at least one of the sewn seam joints relating to the interior upper with a watertight, water vapour permeable functional layer is formed such that a tape made from a thermoplastic material is located at least in the area of the sewn seam and is in contact with the watertight, water vapour permeable functional layer, that the tape extends into the sewn seam holes of the functional layer and fills the space between thread and sewn seam hole, and that the tape has a melting temperature in the range from 60°C to 85°C.

12. Watertight, breathable shoe structure according to claim 11, wherein the lower end of the exterior upper, the lower end of the interior upper and the outer edge of the insole are sewn together, and that the tape is located between exterior upper and interior upper.

13. Watertight, breathable shoe structure according to claim 11, wherein the lower end of the interior upper extends beyond the lower end of the exterior upper and is joined to the insole by means of a sewn seam, that a plastic outsole is injection moulded to the insole and the lower ends of exterior upper and interior upper so that the lower ends of exterior upper and interior upper are surrounded by the outsole and that the tape is located between the exterior upper and the interior upper at least in the area of the sewn seam.