

GRIPPING ELEMENTS

BACKGROUND

5 One of the primary issues with strapless bras is their tendency to slip or shift throughout the day, especially if they do not fit perfectly or lack adequate grip against the skin. Certain activities or movements, such as bending over or reaching up, can cause strapless bras to shift or slide down, requiring frequent adjustments throughout the day. The conventional strapless bra provides the gripping effect via an exposed fabric liner. This separate liner
10 material may create discomfort to the user.

Many options present in the market are available in limited sizes and/or do not provide sufficient support for larger cup sizes. The following materials/ components/ products attempt to solve the above-mentioned issues:

- 15
- non-slip fabrics;
 - gel grips;
 - silicone adhesive strip in the neckline of bras; and
 - adhesive components and inserts.

20 BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is an illustration of a first embodiment of the bra cup according to the present invention (100) comprising a first array of gripping elements arranged in a linear pattern (102a, 102b and 102c) on a first region adjacent to the neckline edge of the cup structure and a second array of gripping elements (104) arranged in a concentric pattern on a second region below
25 the first region, wherein the gripping elements each have a substantially rectangle shape.

FIG. 2 is an illustration of a second embodiment of the bra cup according to the present invention (200) comprising a first array of gripping elements arranged in a zig-zag pattern (202) on a first region adjacent to the neckline edge of the cup structure and a second array
30 of gripping elements arranged in a linear pattern (204) on a second region below the first region.

FIG. 3 is an illustration of a third embodiment of the bra cup according to the present invention (300) comprising a first array of gripping elements arranged in a staggered pattern (302) on a
35 first region adjacent to the neckline edge of the cup structure and a second array of gripping elements (304) arranged in a linear pattern on a second region below the first region, wherein the gripping elements of the second array each have a substantially star shape.

FIG. 4 is an illustration of a fourth embodiment of the bra cup according to the present invention (400) comprising a first array of gripping elements arranged in a linear pattern (402) on a first region adjacent to the neckline edge of the cup structure and a second array of gripping elements (404) arranged in a concentric pattern on a second region below the first region.

FIG. 5 is an illustration of a fifth embodiment of the bra cup according to the present invention (500) comprising a first array of gripping elements arranged in a linear pattern (502a, 502b and 502c) on a first region adjacent to the neckline edge of the cup structure; and a second array of gripping elements arranged in a linear pattern (504a and 504b) on a second region below the first region, wherein the gripping elements each have a substantially rectangle shape.

FIG. 6 is an illustration of a sixth embodiment of the bra cup according to the present invention (600) comprising a first array of gripping elements arranged in a triangular pattern (602) on a first region adjacent to the neckline edge of the cup structure and a second array of gripping elements (604) arranged in a concentric pattern on a second region below the first region.

FIG. 7 is an illustration of a seventh embodiment of the bra cup according to the present invention (700) comprising a first array of gripping elements arranged in a linear pattern (702a, 702b, 702c and 702d) on a first region adjacent to the neckline edge of the cup structure and a second array of gripping elements arranged in a linear pattern (704a, 704b, 704c, 704d and 704e) on a second region below the first region, wherein the gripping elements each have a substantially rectangular shape.

FIG. 8 includes photographs of a polyurethane bra cup.

FIG. 9 includes photographs of a spacer fabric bra cup.

DESCRIPTION

In embodiments herein, the word “comprising” may be interpreted as requiring the features mentioned, but not limiting the presence of other features. Alternatively, the word “comprising” may also relate to the situation where only the components/features listed are intended to be present (e.g. the word “comprising” may be replaced by the phrases “consists of” or “consists essentially of”). It is explicitly contemplated that both the broader and narrower interpretations can be applied to all aspects and embodiments of the present invention. In other words, the

word “comprising” and synonyms thereof may be replaced by the phrase “consisting of” or the phrase “consists essentially of” or synonyms thereof and *vice versa*.

As used herein, the singular forms “a,” “an,” and “the” include plural referents unless the context clearly dictates otherwise. The term “about” as used herein can allow for a degree of variability in a value or range, for example, within 10%, within 5%, within 1%, within 0.5%, within 0.1%, within 0.05%, within 0.01%, within 0.005%, or within 0.001% of a stated value or of a stated limit of a range, and includes the exact stated value or range.

For the avoidance of doubt, the terms “bra”, “brassiere” and “bralette” may be used interchangeably herein.

The term “strapless bra” refers to a bra does not have shoulder straps which are typically used for positioning, lifting and keeping the bra in position on a user’s body.

The term “bra cup” refers a component of a brassiere, bralette, or similar garments for supporting a breast. The bra cup as defined herein comprises a cup structure, the cup structure typically configured to conform to and provide support to a breast of a wearer of a brassiere, bralette, or similar garment. A cup structure may be formed by a knit pattern and/or by moulding of a suitable fabric.

When used herein, the term “concave inner surface” refers to the surface of the bra cup that is in contact with the skin of the user when worn. Accordingly, the term “convex outer surface” refers to the surface at the opposite side of the concave inner surface of the bra cup that is away from the skin of the user when worn.

When used herein, the term “first region” refers to the region adjacent to the neckline edge of the cup structure where a first array of gripping elements is disposed on.

When used herein, the term “second region” refers to the remaining portion of the concave inner surface of the cup structure that is not occupied by the first array of gripping elements. A second array of gripping elements may occupy any of the remaining portion of the concave inner surface not occupied by the first array of gripping elements. For example, the second array of gripping elements may occupy the remaining portion of the concave inner surface such that the entire concave inner surface is covered with gripping elements or the second array of gripping elements may occupy part of the remaining portion of the concave inner surface such that there is space on the concave inner surface that is not occupied by either the first or second array of gripping elements.

When used herein, the term “surface density” refers to the percentage area covered by the array of gripping elements in the first/second region over the area of the first/second region.

$$5 \quad \text{Surface Density of first region} = \frac{\text{Area covered by array of gripping elements in first region}}{\text{area of first region}}$$

$$\text{Surface Density of second region} = \frac{\text{Area covered by array of gripping elements in second region}}{\text{area of second region}}$$

10 The inventors have surprisingly found that forming an array of gripping elements from cured elastomeric polymer composition (for example, silicone), on the concave inner surface of the bra cup enhances the grip of the bra on the user. This is particularly useful when employed in strapless bras – the present invention allows the bra cup(s) to stay in place when the strapless bra is worn for long periods of time whilst also allowing freedom of movement for user. Notably, the present invention does not require the use of adhesive, which may leave a residue on the skin when the bra cup is removed.

The grip of the bra cup is enhanced by having the array of gripping elements disposed on the region adjacent to the neckline edge of the cup structure (i.e., the first region). In an embodiment, the array of gripping elements is disposed on the entire region that is adjacent to the neckline edge of the cup structure (in other words, the array of gripping elements spans substantially the entire length of the neckline edge of the cup structure). In another embodiment, the surface density of the gripping elements in the first region (or the region adjacent to the neckline edge of the cup structure) is higher than the surface density of the gripping elements in the second region (i.e. the remaining portion of the concave inner surface which is not occupied by the first array of gripping elements).

Advantageously, the gripping elements on the first region (i.e., region adjacent to the neckline edge) ensure that the strapless bra stays securely in place during movement, which is an important function since strapless bras do not have shoulder straps to hold the bra in place. The gripping elements on the second region (i.e., remaining portion of the concave inner surface) provide additional support as the weight of the breasts tends to cause the strapless bra to slide down over time. The resistance created by the gripping elements in both the first region and second region assists in maintaining the strapless bra's position and providing the necessary support throughout the day, ensuring comfort and confidence for the user.

The inventors have also developed a method of forming the bra cup disclosed herein, which comprises applying an uncured elastomeric polymer composition comprising an elastomeric polymer to a first surface of a substrate and curing the elastomeric polymer formulation to form the array of gripping elements. The characteristics of the surface, including the appearance of the array of gripping elements (for example, matt finish or a glossy finish), can be adjusted by adjusting the components and the component amounts present in the elastomeric polymer composition.

In certain embodiments, the elastomeric polymer composition may be a two-component composition comprising silicone, a catalyst and a retarder in a first component and silicone in a second component. The two components of the composition are mixed and then applied to the concave inner surface of the cup structure. In other embodiments, the elastomeric polymer composition may be a single component composition comprising silicone, a catalyst, a retarder and a silicone loosener. The single component of the composition is directly applied to the concave inner surface of the cup structure. Application of the elastomeric polymer composition may be achieved using a variety of methods, in particular printing, such as drop on demand printing or similar printing techniques.

Any suitable catalyst can be used for the elastomeric polymer composition which may include platinum, or a tin-based catalyst.

When used herein, the term “retarder” refers to a reagent that is added to delay the curing of the silicone at low temperature levels, enhancing the pot life (operational life) of the silicone which also results in consistent viscosity over time and allowing printing consistency. In addition, the retarder may also modify the viscosity of the silicone mixture, which can be useful for printing applications. For example, the retarder may be a compound with an unsaturated double bond($\text{HC}=\text{C}-\text{R}$), such as tetravinyl tetramethyl cyclotetrasiloxane.

When used herein, the term “loosener” refers to any suitable reagent (such as silicone oil/fluids and non-polar solvents etc.) that improves the printability of the silicone mixture. The loosener may also improve the final texture of the garment.

As will be appreciated by the skilled person, the composition of the the elastomeric polymer composition may vary depending on the fabric/substrate and the type of silicone, as well as the properties of the resulting garment in terms of hand-feel, flexibility, and performance.

EXAMPLES

Manufacturing Process Steps

1. PU Cups

- 5 - The manufacturing process begins with the precision cutting of inner fabric into panels. Using advanced cutting machinery, the fabric is cut into specific sizes according to predefined patterns.
- Cut panels are meticulously placed and aligned on the printing machine to ensure accurate application of the gripping silicon material onto the bra cup's inner surface.
- 10 - Silicone is printed onto the fabric using precise machine settings and suitable silicone formulations. This results in consistent grip and stability on the bra cup's inner surface.
- Panels are carefully unloaded from the printing machine. They are then subjected to a curing process to set the silicone and ensure its durability. During curing, the printed panels are exposed to controlled heat, allowing the silicone to bond firmly to the fabric.
- 15 - Cured panels are bonded with PU foam to form the inner lamination of the bra cup using advanced glue spaying machinery.
- Various components of the bra pad, including the printed and laminated inner panels, are assembled, and undergoes a full moulding process to shape it according to design specifications.
- 20 - After moulding, the panels are carefully removed from the moulds and kept for cooling process.
- Trimming the moulded panels by removing excess material using machinery to make sure, pads have the desired shape and size.
- A thorough inspection is performed to check for defects, quality issues, or any deviations from specifications.
- 25 - The final step involves packaging the finished products.

2. Spacer Cups:

- 30 - The manufacturing process begins with the precision cutting of spacer fabric into panels. Using advanced cutting machinery, the fabric is cut into specific sizes according to predefined patterns.
- Cut panels are meticulously placed and aligned on the printing machine to ensure accurate application of the gripping silicon material onto the bra cup's inner surface.

- Silicone is printed onto the spacer fabric using precise machine settings and suitable silicone formulations. This results in consistent grip and stability on the bra cup's inner surface.
- 5 - Panels are carefully unloaded from the printing machine. They are then subjected to a curing process to set the silicone and ensure its durability. During curing, the printed panels are exposed to controlled heat, allowing the silicone to bond firmly to the fabric.
- Various components of the bra pad, including the printed fabric panels, are assembled and undergoes a full moulding process to shape it according to design specifications.
- 10 - After moulding, the panels are carefully removed from the moulds and kept for cooling process.
- Trimming the moulded panels by removing excess material using machinery to make sure, pads have the desired shape and size.
- A thorough inspection is performed to check for defects, quality issues, or any deviations from specifications.
- 15 - The final step involves packaging the finished products.

Advantages of Invention

- Enhanced grip using a gripping silicon fabric.
- Creating a design that grips and holds in place better.
- 20 - Developing a silicon moldable technique and method.
- Improved stability of the pad and fit.
- Freedom of movement.
- Non-adjusting long-lasting strapless.
- Non-adhesive strapless solutions.
- 25 - Inclusive size range.

CLAIMS

1. A strapless bra comprising:
 - a bra cup comprising:
 - a cup structure comprising a concave inner surface and a convex outer surface;
 - the cup structure having a neckline edge and a under-breast edge corresponding to an outer perimeter of the cup structure;
 - a first array of gripping elements disposed on a first region of the concave inner surface, the first region being adjacent to the neckline edge of the cup structure; and
 - a second array of gripping elements disposed on a second region of the concave inner surface;
 - wherein the first and second arrays of gripping elements are each formed from a cured elastomeric polymer composition and are bonded to the concave inner surface.
2. The strapless bra according to claim 1, wherein the surface density of the gripping elements at the first region is higher than the surface density of the gripping elements at the second region.
3. The strapless bra according to claim 1 or 2, wherein the gripping elements are arranged in one or more patterns on the concave inner surface, the patterns being selected from the group consisting of a linear pattern, a circular pattern, a triangular pattern, a random pattern, a concentric pattern, a spiral pattern, a staggered pattern, a zig-zag pattern, and a combination of two or more thereof.
4. The strapless bra according to claim 3, wherein the pattern of the gripping elements in the first array is different to the pattern of the gripping elements in the second array.
5. The strapless bra according to any one of the preceding claims, wherein the gripping elements have a shape selected from the group consisting of a rectangle, a square, a triangle, a diamond, a hexagon, a star, an oval, and an irregular shape.
6. The strapless bra according to any one of the preceding claims, wherein the gripping elements have a height with respect the concave inner surface of from about 0.1 mm to about 1.5 mm.
7. The strapless bra according to any one of the preceding claims, wherein the elastomeric polymer composition comprises an elastomeric polymer selected from a group

consisting of silicone, thermoplastic elastomer (TPE), nitrile butadiene rubber (NBR), polyurethane (PU), polyvinyl chloride (PVC), polyethylene glycol (PEG) and a combination thereof, optionally wherein, the elastomeric polymer is silicone.

8. The strapless bra according to any one of the preceding claims, wherein the elastomeric polymer composition is a two-component composition comprising:

(a) a first component comprising:

(i) 40-50 wt% silicone;

(ii) 0.1-10 wt% catalyst; and

(iii) 0.1-10 wt% retarder, and

(b) a second component comprising:

(i) 40-50 wt% silicone,

wherein the wt% is based on the total weight of the composition.

9. The strapless bra according to any one of claims 1 to 7, wherein the elastomeric polymer composition is a single component composition comprising:

(a) 50-99 wt% silicone;

(b) 1-10 wt% catalyst;

(c) 1-10 wt% retarder; and

(d) 0.1-30 wt% silicone loosener,

wherein the wt% is based on the total weight of the composition.

10. The strapless bra according to any one of the preceding claims, wherein the cup structure is formed from a polyurethane foam.

11. The strapless bra according to any one of claims 1 to 9, wherein the cup structure is formed from a fabric comprising one or more yarns selected from the group consisting of a polyurethane yarn (e.g. elastane), a polyester yarn, a polyamide yarn (e.g. nylon), cotton yarn, silk yarn, and a combination of two or more thereof, optionally wherein the fabric is a spacer fabric (e.g. a fabric comprising at least fabric layers connected by spacer yarn and/or pile yarns).

12. The strapless bra according to claim 11, wherein the cup structure is formed by a knit pattern and/or by compression moulding of the fabric.

13. The strapless bra according to any one of the preceding claims, wherein the strapless bra comprises two bra cups as defined in any one of the preceding claims, optionally wherein the two bra cups are coupled to each other by a bridge region.

14. A method of manufacturing the strapless bra of any one of claims 1 to 13, the method comprising:

- (a) providing a substrate;
- (b) applying an uncured elastomeric polymer composition comprising an elastomeric polymer to a first surface of the substrate in accordance to a pattern for forming an array of gripping elements;
- (c) curing the elastomeric polymer formulation to form the array of gripping elements;
- (d) subjecting the substrate to a compression moulding process to form one or more cup structures in the substrate, thereby providing the strapless bra.

15. The method according to claim 14, wherein the substrate is a polyurethane foam.

16. The method according to claim 14, wherein the substrate is a fabric comprising one or more yarns selected from the group consisting of a polyurethane yarn (e.g. elastane), a polyester yarn, a polyamide yarn (e.g. nylon), cotton yarn, silk yarn, and a combination of two or more thereof, optionally wherein the fabric is a spacer fabric (e.g. a fabric comprising at least fabric layers connected by spacer yarn and/or pile yarns).

17. The method according to any one of claims 14 to 16, wherein step (b) comprises jetting, printing, spraying, painting or extruding the uncured elastomeric polymer composition to the first surface of the substrate, optionally wherein step (b) comprises printing the uncured elastomeric polymer composition to the first surface of the substrate.

18. The method according to any one of claims 14 to 17, wherein the elastomeric polymer composition is a two-component composition comprising:

- (a) a first component comprising:
 - (i) 40-50 wt% silicone;
 - (ii) 0.1-10 wt% catalyst; and
 - (iii) 0.1-10 wt% retarder, and
- (b) a second component comprising:
 - (i) 40-50 wt% silicone,

wherein the wt% is based on the total weight of the composition.

19. The method according to any one of claims 14 to 17, wherein the elastomeric polymer composition is a single component composition comprising:

- (a) 50-99 wt% silicone;
- (b) 1-10 wt% catalyst;
- (c) 0.1-10 wt% retarder; and
- (d) 0.1-30 wt% silicone loosener,

wherein the wt% is based on the total weight of the composition.

20. The method according to any one of claims 14 to 19, wherein step (c) comprises subjecting the substrate to a temperature and pressure sufficient to cure the elastomeric polymer formulation.

21. A bra cup comprising:

a cup structure comprising a concave inner surface and a convex outer surface;

the cup structure having a neckline edge and a under-breast edge corresponding to an outer perimeter of the cup structure;

a first array of gripping elements disposed on a first region of the concave inner surface, the first region being adjacent to the neckline edge of the cup structure; and

a second array of gripping elements disposed on a second region of the concave inner surface;

wherein the first and second arrays of gripping elements are each formed from a cured elastomeric polymer composition and are bonded to the concave inner surface, and

wherein the surface density of the gripping elements at the first region is higher than the surface density of the gripping elements at the second region.

22. The bra cup according to claim 21, wherein one or more of the following applies:

- (a) the gripping elements are defined according to any of claims 3 to 6;
- (b) the elastomeric polymer composition is defined according to any of claims 7 to 9; and
- (c) the cup structure is defined according to any of claims 10 to 12.

23. A garment comprising the bra cup according to claim 21 or 22.

24. The garment according to claim 23, wherein the garment is a bra or bralette.

25. The garment according to claim 24, wherein the garment is a strapless bra or strapless bralette.