

BLANK FOR CONTAINER

PRIORITY CLAIM

[0001] This application claims priority under 35 U.S.C. § 119(e) to US Provisional Application Serial No. 61/737,406, filed December 14, 2012, which is expressly incorporated by reference herein.

BACKGROUND

[0002] The present disclosure relates to vessels, and in particular to blanks for containers. More particularly, the present disclosure relates to a blank for an insulated container formed from polymeric materials.

SUMMARY

[0003] A vessel in accordance with the present disclosure is configured to hold a product in an interior region formed in the vessel. In illustrative embodiments, the vessel is an insulated container such as a drink cup, a food-storage cup, or a dessert cup.

[0004] In illustrative embodiments, an insulative cup includes a body having a sleeve-shaped side wall and a floor coupled to the body to cooperate with the side wall to form an interior region for storing food, liquid, or any suitable product. The body also includes a rolled brim coupled to an upper end of the side wall and a floor mount interconnecting a lower end of the side wall and the floor.

[0005] The insulative cellular non-aromatic polymeric material included in the body is configured in accordance with the present disclosure to provide means for enabling localized plastic deformation in at least one selected region of the body (e.g., the floor mount and a floor-retaining flange included in the floor mount) to provide (1) a plastically deformed first material segment having a first density in a first portion of the selected region of the body and (2) a second material segment having a relatively lower second density in an adjacent second portion of the selected region of the body. In illustrative embodiments, the more dense first material segment is thinner than the second material segment.

[0006] A blank of polymeric material in accordance with the present disclosure is used to form a body of a cup. In illustrative embodiments, the blank

includes an upper band formed to include a curved top edge and a lower band formed to include a left-end edge, a right-end edge, and a curved bottom edge arranged to extend between the left-end and right-end edges. The lower band is appended to the upper band along a curved fold line to locate the curved fold line between the curved top and bottom edges. The upper band has a relatively long curved top edge and can be formed in a blank conversion process to provide a cup body having a rolled brim and a sleeve-shape side wall extending downwardly from the rolled brim. The lower band has a relatively short curved bottom edge and can be folded about the curved fold line during the blank conversion process to form a portion of a floor mount that is configured to mate with a cup floor to provide a cup.

[0007] In illustrative embodiments, the lower band is formed to include a series of high-density staves of a first density and low-density staves of a relatively lower second density. Each stave is arranged to extend from the curved bottom edge of the lower band toward the curved fold line. The high-density and low-density staves are arranged to lie in an alternating sequence extending from the left-end edge of the lower band to the right-end edge of the lower band to cause density to alternate from stave to stave along a length of the lower band.

[0008] In illustrative embodiments, each low-density stave in the lower band is relatively thick and wide. Each high-density stave in the lower band is relatively thin and narrow. In other illustrative embodiments, diamond density patterns, diagonal density patterns, and other density patterns are used instead of the high-density and low-density staves.

[0009] In illustrative embodiments, a connecting web is defined in the blank by polymeric material extending along and on either side of the curved fold line. After the blank conversion process is completed, the cup body will include a floor mount comprising an annular web-support ring defined by a bottom strip of the upper band, an annular floor-retaining flange surrounded by the annular web-support ring, and an annular connecting web extending along the curved fold line and joining together lower portions of the floor-retaining flange and the surrounding web-support ring to define an upwardly floor-receiving pocket. The connecting web is formed to have a high density that is about the same as the density of one of the high-density staves.

[0010] Additional features of the present disclosure will become apparent to those skilled in the art upon consideration of illustrative embodiments exemplifying the best mode of carrying out the disclosure as presently perceived.

BRIEF DESCRIPTIONS OF THE DRAWINGS

[0011] The detailed description particularly refers to the accompanying figures in which:

[0012] Fig. 1A is a plan view of a blank of polymeric material that is formed in accordance with the present disclosure to as suggested in Fig. 1B to produce a body of a cup shown in Fig. 1C that can be mated with a floor to form a cup as shown, for example, in Figs. 2A and 2B and showing that the body blank includes a side wall and a floor mount coupled to a lower portion of the side wall and also showing that the blank includes a curved lower band along the bottom of the blank and a fan-shaped upper band appended to the curved lower band along a web including a curved fold line;

[0013] Fig. 1B is an end elevation view of the body blank of Fig. 1A suggesting that a floor-retaining flange can be folded inwardly and upwardly about a fold line associated with a web-support ring included in the floor mount to form an upwardly opening floor-receiving pocket;

[0014] Fig. 1C is a reduced-size view of a body formed in a blank conversion process using the body blank of Figs. 1A and 1B before a floor is coupled to the body as suggested in Figs. 2A and 2B to form a cup having an interior region bounded by the body and the floor;

[0015] Fig. 2A is a perspective view of an insulative cup made using the polymeric blank shown in Fig 1A in accordance with the present disclosure showing that the insulative cup includes a body and a floor and showing that a floor region of the body includes a localized area of plastic deformation that provides for increased density in that localized area while maintaining a predetermined insulative characteristic in the body;

[0016] Fig. 2B is an exploded assembly view of the insulative cup of Fig. 2A showing that the insulative cup includes, from top to bottom, the floor and the body including a rolled brim, a side wall, and a floor mount configured to mate with the

floor as shown in Fig. 2A and showing that the floor mount includes a floor-retaining flange having a series of vertically extending wide (low-density) and narrow (high-density) staves arranged to lie in an alternating sequence in side-by-side relation to one another and shown in an opening formed in the side wall;

[0017] Fig. 3 is a partial section view taken along line 3-3 of Fig. 2B showing that the floor region including the localized area of plastic deformation lies in the floor-retaining flange included in the floor mount of the body and showing a first series of spaced-apart depressions formed in an outer surface of the floor-retaining flange and aligned with the narrow and thin (high-density) staves;

[0018] Fig. 4 is a partial section view taken along line 4-4 of Fig. 3 showing the first series of spaced-apart depressions formed in the radially inwardly facing outer surface of the floor-retaining flange and arranged to lie in circumferentially spaced-apart relation to one another;

[0019] Fig. 5 is a plan view of a body blank shown in Fig. 1 and used to make the body of Fig. 2B with portions broken away to reveal that the body blank is formed from a strip of insulative cellular non-aromatic polymeric material and a skin laminated to the strip of insulative cellular non-aromatic polymeric material and showing that during a blank forming process a web former compresses a portion of the body blank along a curved fold line to form the connecting web and a stove former compresses another portion of the body blank between the curved fold line and a curved bottom edge to form a series of (1) wide and thick (low-density) staves and (2) narrow and thin (high-density) staves that lie between the curved fold line and the curved bottom edge and extending in an alternating sequence from a left-end edge of the blank to a right-end edge of the blank;

[0020] Fig. 6 is an enlarged partial plan view of the body blank of Fig. 5 showing the curved fold line and the alternating sequence of wide low-density staves and narrow high-density staves formed in the floor-retaining flange;

[0021] Fig. 7 is a partial section view similar to Fig. 3 showing a second embodiment of a variable density pattern formed in the outer surface of the floor-retaining flange included in a floor mount of a cup body;

[0022] Fig. 8 is a view similar to Fig. 4 showing the second series of spaced-apart depressions formed in the radially inwardly facing outer surface of the floor-retaining flange;

[0023] Fig. 9 is a plan view of a body blank similar to Fig. 5 showing that the knurling former compresses the body blank between a curved fold line and a curved bottom edge to form a set of diamond-shaped portions that extend between the curved fold line and the curved bottom edge, each one of the diamond-shaped portions corresponding to one of the plurality of diamond-shaped ribs;

[0024] Fig. 10 is an enlarged partial plan view of the body blank of Fig. 9 showing the curved fold line and the set of diamond-shaped portions formed in the floor-retaining flange;

[0025] Fig. 11 is a partial section view similar to Figs. 3 and 7 showing a third embodiment of a variable density pattern formed in the outer surface of the floor-retaining flange;

[0026] Fig. 12 is a view similar to Fig. 4 and 8 showing the third series of spaced-apart depressions formed in the radially inwardly facing outer surface of the floor-retaining flange;

[0027] Fig. 13 is a plan view of a body blank similar to Figs. 5 and 9 showing that the stave former compresses the body blank between a curved fold line and a curved bottom edge to form a series of thick and thin slanted portions that extend between the curved fold line and the curved bottom edge;

[0028] Fig. 14 is an enlarged partial plan view of the body blank of Fig. 13 showing the curved fold line and the series of thick and thin slanted portions formed in the floor-retaining flange and extending diagonally in an alternating sequence;

[0029] Fig. 15 is an enlarged partial elevation view of another embodiment of an insulative cup in accordance with the present disclosure showing a region of localized plastic deformation in which a plurality of vertical staves are formed in an inner periphery of the floor-retaining flange so that the vertical staves are hidden when the insulative cup is assembled;

[0030] Fig. 16 is an enlarged partial elevation view of another embodiment of an insulative cup in accordance with the present disclosure similar to Fig. 15 and showing a region of localized plastic deformation in which a plurality of diamond-

shaped ribs are formed in an inner periphery of the floor-retaining flange so that the diamond-shaped ribs are hidden when the insulative cup is assembled;

[0031] Fig. 17 is an enlarged partial elevation view of another embodiment of an insulative cup in accordance with the present disclosure similar to Figs. 15 and 16 showing a region of localized plastic deformation in which a plurality of vertically-slanting ribs are formed in an inner periphery of the floor-retaining flange so that the vertically-slanting ribs are hidden when the insulative cup is assembled;

[0032] Fig. 18 is a partial elevation view of a portion of the floor-retaining flange included in the insulative cup of Fig. 1 showing a plurality of measurement points for determining the dimensional consistency of the plurality of vertical staves formed in the floor-retaining flange; and

[0033] Fig. 19 is a partial elevation view of the portion of the floor-retaining flange shown in Fig. 19 showing the locations at which height, thickness, width, and depth measurements are taken to determine the dimensional consistency of the plurality of vertical ribs formed in the floor-retaining flange.

DETAILED DESCRIPTION

[0034] An illustrative body blank 500 shown in Fig. 1A is made of a polymeric material and is folded as suggested in Fig. 1B and wrapped around a central vertical axis (CA) to form a body 11 of a cup as shown, for example, in Fig. 1C. Once folded, a body blank 500 includes a sleeve-shaped side wall 18 and floor mount 17 coupled to a lower portion of the sleeve-shaped side wall 18 and configured to mate with a floor 20 as suggested in Figs. 2A, 2B, and 3 to form a cup 10. Floor mount 17 is formed in accordance with the present disclosure to have neighboring high-density polymeric portions and relatively low-density polymeric portions cooperate to permit controlled gathering of portions of floor mount 17 as body blank 500 is wrapped around the vertical central axis (CA) during a blank conversion process to form a cup body 11. Floor mount 17 is formed to include an alternating sequence of low-density and high-density vertical staves 180, 182 as shown in the embodiment of Figs. 1-6, while alternative floor mounts embodiments are shown in

Figs. 7-10 (diamond density pattern), Figs. 11-14 (diagonal density pattern), and Figs. 18-19 (other density pattern)

[0035] Body blank 500 includes a curved top edge 506 and a curved bottom edge 508 and each edge has the same center of curvature as suggested in Figs. 1A and 5 to cause a uniform distance to separate curved top and bottom edges 506 along their length. Body blank 500 also includes a straight right edge 512 interconnecting right ends of top and bottom edges 506, 508 and a straight left edge 514 interconnecting left ends of top and bottom edges 506, 508.

[0036] A curved floor-position locator reference line 521 is marked (in phantom) on body blank 500 in Figs. 1A and 5 to show the relative position of a horizontal platform 21 included in floor 20 (see Fig. 2B) when floor 20 is mated to the body 11 formed using body blank 500 as suggested in Figs. 2A and 3. Curved floor-position locator reference line 521 has the same center of curvature as curved top and bottom edges 506, 508 as suggested in Figs. 1A and 5.

[0037] Body blank 500 includes a floor mount 17 bounded by curved floor-position locator reference line 521, curved bottom edge 508, and lower portions of straight right and left edges 512, 514 as suggested in Fig. 1A. Body blank 500 also includes a sleeve-shaped side wall 18 provided above floor mount 17 and bounded by curved top edge 506, curved floor-position locator reference line 521, and upper portions of straight right and left edges 512, 514 as suggested in Fig 1A.

[0038] Floor mount 17 of body blank 500 is formed to include a curved fold line 516 located between curved floor-position locator reference line 521 and curved bottom edge 508 as suggested in Fig. 1A. Curved fold line 516 has the same center of curvature as curved floor-position locator reference line 521 and curved bottom edge 508 as suggested in Figs. 1A and 5.

[0039] Floor mount 17 includes a web-support ring 126 coupled to a lower portion of sleeve-shaped side wall 18 at the curved floor-position locator reference line 521 as suggested in Figs. 1A and 1B. Floor mount 17 also includes a floor-retaining flange 26 provided along curved bottom edge 508 of body blank 500 and a connecting web 25 arranged to extend along curved fold line 516 from left edge 514 to right edge 512 and to interconnect web-support ring 126 and floor-retaining flange 26.

[0040] As suggested in Fig. 1B, floor-retaining flange 26 will be folded inwardly and upwardly about curved fold line 516 while body blank 500 is being wrapped around a central vertical axis (CA) during a blank conversion process. This process produces a cup body 11 having an upwardly opening ring-shaped floor-receiving pocket 20P as suggested in Figs. 1B, 3, and 4. An illustrative floor 20 shown, for example, in Fig. 2B includes a ring-shaped platform-support member 23 that is appended to a perimeter portion of a round horizontal platform 21. Ring-shaped platform-support member 23 is extended downwardly into the companion ring-shaped floor-receiving pocket 20P formed in floor mount 17 to position horizontal platform 21 along the curved floor-position locator reference line 521 so that a cup 10 comprising a body 11 and a floor 20 is formed as shown in Figs. 1C, 2A, 2B, and 3.

[0041] In illustrative embodiments, the arc-shaped floor-retaining flange 26 of floor mount 17 is formed to include along its length an alternating sequence of low-density and high-density staves 180, 182 arranged to lie in side-by-side relation and extend in directions from curved bottom edge 500 toward curved fold line 516 as shown, for example, in Figs. 1A and 5. As suggested in Figs. 3 and 4 (and evident in the other drawings), an alternating sequence of relatively narrow, thin, high-density staves 182 and relatively wide, thick, low-density staves 180 is provided in floor-retaining flange 26. Floor-retaining flange 26 is made of a polymeric material that is able to undergo localized plastic deformation in accordance with the present disclosure during the manufacture of body blank 500 to produce such an alternating sequence of high-density and low-density areas. In an illustrative embodiment, floor-retaining flange 26 of body blank 500 is made of an insulative cellular non-aromatic polymeric material.

[0042] In illustrative embodiments, the arc-shaped connecting web 25 of floor mount 17 that extends along curved fold line 516 is formed to have a higher density than neighboring portions of the web-support ring 126 and floor-retaining flange 26. Connecting web 25 of floor mount 17 is made of a polymeric material that is able to undergo localized plastic deformation in accordance with the present disclosure during manufacture of body blank 500. In an illustrative embodiment, connecting

web 25 of body blank is made of an insulative cellular non-aromatic polymeric material.

[0043] Localized plastic deformation is provided in accordance with the present disclosure in, for example, a floor region 104 of a body 11 of an insulative cup 10 comprising an insulative cellular non-aromatic polymeric material as suggested in Figs. 2A-5. A material has been plastically deformed, for example, when it has changed shape to take on a permanent set in response to exposure to an external compression load and remains in that new shape after the load has been removed. Insulative cup 10 disclosed herein is not a paper cup but rather a cup made of an insulative cellular non-aromatic polymeric material with insulative qualities suitable for holding hot and cold contents.

[0044] A blank 500 of polymeric material in accordance with the present disclosure is used to form a cup body 11 as suggested in Figs. 1A-1C. Then a floor 20 is mated to a floor mount 17 included in the cup body 11 to form a cup 10 as suggested in Figs. 2A and 2B. The polymeric material is an insulative cellular non-aromatic polymeric material in an illustrative embodiment.

[0045] The blank 500 includes an upper band 500U and a lower band 500L as suggested in Fig. 1A. Upper band 500U is formed to include a curved top edge 506. Lower band 500L is formed to include a left-end edge 514, a right-end edge 512, and a curved bottom edge 508 arranged to extend between the left-end and right-end edges 514, 512. Lower band 500L is appended to upper band 500U along a curved fold line 516 to locate the curved fold line 516 between the curved top and bottom edges 506, 508.

[0046] The lower band 500L is formed to include a series of high-density staves 182 of a first density and low-density staves 180 of a relatively lower second density as suggested in Figs. 1A and 6. Each stave is arranged to extend from the curved bottom edge 508 of lower band 500L toward the curved fold line 516. The high-density and low-density staves 182, 180 are arranged to lie in an alternating sequence extending from about the left-end edge of lower band 500L to about the right-end edge of lower band 500L to cause density to alternate from stave to stave along a length of the lower band 500L.

[0047] Lower band 500L has a first side 502 and an opposite second side 504 as suggested in Fig. 1B. Each low-density stave 180 has a first face on first side 502 of lower band 500L, a second face on the opposite second side 504 of lower band 500L, and a first thickness defined by a distance between the first and second faces of the low-density stave 180. Each high-density stave 182 has a first face on the first side 502 of lower band 500L, a second face on second side 504 of lower band 500L, and a second thickness defined by a distance between the first and second faces of the high-density stave 182. The second thickness is less than the first thickness. In an illustrative embodiment, the second thickness is about half of the first thickness.

[0048] Each high-density stave 182 has a narrow width and each low-density stave 180 has a relatively wider wide width as shown, for example, in Figs. 2B and 6. The narrow width is about 0.028 inch (0.711 mm) and the relatively wider wide width is about 0.067 inch (1.702 mm). Lower band 500L includes a border section 500B extending from the left-end edge to the right-end edge and lying between the curved fold line 516 and an upper end of each of the high-density and low-density staves 182, 180 as suggested in Fig. 6. Border section 500B has a height of about 0.035 inch (0.889 mm).

[0049] A connecting web 25 included in the blank 500 is defined by polymeric material extending along and on either side of the curved fold line 516 as suggested in Figs. 1A, 3, 5, and 6. The connecting web 25 has a third density that is lower than the first density in an illustrative embodiment. The third density of the connecting web 25 is about equal to the second density of the low-density staves 180.

[0050] Each low-density stave 180 has a first thickness. Each high-density stave 182 has a relatively thinner second thickness as suggested in Fig. 4. The connecting web 25 has a third thickness that is about equal to the relatively thinner second thickness.

[0051] Upper band 500U includes a left-end edge 514 arranged to extend from the curved fold line 516 to a first end of the curved top edge 506 and a right-end edge 512 arranged to extend from the curved fold line 516 to an opposite second end of the curved top edge 506. Upper band 500U includes a top strip 500U1 arranged to extend along the curved top edge 506 from the left-end edge 514 of upper band 500U to the right-end edge 512 of upper band 500U, a bottom strip 500U3 arranged to extend

along curved fold line 516 from the left-end edge 514 of upper band 500U to the right-end edge 512 of upper band 500U, and a middle strip 500U2 arranged to lie between and interconnect the top and bottom strips and extend from the left-end edge 514 of upper band 500U to the right-end edge 512 of upper band 500U.

[0052] Top strip 500U1 of upper band 500U is configured to be moved relative to the middle strip 500U2 of upper band 500U during a blank conversion process to form a circular rolled brim 16. Middle strip 500U2 of upper band 500U is configured to be wrapped about a central vertical axis (CA) during the blank conversion process to provide a sleeve-shaped side wall 18 coupled to circular rolled brim 16.

[0053] Bottom strip 500U3 of upper band 500U and lower band 500L cooperate to form a floor mount 17 as suggested in Figs. 1A, 1B, and 3. Floor mount 17 is configured to provide means for receiving a portion 23 of a floor 20 during a cup formation process to cause floor 20 and sleeve-shaped side wall 18 to cooperate to form an interior region 14 in response to folding movement of lower band 500L along the curved fold line 516 while wrapping upper band 500U around a vertical central axis (CA) to establish an annular shape of lower band 500L to provide a ring-shaped floor-retaining flange 26 and to establish an annular shape of the bottom strip 500U3 of upper band 500U to provide a ring-shaped web-support ring 126 surrounding the ring-shaped floor-retaining flange 26 to provide an annular floor-receiving pocket 20P therebetween.

[0054] In a first embodiment shown in Figs. 1A-4, first face 502 of lower band 500L is formed to include a depression along the length of a high-density stave 182 and between opposing edges of neighboring low-density staves 180. The depression is arranged to open in a direction away from the ring-shaped web-support ring 126 defined by the bottom strip 500U3 of upper band 500U and arranged to surround high-density and low-density staves 182, 180 included in the floor-retaining flange 26 defined by lower band 500L.

[0055] In another embodiment shown in Fig. 15, first face of lower band 500L is formed to include a depression along the length of a high-density stave 182 and between opposing edges of neighboring low-density staves 180. The depression is arranged to open in a direction toward the ring-shaped web support ring 126 defined

by the bottom strip of upper band 500U and arranged to surround high-density and low-density staves 182, 180 included in the floor-retaining flange 26 defined by lower band 500L.

[0056] A first embodiment of insulative cup 10 having region 104 where localized plastic deformation provides segments of insulative cup 10 that exhibit higher material density than neighboring segments of insulative cup 10 in accordance with the present disclosure is shown in Figs. 2A-5. Insulative cup 10 is similar to the insulative cup 10 disclosed in U.S. Patent Application No. 13/491,007 and is incorporated by reference in its entirety herein. In the present application, the fourth region 104 of insulative cup 10 of U.S. Patent Application no. 13/491,007 is replaced with other floor region embodiments as disclosed herein. As an example, insulative cup 10 is made using an illustrative body blank 500 shown in Figs. 1A and 5. A suitable cup-manufacturing process that makes body blank 500 and insulative cup 10 is disclosed in U.S. Patent Application no. 13/526,444 and is incorporated by reference in its entirety herein.

[0057] An insulative cup 10 comprises a body 11 including a sleeve-shaped side wall 18 and a floor 20 coupled to body 11 to define an interior region 14 bound by sleeve-shaped side wall 18 and floor 20 as shown, for example, in Fig. 2A. Body 11 further includes a rolled brim 16 coupled to an upper end of side wall 18 and a floor mount 17 coupled to a lower end of side wall 18 as suggested in Figs. 2A, 2B, and 3. Floor mount 17 includes a web-support ring 126, a floor-retaining flange 26, and a connecting web 25 as shown, for example, in Figs. 1A, 1B, and 3.

[0058] Body 11 is formed from a strip of insulative cellular non-aromatic polymeric material as disclosed herein. In accordance with the present disclosure, a strip of insulative cellular non-aromatic polymeric material is configured (by application of pressure-with or without application of heat) to provide means for enabling localized plastic deformation in at least one selected region (for example, region 104) of body 11 to provide a plastically deformed first material segment having a first density located in a first portion of the selected region of body 11 and a second material segment having a second density lower than the first density located in an adjacent second portion of the selected region of body 11 without fracturing the

insulative cellular non-aromatic polymeric material so that a predetermined insulative characteristic is maintained in body 11.

[0059] According to the present disclosure, body 11 includes localized plastic deformation that is enabled by the insulative cellular non-aromatic polymeric material in a floor-retaining flange 26 of a floor mount 17. Floor-retaining flange 26 includes an alternating sequence of upright thick relatively low-density staves 180 and thin relatively high-density staves 182 arranged in side-to-side relation to extend upwardly from a connecting web 25 of floor mount 17 toward interior region 14 bounded by sleeve-shaped side wall 18. This alternating sequence of thick low-density staves 180 and thin high-density staves 182 is preformed in a body blank 500 made of a deformable polymeric material in an illustrative embodiment before body blank 500 is formed to define insulative cup 10 as suggested in Figs. 2A-5.

[0060] Referring now to Fig. 5, body blank 500 is formed to include connecting web 25 of floor mount 17 which is a relatively high-density area of localized plastic deformation that interconnects a relatively low density web-support ring 126 of floor mount 17 to a relatively low density floor-retaining flange 26 of floor mount 12. Referring to Fig. 3, floor mount 17 is configured to include a ring-shaped floor-receiving pocket 20P sized to receive a platform-support member 23 of floor 20 (as also suggested in Fig. 1B) such that floor 20 is supported by the floor mount 17 to cause a horizontal platform 21 of floor 20 to be supported at circular floor-position locator reference line 521 to form a boundary of the interior region 14 of insulative cup 10. Insulative cup 10 forms a vessel having a mouth 32 opening into an interior region 14 that is bounded by sleeve-shaped side wall 18 and horizontal platform 21 of floor 20.

[0061] Sleeve-shaped side wall 18 includes an upright inner strip 514, an upright outer strip 512, and an upright funnel-shaped web 513 extending between inner and outer strips 514, 512 as suggested in Fig. 3. Upright inner strip 514 is arranged to extend upwardly from floor 20 and upright outer strip 512 is arranged to extend upwardly from floor 20 to mate with upright inner strip 514 along an interface 184 therebetween to form a seam of sleeve-shaped side wall 18 as suggested in Figs. 3 and 4. Upright funnel-shaped web 513 is arranged to interconnect upright inner and outer strip 514, 512 and surround interior region 14. Upright funnel-shaped web 513

is configured to cooperate with upright inner and outer strips 514, 512 to form sleeve-shaped side wall 18 as suggested in Figs. 2 and 3.

[0062] Rolled brim 16 is coupled to an upper end of sleeve-shaped side wall 18 to lie in spaced-apart relation to floor 20 and to frame an opening into interior region 14. Rolled brim 16 includes an inner rolled tab 161 (shown in phantom), an outer rolled tab 162, and a C-shaped brim lip 163 as suggested in Figs. 1 and 2. The inner rolled tab 161 is coupled to an upper end of upright outer strip 512 included in sleeve-shaped side wall 18. Outer rolled tab 162 is coupled to an upper end of upright inner strip 514 included in sleeve-shaped side wall 18 and to an outwardly facing exterior surface of inner rolled tab 161. Brim lip 163 is arranged to interconnect oppositely facing side edges of each of inner and outer rolled tabs 161, 162. Brim lip 163 is configured to cooperate with inner and outer rolled tabs 161, 162 to form rolled brim 16 as suggested in Figs. 2A and 2B.

[0063] Floor mount 17 of body 11 is coupled to a lower end of sleeve-shaped side wall 18 and to floor 20 to support floor 20 in a stationary position relative to sleeve-shaped side wall 18 to form interior region 14 as suggested in Figs. 2A, 2B and 3. Floor mount 17 includes a floor-retaining flange 26 coupled to floor 20, a web-support ring 126 coupled to the lower end of sleeve-shaped side wall 18 and arranged to surround floor-retaining flange 26, and a connecting web 25 arranged to interconnect floor-retaining flange 26 and web-support ring 126 as suggested in Fig. 1B and 3. Connecting web 25 is configured to provide a material segment having higher first density. Connecting web-support ring 126 is configured to provide a second material segment having lower second density. Each of connecting web 25 and web-support ring 126 has an annular shape. Floor-retaining flange 26 has an annular shape. Each of floor-retaining flange 26, connecting web 25, and web-support ring 126 includes an inner layer having an interior surface mating with floor 20 and an overlapping outer layer mating with an exterior surface of inner layer as suggested in Figs. 2B and 3.

[0064] Floor 20 of insulative cup 10 includes a horizontal platform 21 bounding a portion of interior region 14 and a platform-support member 23 coupled to horizontal platform 21 as shown, for example, in Figs. 2 and 3. Platform-support member 23 is ring-shaped and arranged to extend downwardly away from horizontal

platform 21 and interior region 14 into a floor-receiving pocket 20P provided between floor-retaining flange 26 and the web-support ring 126 surrounding floor-retaining flange 26 to mate with each of floor-retaining flange 26 and web-support ring 126 as suggested in Figs. 1B, 3, and 7.

[0065] Platform-support member 23 of floor 20 has an annular shape and is arranged to surround floor-retaining flange 26 and lie in an annular space provided between horizontal platform 21 and connecting web 25 as suggested in Fig. 3. Each of floor-retaining flange 26, connecting web 25, and web-support ring 126 includes an inner layer having an interior surface mating with floor 20 and an overlapping outer layer mating with an exterior surface of inner layer as suggested in Fig. 3. Inner layer of each of floor-retaining flange 26, web 25, and web-support ring 126 is arranged to mate with platform-support member 23 as suggested in Fig. 3.

[0066] Floor-retaining flange 26 of floor mount 17 is arranged to lie in a stationary position relative to sleeve-shaped side wall 18 and coupled to floor 20 to retain floor 20 in a stationary position relative to sleeve-shaped side wall 18 as suggested in Figs. 2B and 3. Horizontal platform 21 of floor 20 has a perimeter edge mating with the circular floor-position locator reference line 521 provided on an inner surface of sleeve-shaped side wall 18 and an upwardly facing top side bounding a portion of interior region 14 as suggested in Fig. 3.

[0067] Floor-retaining flange 26 of floor mount 17 is ring-shaped and includes an alternating sequence of upright thick low-density staves 180 and thin high-density staves 182 arranged to lie in side-to-side relation to one another to extend upwardly toward a downwardly facing underside of horizontal platform 21. A first of the upright thick low-density staves 180 is configured to include a right side edge extending upwardly toward the underside of horizontal platform 21. A second of the upright thick staves 180 is configured to include a left side edge arranged to extend upwardly toward underside of horizontal platform 21 and lie in spaced-apart confronting relation to right side edge of the first of the upright thick staves 180. A first of the upright thin high-density staves 182 is arranged to interconnect left and right side edges and cooperate with left and right side edges to define therebetween a vertical channel opening inwardly into a lower interior region bounded by horizontal platform 21 and floor-retaining flange 26 as suggested in Figs. 3 and 4. The first of

the thin high-density staves 182 is configured to provide the first material segment having the higher first density. The first of the thick low-density staves 180 is configured to provide the second material segment having the lower second density.

[0068] Floor-retaining flange 26 of floor mount 17 has an annular shape and is arranged to surround a vertically extending central axis (CA) intercepting a center point of horizontal platform 21 as suggested in Figs. 3 and 4. The first of the thin high-density staves 182 has an inner wall facing toward a portion of the vertically extending central axis CA passing through the lower interior region. Platform-support member 23 is arranged to surround floor-retaining flange 26 and cooperate with horizontal platform 21 to form a downwardly opening floor chamber 20C containing the alternating series of upright thick low-density staves 180 and thin high-density staves 182 therein.

[0069] Each first material segment (e.g. stave 182) in the insulative cellular non-aromatic polymeric material has a relatively thin first thickness. Each companion second material segment (e.g. stave 180) in the insulative cellular non-aromatic polymeric material has a relatively thicker second thickness.

[0070] Body 11 is formed from a sheet of insulative cellular non-aromatic polymeric material that includes, for example, a strip of insulative cellular non-aromatic polymeric material and a skin coupled to one side of the strip of insulative cellular non-aromatic polymeric material. In one embodiment of the present disclosure, text and artwork or both can be printed on a film included in the skin. The skin may further comprise an ink layer applied to the film to locate the ink layer between the film and the strip of insulative cellular non-aromatic polymeric material. In another example, the skin and the ink layer are laminated to the strip of insulative cellular non-aromatic polymeric material by an adhesive layer arranged to lie between the ink layer and the insulative cellular non-aromatic polymer material. As an example, the skin may be biaxially oriented polypropylene.

[0071] Insulative cellular non-aromatic polymeric material comprises, for example, a polypropylene based resin having a high melt strength, one or both of a polypropylene copolymer and homopolymer resin, and one or more cell-forming agents. As an example, cell-forming agents may include a primary nucleation agent, a secondary nucleation agent, and a blowing agent defined by gas means for expanding

the resins and to reduce density. In one example, the gas means comprises carbon dioxide. In another example, the base resin comprises broadly distributed molecular weight polypropylene characterized by a distribution that is unimodal and not bimodal. Further details of a suitable material for use as insulative cellular non-aromatic polymeric material is disclosed in U.S. Patent Application No. 13/491,327, previously incorporated herein by reference.

[0072] Insulative cup 10 is an assembly comprising the body blank 500 and the floor 20. As an example, floor 20 is mated with bottom portion 24 during cup-manufacturing process 40 to form a primary seal therebetween. A secondary seal may also be established between support structure 19 and floor 20. An insulative container may be formed with only the primary seal, only the secondary seal, or both the primary and secondary seals.

[0073] Referring again to Fig. 2A, a top portion of side wall 18 is arranged to extend in a downward direction 28 toward floor 20 and is coupled to bottom portion 24. Bottom portion 24 is arranged to extend in an opposite upward direction 30 toward rolled brim 16. Top strip 500U1 of upper band 500U is curled during cup-manufacturing process 40 to form rolled brim 16. Rolled brim 16 forms a mouth 32 that is arranged to open into interior region 14 of cup 10.

[0074] Side wall 18 is formed using a body blank 500 as suggested in Figs. 5 and 6. Body blank 500 may be produced from a strip of insulative cellular non-aromatic polymeric material, a laminated sheet, or a strip of insulative cellular non-aromatic polymeric material that has been printed on. Referring now to Figs. 5 and 6, body blank 500 is generally planar with a first side 502 and a second side 504. Body blank 500 is embodied as a circular ring sector with an outer arc length S_1 that defines a first edge 506 and an inner arc length S_2 that defines a second edge 508. The arc length S_1 is defined by a subtended angle Θ in radians times the radius R_1 from an axis 510 to the edge 506. Similarly, inner arc length S_2 has a length defined as subtended angle Θ in radians times the radius R_2 . The difference of $R_1 - R_2$ is a length h which is the length of two linear edges 512 and 514. Changes in R_1 , R_2 and Θ will result in changes in the size of insulative cup 10. First linear edge 512 and second linear edge 514 each lie on a respective ray emanating from center 510. Thus,

body blank 500 has two planar sides, 502 and 504, as well as four edges 506, 508, 512, and 514 which define the boundaries of body blank 500.

[0075] Fold line 516 has a radius R_3 measured between center 510 and a fold line 516 and fold line 516 has a length S_3 . As shown in Fig. 5, R_1 is relatively greater than R_3 . R_3 is relatively greater than R_2 . The differences between R_1 , R_2 , and R_3 may vary depending on the application.

[0076] Fold line 516 shown in Fig. 5 is a selected region of a strip of insulative cellular non-aromatic polymeric material that has been plastically deformed in accordance with the present disclosure (by application of pressure-- with or without application of heat) to induce a permanent set resulting in a localized area of increased density and reduced thickness. The thickness of the insulative cellular non-aromatic polymeric material at fold line 516 is reduced by about 50%. In addition, the blank 500 is formed to include a number of depressions 518 or ribs 518 positioned between the curved bottom edge 508 and curved fold line 516 with the depressions 518 creating a discontinuity in a surface 531. Each depression 518 is linear having a longitudinal axis that overlies a ray emanating from center 510. As discussed above, depressions 518 promote orderly forming of floor-retaining flange 26. The insulative cellular non-aromatic polymer material of reduced thickness at fold line 516 ultimately serves as connecting web 25 in the illustrative insulative cup 10. As noted above, connecting web 25 promotes folding of floor-retaining flange 26 inwardly toward interior region 14. Due to the nature of the insulative cellular non-aromatic polymeric material used to produce illustrative body blank 500, the reduction of thickness in the material at curved fold line 516 and depressions 518 owing to the application of pressure-- with or without application of heat -- increases the density of the insulative cellular non-aromatic polymeric material at the localized reduction in thickness.

[0077] As shown in Fig. 6, each depression 518 formed in floor-retaining flange 26 is spaced apart from each neighboring depression 518 by a first distance 551. In an illustrative example, first distance 551 is about 0.067 inches (1.7018 mm). Each depression 518 is also configured to have a first width 552. In an illustrative example, first width 552 is about 0.028 inches (0.7112 mm). Each depression 518 is

also spaced apart from curved fold line 516 by a second distance 553. In an illustrative example, second distance 553 is about 0.035 inches (0.889 mm).

[0078] Depressions 518 and curved fold line 516 are formed by a die that cuts body blank 500 from a strip of insulative cellular non-aromatic polymeric material, laminated sheet, or a strip of printed-insulative cellular non-aromatic polymeric material and is formed to include punches or protrusions that reduce the thickness of the body blank 500 in particular locations during the cutting process. The cutting and reduction steps could be performed separately, performed simultaneously, or that multiple steps may be used to form the material. For example, in a progressive process, a first punch or protrusion could be used to reduce the thickness a first amount by applying a first pressure load. A second punch or protrusion could then be applied with a second pressure load greater than the first. In the alternative, the first punch or protrusion could be applied at the second pressure load. Any number of punches or protrusions may be applied at varying pressure loads, depending on the application.

[0079] As shown in Figs. 1A-4, depressions 518 formed in floor-retaining flange 26 permit controlled gathering of the floor-retaining flange 26 that supports a platform-support member 23 and horizontal platform 21. Floor-retaining flange 26 bends about curved fold line 516 to form floor-receiving pocket 20P with curved fold line 516 being configured to form connecting web 25. The absence of material in depressions 518 provides relief for the insulative cellular non-aromatic polymeric material as it is formed into floor-retaining flange 26. This controlled gathering can be contrasted to the bunching of material that occurs when materials that have no relief are formed into a structure having a narrower dimension. For example, in traditional paper cups, a retaining flange type will have a discontinuous surface due to uncontrolled gathering. Such a surface is usually worked in a secondary operation to provide an acceptable visual surface, or the uncontrolled gathering is left without further processing, with an inferior appearance. The approach of forming the depressions 518 in accordance with the present disclosure is an advantage of the insulative cellular non-aromatic polymeric material of the present disclosure in that the insulative cellular non-aromatic polymeric material is susceptible to plastic

deformation in localized zones in response to application of pressure (with or without application of heat) to achieve a superior visual appearance.

[0080] In another embodiment shown in Figs. 7-10, an insulative cup 310 is similar to insulative cup 10; however, the floor-retaining flange 26 of floor mount-17 of insulative cup 10 is omitted and replaced with a floor-retaining flange 326 of floor mount 317 that includes a pattern of areas of thicker and thinner areas that form a crossing pattern as suggested in Figs. 7, 9, and 10. Elements of insulative cup 310 that are similar to insulative cup 10 have like reference designators and the elements that are structurally different are given a new reference designator.

[0081] Insulative cup 310 is formed from a body blank 600 shown in Figs. 9 and 10. Body blank 600 is similar to body blank 500, with the principal difference being that the staves 180 and 182 are replaced with knurling 360. The geometry of body blank 600 will not be discussed in detail here, except where the structure of body blank 600 differs from body blank 500. For example, floor-retaining flange 326 includes first high-density areas of reduced thickness 382 which are positioned at an angle 386 of about 45 degrees as compared to second edge 508 as suggested in Figs. 7 and 10. Second high-density areas of reduced thickness 383 formed in floor-retaining flange 326 are oriented perpendicular to the first high-density areas of reduced thickness 382 and intersect the high-density first areas of reduced thickness 382 at intersections 384. The reduced high-density areas of thickness 382 and 383 are interposed between unreduced low-density areas 380 which may include areas bounded by reduced areas of thickness 382 and 383 and/or a fold line 516 formed in a blank 600.

[0082] Knurling 360 which is a result of the formation of reduced areas of thickness 382 and 383 also permits controlled gathering of floor-retaining flange 326 similar to the staves 180 and 182 of insulative cup 10. For example, reduced areas of thickness 382 and 383 provide relief when the blank 600 is wrapped about the central axis CA so that the surface of floor-retaining flange 326 appears neat and regular when insulative cup 310 is formed.

[0083] Angle 386 may be varied from zero to ninety degrees depending on various factors. Likewise, the second areas of reduced thickness 383 may intersect the first areas of reduced thickness 383 at any of a number of angles when the

knurling 360 is formed. Furthermore, the distance between adjacent areas of reduced thickness 382 may be greater than or less than the distance between adjacent areas of reduced thickness 383 such that the pattern may be varied.

[0084] In yet another embodiment shown in Figs. 11-14, an insulative cup 410 is similar to insulative cup 10; however, the floor-retaining flange 26 of floor mount-17 of insulative cup 10 is omitted and replaced with a floor-retaining flange 426 of floor mount 417 that includes a diagonal pattern formed at an angle as suggested in Figs. 11, 13, and 14. Elements of insulative cup 410 that are similar to insulative cup 10 have like reference designators and the elements that are structurally different are given a new reference designator.

[0085] Insulative cup 410 is formed from a body blank 700 as shown in Figs. 13 and 14. Body blank 600 is similar to body blank 500, with the principal difference being that the staves 180 and 182 are replaced with staves 480 and 482. The geometry of body blank 700 will not be discussed in detail here, except where the structure of body blank 700 differs from body blank 500. For example, floor-retaining flange 426 includes high-density first staves of reduced thickness 482 which are positioned at an angle 486 of about 45 degrees as compared to second edge 508 as suggested in Figs. 11 and 14. Second low-density staves 482 are interposed between first high-density staves 480.

[0086] Staves 480 and 482 facilitate orderly gathering of floor-retaining flange 426 similar to the staves 180 and 182 of insulative cup 10. For example, high-density staves 480 have reduced areas of thickness that provide relief when body blank 700 is wrapped about the central axis CA so that the surface of floor-retaining flange 426 appears neat and regular when insulative cup 410 is formed. Angle 486 may be varied degrees depending on various factors. Furthermore, the distance between adjacent staves 382 may be varied.

[0087] The foregoing discloses various patterns that may be formed in the floor region 104 of the insulative cups 10, 310, and 410 with the patterns oriented toward the floor chamber 20C of insulative cups 10, 310, and 410. As suggested in Figs. 15-17, the patterns formed in floor-retaining flanges 26, 326, and 426 may be formed on the opposite side of the respective body blanks 500, 600, and 700 so that the patterns are juxtaposed against platform-support member 13 of floor 20.

[0088] For example, insulative cup 10' comprises a floor-retaining flange 26' includes staves 180' and 182' which are not visible from the inner floor chamber 20C as suggested in Fig. 15. Staves 180' and 182' still permit controlled gathering of the floor-retaining flange 26' when it is wrapped about the platform-support member 23 and the insulative cup 10' is formed, but the expanded material is hidden from view and an inner surface of floor-retaining flange 26' visible from the inner floor chamber 20C is relatively smooth because of the relief provided by the staves 180' and 182'.

[0089] Similarly, an insulative cup 310' is formed such that knurling 360' is in contact with the platform-support member 23 and not visible from the inner floor chamber 20C as suggested in Fig. 16. A floor-retaining flange 326' includes first areas of reduced thickness 382' and second areas of reduced thickness 383' that intersect at intersections 384' leaving areas 380' of normal thickness. Knurling 360' still permits controlled gathering of the floor-retaining flange 326' when it is wrapped about the platform-support member 23 and the insulative cup 310' is formed, but the expanded material is hidden from view and an inner surface of floor-retaining flange 326' visible from the inner floor chamber 20C is relatively smooth because of the relief provided by the first areas of reduced thickness 382' and second areas of reduced thickness 383'.

[0090] Still another insulative cup 410' is formed such that a floor-retaining flange 426' includes first staves 480' and second staves 482' in contact with the platform-support member 13 and not visible from the inner floor chamber 20C as suggested in Fig. 17. The second staves 482' are areas of reduced thickness and the first staves 480' have a larger thickness than the second staves 482'. The staves 480' and 482' are formed at an angle relative to the lower edge of insulative cup 410'. The relief provided by second staves 482' permits controlled gathering of the floor-retaining flange 426' when it is wrapped about the platform-support member 23 and the insulative cup 410' is formed, but the expanded material is hidden from view and an inner surface of floor-retaining flange 426' visible from the inner floor chamber 20C is relatively smooth.

[0091] The deformation achieved in the blanks is dependent on several factors. As illustrated in Figs. 18 and 19, the deformation of the insulative cellular non-aromatic polymeric material may result in some irregularity of the material in

cross-section. For example, Fig. 18 is a partial elevation view of a portion of the floor-retaining flange included in the insulative cup of Fig. 2A showing a plurality of measurement points for determining the dimensional consistency of the plurality of vertical ribs formed in the floor-retaining flange. In general, the dimensional consistency is maintained at each measurement point. However, as shown in Fig. 19, there may be some variation of the thickness in some embodiments.

[0092] The partial elevation view of the portion of the floor-retaining flange shown in Fig. 19 shows the locations at which height 186, thickness 188, width 190, and depth 192 measurements are taken to determine the dimensional consistency of the plurality of staves 180 and 182 formed in the floor-retaining flange. In the illustrative embodiment of Fig. 19, stave 180 has a height 186 that is approximately equal to the thickness of a sheet used to form the body blank 500. Depth 192 of stave 180 is maximized in a central location and is gradually reduced to stave 182 which has a thickness 188. The width of each combination of staves 180 and 182 is maintained consistently at 190. Thus, while the stave 180 has some lateral variation in depth, the thickness 188 and height 186 are maintained along the length of each stave 180.

[0093] Insulative cellular non-aromatic polymeric material is configured in accordance with the present disclosure to provide means for enabling localized plastic deformation in at least one selected region of body of an insulative cup to provide (1) a plastically deformed first material segment having a first density in a first portion of the selected region of the body and (2) a second material segment having a relatively lower second density in an adjacent second portion of the selected region of the body. In illustrative embodiments, the first material segment is thinner than the second material segment.

[0094] One aspect of the present disclosure provides a formulation for manufacturing an insulative cellular non-aromatic polymeric material. As referred to herein, an insulative cellular non-aromatic polymeric material refers to an extruded structure having cells formed therein and has desirable insulative properties at given thicknesses. Another aspect of the present disclosure provides a resin material for manufacturing an extruded structure of insulative cellular non-aromatic polymeric material. Still another aspect of the present disclosure provides an extrudate

comprising an insulative cellular non-aromatic polymeric material. Yet another aspect of the present disclosure provides a structure of material formed from an insulative cellular non-aromatic polymeric material. A further aspect of the present disclosure provides a container formed from an insulative cellular non-aromatic polymeric material.

[0095] In exemplary embodiments, a formulation includes at least two polymeric materials. In one exemplary embodiment, a primary or base polymer comprises a high melt strength polypropylene that has long chain branching. In one exemplary embodiment, the polymeric material also has non-uniform dispersity. Long chain branching occurs by the replacement of a substituent, *e.g.*, a hydrogen atom, on a monomer subunit, by another covalently bonded chain of that polymer, or, in the case of a graft copolymer, by a chain of another type. For example, chain transfer reactions during polymerization could cause branching of the polymer. Long chain branching is branching with side polymer chain lengths longer than the average critical entanglement distance of a linear polymer chain. Long chain branching is generally understood to include polymer chains with at least 20 carbon atoms depending on specific monomer structure used for polymerization. Another example of branching is by crosslinking of the polymer after polymerization is complete. Some long chain branch polymers are formed without crosslinking. Polymer chain branching can have a significant impact on material properties. Originally known as the polydispersity index, dispersity is the measured term used to characterize the degree of polymerization. For example, free radical polymerization produces free radical monomer subunits that attach to other free radical monomers subunits to produce distributions of polymer chain lengths and polymer chain weights. Different types of polymerization reactions such as living polymerization, step polymerization, and free radical polymerization produce different dispersity values due to specific reaction mechanisms. Dispersity is determined as the ratio of weight average molecular weight ratio to number average molecular weight. Uniform dispersity is generally understood to be a value near or equal to 1. Non-uniform dispersity is generally understood to be a value greater than 2. Final selection of a polypropylene material may take into account the properties of the end material, the additional materials needed during formulation, as well as the conditions during the extrusion

process. In exemplary embodiments, high melt strength polypropylenes may be materials that can hold a gas (as discussed hereinbelow), produce desirable cell size, have desirable surface smoothness, and have an acceptable odor level (if any).

[0096] One illustrative example of a suitable polypropylene base resin is DAPLOY™ WB140 homopolymer (available from Borealis A/S), a high melt strength structural isomeric modified polypropylene homopolymer (melt strength = 36, as tested per ISO 16790 which is incorporated by reference herein, melting temperature = 325.4°F (163°C) using ISO 11357, which is incorporated by reference herein).

[0097] Borealis DAPLOY™ WB140 properties (as described in a Borealis product brochure):

Property	Typical Value	Unit	Test Method
Melt Flow Rate (230/2.16)	2.1	g/10 min	ISO 1133
Flexural Modulus	1900	MPa	ISO 178
Tensile Strength at Yield	40	MPa	ISO 527-2
Elongation at Yield	6	%	ISO 527-2
Tensile Modulus	2000	MPa	ISO 527-2
Charpy impact strength, notched (+23°C)	3.0	kJ/m ²	ISO 179/1eA
Charpy impact strength, notched (-20°C)	1.0	kJ /m ²	ISO 179/1eA
Heat Deflection Temperature A (at 1.8 MPa load)	60	°C	ISO 75-2 Method A
Heat Deflection Temperature B (at 0.46 MPa load)	110	°C	ISO 75-2 Method B

[0098] Other polypropylene polymers having suitable melt strength, branching, and melting temperature may also be used. Several base resins may be used and mixed together.

[0099] In certain exemplary embodiments, a secondary polymer may be used with the base polymer. The secondary polymer may be, for example, a polymer with sufficient crystallinity. The secondary polymer may also be, for example, a polymer with sufficient crystallinity and melt strength. In exemplary embodiments, the secondary polymer may be at least one crystalline polypropylene homopolymer, an impact polypropylene copolymer, mixtures thereof or the like. One illustrative example is a high crystalline polypropylene homopolymer, available as F020HC from Braskem. Another illustrative example is an impact polypropylene copolymer commercially available as PRO-FAX SC204™ (available from LyndellBasell

Industries Holdings, B.V.). Another illustrative example include is Homo PP - INSPIRE 222, available from Braskem. Another illustrative example included is the commercially available polymer known as PP 527K, available from Sabic. Another illustrative example is a polymer commercially available as XA-11477-48-1 from LyndellBasell Industries Holdings, B.V. In one aspect the polypropylene may have a high degree of crystallinity, *i.e.*, the content of the crystalline phase exceeds 51% (as tested using differential scanning calorimetry) at 10°C/min cooling rate. In exemplary embodiments, several different secondary polymers may be used and mixed together.

[00100] In exemplary embodiments, the secondary polymer may be or may include polyethylene. In exemplary embodiments, the secondary polymer may include low density polyethylene, linear low density polyethylene, high density polyethylene, ethylene-vinyl acetate copolymers, ethylene-ethylacrylate copolymers, ethylene-acrylic acid copolymers, polymethylmethacrylate mixtures of at least two of the foregoing and the like. The use of non-polypropylene materials may affect recyclability, insulation, microwavability, impact resistance, or other properties, as discussed further hereinbelow.

[00101] One or more nucleating agents are used to provide and control nucleation sites to promote formation of cells, bubbles, or voids in the molten resin during the extrusion process. Nucleating agent means a chemical or physical material that provides sites for cells to form in a molten resin mixture. Nucleating agents may be physical agents or chemical agents. Suitable physical nucleating agents have desirable particle size, aspect ratio, and top-cut properties, shape, and surface compatibility. Examples include, but are not limited to, talc, CaCO₃, mica, kaolin clay, chitin, aluminosilicates, graphite, cellulose, and mixtures of at least two of the foregoing. The nucleating agent may be blended with the polymer resin formulation that is introduced into the hopper. Alternatively, the nucleating agent may be added to the molten resin mixture in the extruder. When the chemical reaction temperature is reached the nucleating agent acts to enable formation of bubbles that create cells in the molten resin. An illustrative example of a chemical blowing agent is citric acid or a citric acid-based material. After decomposition, the chemical blowing agent forms small gas cells which further serve as nucleation sites for larger cell growth from physical blowing agents or other types thereof. One representative example is

Hydrocerol™ CF-40E™ (available from Clariant Corporation), which contains citric acid and a crystal nucleating agent. Another representative example is Hydrocerol™ CF-05E™ (available from Clariant Corporation), which contains citric acid and a crystal nucleating agent. In illustrative embodiments one or more catalysts or other reactants may be added to accelerate or facilitate the formation of cells.

[00102] In certain exemplary embodiments, one or more blowing agents may be incorporated. Blowing agent means a physical or a chemical material (or combination of materials) that acts to expand nucleation sites. Nucleating agents and blowing agents may work together. The blowing agent acts to reduce density by forming cells in the molten resin. The blowing agent may be added to the molten resin mixture in the extruder. Representative examples of physical blowing agents include, but are not limited to, carbon dioxide, nitrogen, helium, argon, air, water vapor, pentane, butane, or other alkane mixtures of the foregoing and the like. In certain exemplary embodiments, a processing aid may be employed that enhances the solubility of the physical blowing agent. Alternatively, the physical blowing agent may be a hydrofluorocarbon, such as 1,1,1,2-tetrafluoroethane, also known as R134a, a hydrofluoroolefin, such as, but not limited to, 1,3,3,3-tetrafluoropropene, also known as HFO-1234ze, or other haloalkane or haloalkane refrigerant. Selection of the blowing agent may be made to take environmental impact into consideration.

[00103] In exemplary embodiments, physical blowing agents are typically gases that are introduced as liquids under pressure into the molten resin via a port in the extruder. As the molten resin passes through the extruder and the die head, the pressure drops causing the physical blowing agent to change phase from a liquid to a gas, thereby creating cells in the extruded resin. Excess gas blows off after extrusion with the remaining gas being trapped in the cells in the extrudate.

[00104] Chemical blowing agents are materials that degrade or react to produce a gas. Chemical blowing agents may be endothermic or exothermic. Chemical blowing agents typically degrade at a certain temperature to decompose and release gas. In one aspect the chemical blowing agent may be one or more materials selected from the group consisting of azodicarbonamide; azodiisobutyro-nitrile; benzenesulfonhydrazide; 4,4-oxybenzene sulfonylsemicarbazide; p-toluene sulfonyl semi-carbazide; barium azodicarboxylate; *N,N'*-dimethyl-*N,N'*-

dinitrosoterephthalamide; trihydrazino triazine; methane; ethane; propane; *n*-butane; isobutane; *n*-pentane; isopentane; neopentane; methyl fluoride; perfluoromethane; ethyl fluoride; 1,1-difluoroethane; 1,1,1-trifluoroethane; 1,1,1,2-tetrafluoro-ethane; pentafluoroethane; perfluoroethane; 2,2-difluoropropane; 1,1,1-trifluoropropane; perfluoropropane; perfluorobutane; perfluorocyclobutane; methyl chloride; methylene chloride; ethyl chloride; 1,1,1-trichloroethane; 1,1-dichloro-1-fluoroethane; 1-chloro-1,1-difluoroethane; 1,1-dichloro-2,2,2-trifluoroethane; 1-chloro-1,2,2,2-tetrafluoroethane; trichloromonofluoromethane; dichlorodifluoromethane; trichlorotrifluoroethane; dichlorotetrafluoroethane; chloroheptafluoropropane; dichlorohexafluoropropane; methanol; ethanol; *n*-propanol; isopropanol; sodium bicarbonate; sodium carbonate; ammonium bicarbonate; ammonium carbonate; ammonium nitrite; *N,N'*-dimethyl-*N,N'*-dinitrosoterephthalamide; *N,N'*-dinitrosopentamethylene tetramine; azodicarbonamide; azobisisobutyronitrile; azocyclohexylnitrile; azodiaminobenzene; bariumazodicarboxylate; benzene sulfonyl hydrazide; toluene sulfonyl hydrazide; *p,p'*-oxybis(benzene sulfonyl hydrazide); diphenyl sulfone-3,3'-disulfonyl hydrazide; calcium azide; 4,4'-diphenyl disulfonyl azide; and *p*-toluene sulfonyl azide.

[00105] In one aspect of the present disclosure, where a chemical blowing agent is used, the chemical blowing agent may be introduced into the resin formulation that is added to the hopper.

[00106] In one aspect of the present disclosure, the blowing agent may be a decomposable material that forms a gas upon decomposition. A representative example of such a material is citric acid or a citric-acid based material. In one exemplary aspect of the present disclosure it may be possible to use a mixture of physical and chemical blowing agents.

[00107] In one aspect of the present disclosure, at least one slip agent may be incorporated into the resin mixture to aid in increasing production rates. Slip agent (also known as a process aid) is a term used to describe a general class of materials which are added to a resin mixture and provide surface lubrication to the polymer during and after conversion. Slip agents may also reduce or eliminate die drool. Representative examples of slip agent materials include amides of fats or fatty acids, such as, but not limited to, erucamide and oleamide. In one exemplary aspect, amides

from oleyl (single unsaturated C₁₈) through erucyl (C₂₂ single unsaturated) may be used. Other representative examples of slip agent materials include low molecular weight amides and fluoroelastomers. Combinations of two or more slip agents can be used. Slip agents may be provided in a master batch pellet form and blended with the resin formulation.

[00108] One or more additional components and additives optionally may be incorporated, such as, but not limited to, impact modifiers, colorants (such as, but not limited to, titanium dioxide), and compound regrind.

[00109] The polymer resins may be blended with any additional desired components and melted to form a resin formulation mixture.

[00110] The following numbered clauses include embodiments that are contemplated and non-limiting:

[00111] Clause 1. A blank of polymeric material used to form a body of a cup, the blank comprising

[00112] an upper band formed to include a curved top edge and

[00113] a lower band formed to include a left-end edge, a right-end edge, and a curved bottom edge arranged to extend between the left-end and right-end edges, wherein the lower band is appended to the upper band along a curved fold line to locate the curved fold line between the curved top and bottom edges, the lower band is formed to include a series of high-density staves of a first density and low-density staves of a relatively lower second density, each stave is arranged to extend from the curved bottom edge of the lower band toward the curved fold line, and the high-density and low-density staves are arranged to lie in an alternating sequence extending from about the left-end edge of the lower band to the right-end edge of the lower band to cause density to alternate from stave to stave along a length of the lower band.

[00114] Clause 2. The blank of any preceding clause, wherein the lower band has a first side and an opposite second side, each low-density stave has a first face on the first side of the lower band, a second face on the opposite second side of the lower band, and a first thickness defined by a distance between the first and second faces of the low-density stave, and each high-density stave has a first face on the first side of the lower band, a second face on the second side of the lower band,

and a second thickness defined by a distance between the first and second faces of the high-density stave, and the second thickness is less than the first thickness.

[00115] Clause 3. The blank of any preceding clause, wherein the second thickness is about half of the first thickness.

[00116] Clause 4. The blank of any preceding clause, wherein the polymeric material is an insulative cellular non-aromatic polymeric material.

[00117] Clause 5. The blank of any preceding clause, wherein each high-density stave has a narrow width and each low-density stave has a relatively wider wide width.

[00118] Clause 6. The blank of any preceding clause, wherein the narrow width is about 0.028 inch (0.711 mm) and the relatively wider wide width is about 0.067 inch (1.702 mm).

[00119] Clause 7. The blank of any preceding clause, wherein the lower band includes a border section extending from the left-end edge to the right-end edge and lying between the curved fold line and an upper end of each of the high-density and low-density staves and the border section has a height of about 0.035 inch (0.889 mm).

[00120] Clause 8. The blank of any preceding clause, wherein the polymeric material is an insulative cellular non-aromatic polymeric material.

[00121] Clause 9. The blank of any preceding clause, wherein a connecting web is defined by polymeric material extending along and on either side of the curved fold line and the connecting web has a third density that is lower than the first density.

[00122] Clause 10. The blank of any preceding clause, wherein the third density of the connecting web is about equal to the second density of the low-density staves.

[00123] Clause 11. The blank of any preceding clause, wherein each low-density stave has a first thickness, each high-density stave has a relatively thinner second thickness, and the connecting web has a third thickness that is about equal to the relatively thinner second thickness.

[00124] Clause 12. The blank of any preceding clause, wherein the polymeric material is an insulative cellular non-aromatic polymeric material.

[00125] Clause 13. The blank of any preceding clause, wherein the upper band includes a left-end edge arranged to extend from the curved fold line to a first end of the curved top edge and a right-end edge arranged to extend from the curved fold line to an opposite second end of the curved top edge, the upper band includes a top strip arranged to extend along the curved top edge from the left-end edge of the upper band to the right-end edge of the upper band, a bottom strip arranged to extend along the curved fold line from the left-end edge of the upper band to the right-end edge of the upper band, and a middle strip arranged to lie between and interconnect the top and bottom strips and extend from the left-end edge of the upper band to the right-end edge of the upper band, the top strip is configured to be moved relative to the middle strip during a blank conversion process to form a circular rolled brim, the middle strip is configured to be wrapped about a central vertical axis during the blank conversion process to provide a sleeve-shaped side wall coupled to the circular rolled brim, and the bottom strip of the upper band and the lower band cooperate to form a floor mount configured to provide means for receiving a portion of a floor during a cup formation process to cause the floor and the sleeve-shaped side wall to cooperate to form an interior region in response to folding movement of the lower band along the curved fold line while wrapping the upper band around a vertical central axis to establish an annular shape of the lower band to provide a ring-shaped floor-retaining flange and to establish an annular shape of the bottom strip of the upper band to provide a ring-shaped web-support ring surrounding the ring-shaped floor-retaining flange to provide an annular floor-receiving pocket therebetween.

[00126] Clause 14. The blank of any preceding clause, wherein the lower band has a first side and an opposite second side, each low-density stave has a first face on the first side of the lower band, a second face on the opposite second side of the lower band, and a first thickness defined by a distance between the first and second faces of the low-density stave, and each high-density stave has a first face on the first side of the lower band, a second face on the second side of the lower band, and a second thickness defined by a distance between the first and second faces of the high-density stave, and the second thickness is less than the first thickness.

[00127] Clause 15. The blank of any preceding clause, wherein the first face is formed to include a depression along the length of a high-density stave and

between opposing edges of neighboring low-density staves and the depression is arranged to open in a direction away from the ring-shaped web support ring defined by the bottom strip of the upper band and arranged to surround high-density and low-density staves included in the floor-retaining flange defined by the lower band.

[00128] Clause 16. The blank of any preceding clause, wherein the polymeric material is an insulative cellular non-aromatic polymeric material.

[00129] Clause 17. The blank of any preceding clause, wherein the first face is formed to include a depression along the length of a high-density stave and between opposing edges of neighboring low-density staves and the depression is arranged to open in a direction toward the ring-shaped web support ring defined by the bottom strip of the upper band and arranged to surround high-density and low-density staves included in the floor-retaining flange defined by the lower band.

[00130] Clause 18. The blank of any preceding clause, wherein the polymeric material is an insulative cellular non-aromatic polymeric material.

[00131] Clause 19. The blank of any preceding clause, wherein a connecting web is defined by polymeric material extending along and on either side of the curved fold line and the connecting web has a third density that is lower than the first density and wherein the connecting web is appended to the web-support ring and to the floor-retaining flange.

[00132] Clause 20. The blank of any preceding clause, wherein the polymeric material is an insulative cellular non-aromatic polymeric material.

[00133] Clause 21. A blank used to form a body of a cup, the blank comprising a generally planar sheet of insulative cellular non-aromatic polymeric material having a first side and a second side, the sheet being defined by a first arcuate edge, a second arcuate edge, a first linear edge, and a second linear edge, the sheet including a first strip and a second strip, the first and second strips being separated by a first area of reduced thickness, the second strip having a plurality of second areas of reduced thickness positioned in the second strip.

[00134] Clause 22. The blank of any preceding clause, wherein the first area of reduced thickness extends from the first linear edge to the second linear edge.

- [00135] Clause 23. The blank of any preceding clause, wherein the first area of reduced thickness comprises a first depression and the first depression has an arcuate axis with a radius that is centered on the common radial axis.
- [00136] Clause 24. The blank of any preceding clause, wherein the first depression is reduced to about 50% of the nominal thickness.
- [00137] Clause 25. The blank of any preceding clause, wherein the first depression is plastically deformed.
- [00138] Clause 26. The blank of any preceding clause, wherein the first depression has been deformed to take a permanent set.
- [00139] Clause 27. The blank of any preceding clause, wherein the first depression comprises a localized area of higher density.
- [00140] Clause 28. The blank of any preceding clause, wherein cells of the insulative cellular non-aromatic polymeric material remain unbroken in the localized area of higher density.
- [00141] Clause 29. The blank of any preceding clause, wherein the second areas of reduced thickness comprises a plurality of second depressions, each second depression aligned along an independent linear axis.
- [00142] Clause 30. The blank of any preceding clause, wherein the axes of least two of the second depressions are parallel.
- [00143] Clause 31. The blank of any preceding clause, comprising at least three parallel and evenly spaced second depressions that form congruent areas of nominal thickness between the second depressions.
- [00144] Clause 32. The blank of any preceding clause, wherein the second depressions include at least two second depressions aligned in a first direction and at least two second depressions aligned in a second direction, at least one of the two second depressions aligned in the first direction intersecting at least one of the two second depressions aligned in the second direction.
- [00145] Clause 33. The blank of any preceding clause, wherein at least one of the first or second directions is not parallel to at least one of the first or second linear edges.
- [00146] Clause 34. The blank of any preceding clause, wherein an angle between the first and second directions is between zero and ninety degrees.

- [00147] Clause 35. The blank of any preceding clause, wherein the angle between the first and second directions is about forty-five degrees.
- [00148] Clause 36. The blank of any preceding clause, comprising a plurality of arcuate third depressions parallel to the first and second arcuate edges, the arcuate third depressions intersecting at least one of the second depressions.
- [00149] Clause 37. The blank of any preceding clause, wherein the first and second linear edges each lie along a ray emanating from the common radial axis of the first and second arcuate edges.
- [00150] Clause 38. The blank of any preceding clause, wherein the sheet is defined by a circular ring sector.
- [00151] Clause 39. The blank of any preceding clause, wherein an area adjacent one or more of the depressions has a non-uniform thickness that varies between the thickness of the respective depression and the nominal thickness.
- [00152] Clause 40. A blank used to form a body of a cup, the blank comprising a generally planar sheet of insulative cellular non-aromatic polymeric material having a first side and a second side and a nominal thickness, the sheet being defined by circular ring sector, the sheet including a first strip and a second strip, the first and second strips being separated by a first area of reduced thickness, and a plurality of second areas of reduced thickness positioned in the second strip.
- [00153] Clause 41. The blank of any preceding clause, wherein the circular ring sector comprises outer and inner arcuate edges that are each defined by a radius that is centered on common radial axis.
- [00154] Clause 42. The blank of any preceding clause, wherein the first area of reduced thickness extends between two non-arcuate edges of the circular ring sector.
- [00155] Clause 43. The blank of any preceding clause, wherein the first area of reduced thickness comprises a depression and the depression is arranged along an arc having a radius centered on the common radial axis.
- [00156] Clause 44. The blank of any preceding clause, wherein the depression comprises a localized area of higher density.

[00157] Clause 45. The blank of any preceding clause, wherein cells of the insulative cellular non-aromatic polymeric material remain unbroken in the localized area of higher density.

[00158] Clause 46. The blank of any preceding clause, wherein the second areas of reduced thickness comprise spaced apart linear depressions.

[00159] Clause 47. The blank of any preceding clause, wherein the linear depressions are parallel.

[00160] Clause 48. The blank of any preceding clause, wherein second strip includes a first set of parallel linear depressions aligned in a first direction and a second set of parallel linear depressions aligned in a second direction, at least some of the first set of linear depressions intersecting at least some of the second set of linear depressions such that congruent areas of nominal thickness are formed between the intersecting linear depressions.

[00161] Clause 49. The blank of any preceding clause, wherein angle between the first and second directions is between zero and ninety degrees.

[00162] Clause 50. The blank of any preceding clause, wherein the angle between the first and second directions is about forty-five degrees.

[00163] Clause 51. The blank of any preceding clause, further comprising a plurality of additional arcuate depressions parallel to the first and second arcuate edges, the additional arcuate depressions intersecting at least one of linear depressions.

[00164] Clause 52. The blank of any preceding clause, wherein an area adjacent one or more of the depressions has a non-uniform thickness that varies between the thickness of the respective depression and the nominal thickness.

[00165] Clause 53. The blank of any preceding clause, wherein a depression is reduced to about 50% of the nominal thickness.

[00166] Clause 54. The blank of any preceding clause, wherein a depression is plastically deformed.

[00167] Clause 55. The blank of any preceding clause, wherein a depression has been deformed to take a permanent set.

[00168] Clause 56. A blank used to form a body of a cup, the blank comprising a generally planar sheet of insulative cellular non-aromatic polymeric

material having a first side and a second side, the sheet being defined by a first arcuate edge, a second arcuate edge, a first linear edge, and a second linear edge, an arcuately shaped area of reduced thickness being positioned between the first and second arcuate edges and parallel to at least one of the first and second arcuate edges, and a plurality of areas of reduced thickness being positioned between the arcuately shaped area of reduced thickness and at least one of the first arcuate edge and the second arcuate edge.

[00169] Clause 57. The blank of any preceding clause, wherein the arcuately shaped area of reduced thickness extends from the first linear edge to the second linear edge.

[00170] Clause 58. The blank of any preceding clause, wherein the arcuately shaped area of reduced thickness comprises a depression.

[00171] Clause 59. The blank of any preceding clause, wherein the sheet has a generally uniform nominal thickness and the depression is reduced to about 50% of the nominal thickness.

[00172] Clause 60. The blank of any preceding clause, wherein the depression is plastically deformed.

[00173] Clause 61. The blank of any preceding clause, wherein the depression has been deformed to take a permanent set.

[00174] Clause 62. The blank of any preceding clause, wherein the depression comprises a localized area of higher density.

[00175] Clause 63. The blank of any preceding clause, wherein cells of the insulative cellular non-aromatic polymeric material remain unbroken in the localized area of higher density.

[00176] Clause 64. The blank of any preceding clause, wherein the plurality of areas of reduced thickness positioned between the arcuately shaped area of reduced thickness and at least one of the first arcuate edge and the second arcuate edge comprises a plurality of depressions and each depression is aligned along an independent linear axis.

[00177] Clause 65. The blank of any preceding clause, wherein the axes of least two depressions aligned along an independent linear axis are parallel.

[00178] Clause 66. The blank of any preceding clause, comprising at least three depressions aligned along an independent linear axis, the independent axes of the three depressions being parallel and evenly spaced such that congruent areas of nominal thickness are formed between the depressions.

[00179] Clause 67. The blank of any preceding clause, wherein the plurality of linear depressions positioned between the arcuately shaped area of reduced thickness and at least one of the first arcuate edge and the second arcuate edge include at least two depressions aligned along an independent linear axis, the independent axes of the depressions being parallel and aligned in first direction, and at least two depressions aligned along an independent linear axis, the independent axes of the depressions being parallel and aligned in the second direction, at least one of the two depressions aligned in the first direction intersecting at least one of the two depressions aligned in the second direction.

[00180] Clause 68. The blank of any preceding clause, wherein at least one of the first or second directions is not parallel to at least one of the first or second linear edges.

[00181] Clause 69. The blank of any preceding clause, wherein angle between the first and second directions is between zero and ninety degrees.

[00182] Clause 70. The blank of any preceding clause, wherein the angle between the first and second directions is about forty-five degrees.

[00183] Clause 71. The blank of any preceding clause, comprising a plurality of additional arcuate depressions parallel to the first and second arcuate edges, the additional arcuate depressions intersecting at least one of the plurality of depressions aligned along an independent linear axis.

[00184] Clause 72. The blank of any preceding clause, wherein the first and second linear edges each lie along a ray emanating from the common radial axis of the first and second arcuate edges.

[00185] Clause 73. The blank of any preceding clause, wherein the sheet is defined by a circular ring sector.

[00186] Clause 74. The blank of any preceding clause, wherein the sheet has a generally uniform nominal thickness and an area adjacent one or more of the

depressions has a non-uniform thickness that varies between the thickness of the respective depression and the nominal thickness.

EXAMPLES

[00187] The following examples are set forth for purposes of illustration only. Parts and percentages appearing in such examples are by weight unless otherwise stipulated. All ASTM, ISO and other standard test method cited or referred to in this disclosure are incorporated by reference in their entirety.

Example 1 - Formulation and Extrusion

[00188] DAPLOY™ WB140 polypropylene homopolymer (available from Borealis A/S) was used as the polypropylene base resin. F020HC, available from Braskem, a polypropylene homopolymer resin, was used as the secondary resin. The two resins were blended with: Hydrocerol™ CF-40E™ as a chemical blowing agent, talc as a nucleation agent, CO₂ as a physical blowing agent, a slip agent, and titanium dioxide as a colorant. The colorant can be added to the base resin or to the secondary resin and may be done prior to mixing of the two resins. Percentages were:

81.45%	Primary Resin: Borealis WB140 HMS high melt strength homopolymer polypropylene
15%	Secondary Resin: Braskem F020HC homopolymer polypropylene
0.05%	Chemical Blowing Agent: Clariant Hydrocerol CF-40E™
0.5%	Nucleation Agent: Heritage Plastics HT4HP Talc
1%	Colorant: Colortech 11933-19 TiO ₂ PP
2%	Slip agent: Ampacet™ 102823 Process Aid LLDPE (linear low-density polyethylene), available from Ampacet Corporation
2.2 lbs/hr	CO ₂ physical blowing agent introduced into the molten resin

[00189] Density of the strip formed ranged from about 0.140 g/cm³ to about 0.180 g/cm³.

[00190] The formulation was added to an extruder hopper. The extruder heated the formulation to form a molten resin mixture. To this mixture was added the CO₂ to expand the resin and reduce density. The mixture thus formed was extruded through a die head into a strip. The strip was then cut and formed into insulative cup.

[00191] The carbon dioxide was injected into the resin blend to expand the resin and reduce density. The mixture thus formed was extruded through a die head into a sheet. The sheet was then cut and formed into a cup.

Example 2 – Formulation and Extrusion

[00192] DAPLOY™ WB140 HMS polypropylene homopolymer (available from Borealis A/S) was used as the polypropylene base resin. F020HC polypropylene homopolymer resin (available from Braskem), was used as the secondary resin. The two resins were blended with: Hydrocerol™ CF-40E™ as a primary nucleation agent, HPR-803i fibers (available from Milliken) as a secondary nucleation agent, CO₂ as a blowing agent, Ampacet™ 102823 LLDPE as a slip agent, and titanium dioxide as a colorant. The colorant can be added to the base resin or to the secondary resin and may be done prior to mixing of the two resins. Percentages were:

80.95%	Primary resin
15%	Secondary resin
0.05%	Primary nucleating agent
1%	Secondary nucleating agent
1%	Colorant
2%	Slip agent

[00193] The formulation was added to an extruder hopper. The extruder heated the formulation to form a molten resin mixture. To this mixture was added

2.2 lbs/hr CO₂

[00194] The carbon dioxide was injected into the resin blend to expand the resin and reduce density. The mixture thus formed was extruded through a die head into a sheet. The sheet was then cut and formed into a cup.

CLAIMS

1. A blank of polymeric material used to form a body of a cup, the blank comprising
 - an upper band formed to include a curved top edge and
 - a lower band formed to include a left-end edge, a right-end edge, and a curved bottom edge arranged to extend between the left-end and right-end edges, wherein the lower band is appended to the upper band along a curved fold line to locate the curved fold line between the curved top and bottom edges, the lower band is formed to include a series of high-density staves of a first density and low-density staves of a relatively lower second density, each stave is arranged to extend from the curved bottom edge of the lower band toward the curved fold line, and the high-density and low-density staves are arranged to lie in an alternating sequence extending from about the left-end edge of the lower band to the right-end edge of the lower band to cause density to alternate from stave to stave along a length of the lower band.
2. The blank of claim 1, wherein the lower band has a first side and an opposite second side, each low-density stave has a first face on the first side of the lower band, a second face on the opposite second side of the lower band, and a first thickness defined by a distance between the first and second faces of the low-density stave, and each high-density stave has a first face on the first side of the lower band, a second face on the second side of the lower band, and a second thickness defined by a distance between the first and second faces of the high-density stave, and the second thickness is less than the first thickness.
3. The blank of claim 2, wherein the second thickness is about half of the first thickness.
4. The blank of claim 2, wherein the polymeric material is an insulative cellular non-aromatic polymeric material.
5. The blank of claim 1, wherein each high-density stave has a narrow width and each low-density stave has a relatively wider wide width.
6. The blank of claim 5, wherein the narrow width is about 0.028 inch (0.711 mm) and the relatively wider wide width is about 0.067 inch (1.702 mm).

7. The blank of claim 6, wherein the lower band includes a border section extending from the left-end edge to the right-end edge and lying between the curved fold line and an upper end of each of the high-density and low-density staves and the border section has a height of about 0.035 inch (0.889 mm).

8. The blank of claim 5, wherein the polymeric material is an insulative cellular non-aromatic polymeric material.

9. The blank of claim 1, wherein a connecting web is defined by polymeric material extending along and on either side of the curved fold line and the connecting web has a third density that is lower than the first density.

10. The blank of claim 9, wherein the third density of the connecting web is about equal to the second density of the low-density staves.

11. The blank of claim 10, wherein each low-density stave has a first thickness, each high-density stave has a relatively thinner second thickness, and the connecting web has a third thickness that is about equal to the relatively thinner second thickness.

12. The blank of claim 9, wherein the polymeric material is an insulative cellular non-aromatic polymeric material.

13. The blank of claim 1, wherein the upper band includes a left-end edge arranged to extend from the curved fold line to a first end of the curved top edge and a right-end edge arranged to extend from the curved fold line to an opposite second end of the curved top edge, the upper band includes a top strip arranged to extend along the curved top edge from the left-end edge of the upper band to the right-end edge of the upper band, a bottom strip arranged to extend along the curved fold line from the left-end edge of the upper band to the right-end edge of the upper band, and a middle strip arranged to lie between and interconnect the top and bottom strips and extend from the left-end edge of the upper band to the right-end edge of the upper band, the top strip is configured to be moved relative to the middle strip during a blank conversion process to form a circular rolled brim, the middle strip is configured to be wrapped about a central vertical axis during the blank conversion process to provide a sleeve-shaped side wall coupled to the circular rolled brim, and the bottom strip of the upper band and the lower band cooperate to form a floor mount configured to provide means for receiving a portion of a floor during a cup formation

process to cause the floor and the sleeve-shaped side wall to cooperate to form an interior region in response to folding movement of the lower band along the curved fold line while wrapping the upper band around a vertical central axis to establish an annular shape of the lower band to provide a ring-shaped floor-retaining flange and to establish an annular shape of the bottom strip of the upper band to provide a ring-shaped web-support ring surrounding the ring-shaped floor-retaining flange to provide an annular floor-receiving pocket therebetween.

14. The blank of claim 13, wherein the lower band has a first side and an opposite second side, each low-density stave has a first face on the first side of the lower band, a second face on the opposite second side of the lower band, and a first thickness defined by a distance between the first and second faces of the low-density stave, and each high-density stave has a first face on the first side of the lower band, a second face on the second side of the lower band, and a second thickness defined by a distance between the first and second faces of the high-density stave, and the second thickness is less than the first thickness.

15. The blank of claim 14, wherein the first face is formed to include a depression along the length of a high-density stave and between opposing edges of neighboring low-density staves and the depression is arranged to open in a direction away from the ring-shaped web support ring defined by the bottom strip of the upper band and arranged to surround high-density and low-density staves included in the floor-retaining flange defined by the lower band.

16. The blank of claim 15, wherein the polymeric material is an insulative cellular non-aromatic polymeric material.

17. The blank of claim 14, wherein the first face is formed to include a depression along the length of a high-density stave and between opposing edges of neighboring low-density staves and the depression is arranged to open in a direction toward the ring-shaped web support ring defined by the bottom strip of the upper band and arranged to surround high-density and low-density staves included in the floor-retaining flange defined by the lower band.

18. The blank of claim 17, wherein the polymeric material is an insulative cellular non-aromatic polymeric material.

19. The blank of claim 14, wherein a connecting web is defined by polymeric material extending along and on either side of the curved fold line and the connecting web has a third density that is lower than the first density and wherein the connecting web is appended to the web-support ring and to the floor-retaining flange.

20. The blank of claim 19, wherein the polymeric material is an insulative cellular non-aromatic polymeric material.

21. A blank used to form a body of a cup, the blank comprising a generally planar sheet of insulative cellular non-aromatic polymeric material having a first side and a second side, the sheet being defined by a first arcuate edge, a second arcuate edge, a first linear edge, and a second linear edge, the sheet including a first strip and a second strip, the first and second strips being separated by a first area of reduced thickness, the second strip having a plurality of second areas of reduced thickness positioned in the second strip.

22. The blank of claim 21, wherein the first area of reduced thickness extends from the first linear edge to the second linear edge.

23. The blank of claim 21, wherein the first area of reduced thickness comprises a first depression and the first depression has an arcuate axis with a radius that is centered on the common radial axis.

24. The blank of claim 23, wherein the first depression is reduced to about 50% of the nominal thickness.

25. The blank of claim 24, wherein the first depression is plastically deformed.

26. The blank of claim 24, wherein the first depression has been deformed to take a permanent set.

27. The blank of claim 23, wherein the first depression comprises a localized area of higher density.

28. The blank of claim 27, wherein cells of the insulative cellular non-aromatic polymeric material remain unbroken in the localized area of higher density.

29. The blank of claim 28, wherein the second areas of reduced thickness comprises a plurality of second depressions, each second depression aligned along an independent linear axis.

30. The blank of claim 29, wherein the axes of least two of the second depressions are parallel.

31. The blank of claim 29, comprising at least three parallel and evenly spaced second depressions that form congruent areas of nominal thickness between the second depressions.

32. The blank of claim 29, wherein the second depressions include at least two second depressions aligned in a first direction and at least two second depressions aligned in a second direction, at least one of the two second depressions aligned in the first direction intersecting at least one of the two second depressions aligned in the second direction.

33. The blank of claim 32, wherein at least one of the first or second directions is not parallel to at least one of the first or second linear edges.

34. The blank of claim 33, wherein an angle between the first and second directions is between zero and ninety degrees.

35. The blank of claim 34, wherein the angle between the first and second directions is about forty-five degrees.

36. The blank of claim 29, comprising a plurality of arcuate third depressions parallel to the first and second arcuate edges, the arcuate third depressions intersecting at least one of the second depressions.

37. The blank of claim 36, wherein the first and second linear edges each lie along a ray emanating from the common radial axis of the first and second arcuate edges.

38. The blank of claim 36, wherein the sheet is defined by a circular ring sector.

39. The blank of claim 36, wherein an area adjacent one or more of the depressions has a non-uniform thickness that varies between the thickness of the respective depression and the nominal thickness.

40. A blank used to form a body of a cup, the blank comprising a generally planar sheet of insulative cellular non-aromatic polymeric material having a first side and a second side and a nominal thickness, the sheet being defined by circular ring sector, the sheet including a first strip and a second strip, the first and second strips being separated by a first area of reduced thickness, and a plurality of second areas of reduced thickness positioned in the second strip.

41. The blank of claim 40, wherein the circular ring sector comprises outer and inner arcuate edges that are each defined by a radius that is centered on common radial axis.

42. The blank of claim 40, wherein the first area of reduced thickness extends between two non-arcuate edges of the circular ring sector.

43. The blank of claim 42, wherein the first area of reduced thickness comprises a depression and the depression is arranged along an arc having a radius centered on the common radial axis.

44. The blank of claim 43, wherein the depression comprises a localized area of higher density.

45. The blank of claim 44, wherein cells of the insulative cellular non-aromatic polymeric material remain unbroken in the localized area of higher density.

46. The blank of claim 45, wherein the second areas of reduced thickness comprise spaced apart linear depressions.

47. The blank of claim 46, wherein the linear depressions are parallel.

48. The blank of claim 40, wherein second strip includes a first set of parallel linear depressions aligned in a first direction and a second set of parallel linear depressions aligned in a second direction, at least some of the first set of linear depressions intersecting at least some of the second set of linear depressions such that congruent areas of nominal thickness are formed between the intersecting linear depressions.

49. The blank of claim 48, wherein angle between the first and second directions is between zero and ninety degrees.

50. The blank of claim 48, wherein the angle between the first and second directions is about forty-five degrees.

51. The blank of claim 48, further comprising a plurality of additional arcuate depressions parallel to the first and second arcuate edges, the additional arcuate depressions intersecting at least one of linear depressions.

52. The blank of claim 51, wherein an area adjacent one or more of the depressions has a non-uniform thickness that varies between the thickness of the respective depression and the nominal thickness.

53. The blank of claim 52, wherein a depression is reduced to about 50% of the nominal thickness.

54. The blank of claim 53, wherein a depression is plastically deformed.

55. The blank of claim 53, wherein a depression has been deformed to take a permanent set.

56. A blank used to form a body of a cup, the blank comprising a generally planar sheet of insulative cellular non-aromatic polymeric material having a first side and a second side, the sheet being defined by a first arcuate edge, a second arcuate edge, a first linear edge, and a second linear edge, an arcuately shaped area of reduced thickness being positioned between the first and second arcuate edges and parallel to at least one of the first and second arcuate edges, and a plurality of areas of reduced thickness being positioned between the arcuately shaped area of reduced thickness and at least one of the first arcuate edge and the second arcuate edge.

57. The blank of claim 56, wherein the arcuately shaped area of reduced thickness extends from the first linear edge to the second linear edge.

58. The blank of claim 57, wherein the arcuately shaped area of reduced thickness comprises a depression.

59. The blank of claim 58, wherein the sheet has a generally uniform nominal thickness and the depression is reduced to about 50% of the nominal thickness.

60. The blank of claim 59, wherein the depression is plastically deformed.

61. The blank of claim 59, wherein the depression has been deformed to take a permanent set.

62. The blank of claim 58, wherein the depression comprises a localized area of higher density.

63. The blank of claim 62, wherein cells of the insulative cellular non-aromatic polymeric material remain unbroken in the localized area of higher density.

64. The blank of claim 63, wherein the plurality of areas of reduced thickness positioned between the arcuately shaped area of reduced thickness and at least one of the first arcuate edge and the second arcuate edge comprises a plurality of depressions and each depression is aligned along an independent linear axis.

65. The blank of claim 64, wherein the axes of least two depressions aligned along an independent linear axis are parallel.

66. The blank of claim 64, comprising at least three depressions aligned along an independent linear axis, the independent axes of the three depressions being parallel and evenly spaced such that congruent areas of nominal thickness are formed between the depressions.

67. The blank of claim 64, wherein the plurality of linear depressions positioned between the arcuately shaped area of reduced thickness and at least one of the first arcuate edge and the second arcuate edge include at least two depressions aligned along an independent linear axis, the independent axes of the depressions being parallel and aligned in first direction, and at least two depressions aligned along an independent linear axis, the independent axes of the depressions being parallel and aligned in the second direction, at least one of the two depressions aligned in the first direction intersecting at least one of the two depressions aligned in the second direction.

68. The blank of claim 67, wherein at least one of the first or second directions is not parallel to at least one of the first or second linear edges.

69. The blank of claim 68, wherein angle between the first and second directions is between zero and ninety degrees.

70. The blank of claim 68, wherein the angle between the first and second directions is about forty-five degrees.

71. The blank of claim 64, comprising a plurality of additional arcuate depressions parallel to the first and second arcuate edges, the additional arcuate depressions intersecting at least one of the plurality of depressions aligned along an independent linear axis.

72. The blank of claim 71, wherein the first and second linear edges each lie along a ray emanating from the common radial axis of the first and second arcuate edges.

73. The blank of claim 71, wherein the sheet is defined by a circular ring sector.

74. The blank of claim 71, wherein the sheet has a generally uniform nominal thickness and an area adjacent one or more of the depressions has a non-uniform thickness that varies between the thickness of the respective depression and the nominal thickness.