

BLANK FOR CONTAINER

PRIORITY CLAIM

[0001] This application claims priority under 35 U.S.C. § 119(e) to U.S. 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 insulated 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 tray, or a box.

[0004] In illustrative embodiments, a blank may be arranged to establish a container. The blank includes a base, a first side wall, a second side wall, a front wall, and a back wall. Together the base, the first side wall, the second side wall, the front wall, and the back wall cooperate to define an interior region therebetween. In illustrative embodiments, the blank is made from a sheet including an insulative cellular non-aromatic polymeric material.

[0005] In illustrative embodiments, the insulative cellular non-aromatic polymeric material included in the blank 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 region interconnecting the base and the first side wall) to provide (1) a plastically deformed first material segment having a first density in a first portion of the selected region of the blank and (2) a second material segment having a relatively lower second density in an adjacent second portion of the selected region of the blank. In illustrative embodiments, the more dense first material segment is thinner than the second material segment.

[0006] 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

[0007] The detailed description particularly refers to the accompanying figures in which:

[0008] Fig. 1 is perspective view of an insulative container in accordance with the present disclosure made from a blank as suggested in Figs. 2 and 3 and showing that the insulative container includes a floor, a cover spaced apart above the floor, a front wall, an opposite back wall, and two interconnecting side walls;

[0009] Fig. 2 is plan view of the blank used to form the insulative container of Fig. 1; and

[0010] Fig. 3 is a plan view showing an opposite side of the blank of Fig. 1 and showing that the blank includes graphics which may be displayed on the insulative container after the blank is folded to form the insulative container as shown in Fig. 1.

DETAILED DESCRIPTION

[0011] Localized plastic deformation is provided in accordance with the present disclosure in, for example, a region 820 included in a blank 800 about which a front wall 836 is folded relative to a base 838 comprising an insulative cellular non-aromatic polymeric material as suggested in Figs. 1-3. 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.

[0012] Blank 800 for container 810 is formed from a sheet including insulative cellular non-aromatic polymeric material as suggested in Figs. 1-3. Container 810 is formed when blank 800 is folded and glued as shown in Fig. 1. Blank 800 includes regions 812, 814, 816, 818, 820, 822, 824, 826, 830, 832, 834 (also called connecting webs 812, 814, 816, 818, 820, 822, 824, 826, 830, 832, 834) of localized plastic deformation that correspond to fold lines.

[0013] Blank 800 includes a first side 840 that corresponds to the inner surfaces of container 810 as suggested in Fig. 2. Blank 800 may be formed in a blank forming process as described in U.S. Pat. Application No. 13/526,444, incorporated herein by reference. Blank 800 is cut to include the perimeter shown in Figs. 2 and 3 and a pressing operation may reduce the regions 812, 814, 816, 818, 820, 822, 824,

826, 830, 832, 834 to define base 838 (also called floor 838) and two side walls 842, 844 coupled to base 838. Two respective flaps 846 and 848 are coupled to side walls 842 and 844. A front wall 836 is coupled to base 838 with two flaps 850 and 852 coupled to front wall 836. A back wall 854 is coupled to base 838. Two flaps 856 and 858 are coupled to back wall 854 and are positioned to engage respective side walls 842 and 844 when blank 800 is folded to form container 810. A cover 860 is also coupled to back wall 854 and a flap 862 is coupled to cover 860 as shown in Figs. 2 and 3.

[0014] When assembled, flaps 850 and 852 are secured to respective side walls 842 and 844; flaps 842 and 844 are each secured to cover 860; flap 862 is secured to front wall 836 and flaps 856 and 858 are secured to side walls 842, 844. Flaps 846, 848, 850, 852, 856, 858, and 862 are secured through gluing. In some embodiments, heat may be applied to flaps 846, 848, 850, 852, 856, 858, and 862 such that flaps 846, 848, 850, 852, 856, 858, and 862 are secured to walls 836, 842, 844 by a heat seal. In other embodiments, an adhesive may be applied to flaps 846, 848, 850, 852, 856, 858, and 862 such that flaps 846, 848, 850, 852, 856, 858, and 862 are secured to the walls 836, 842, 844 by the adhesive.

[0015] As shown in Figs. 1 and 3, a second side 864 of blank 800 corresponds to an outer surface of container 810 when container 810 is assembled. Relief provided by regions 812, 814, 816, 818, 820, 822, 824, 826, 830, 832, and 834 minimizes creasing or buckling on the second side 864 when container 810 is assembled.

[0016] Blank 800 is formed from a sheet including insulative cellular non-aromatic polymeric material as disclosed herein. In accordance with the present disclosure, the 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 820) of blank 800 to provide a plastically deformed first material segment having a first density located in a first portion of the selected region of blank 800 and a second material segment (based 838) having a second density lower than the first density located in an adjacent second portion of the selected region blank 800 without fracturing the insulative cellular non-aromatic polymeric material so that a predetermined insulative characteristic is maintained in container 810.

[0017] Blank 800 is formed from a sheet including insulative cellular non-aromatic polymeric material and a skin coupled to one side of the 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 insulative cellular non-aromatic polymeric material. In another example, the skin and the ink layer are laminated to the 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.

[0018] 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.

[0019] Portions (850, 852, 836, 846, 842, 838, 844, 848, 856, 854, 858, 862, 860) of blank 800 have a generally uniform first thickness (also called nominal thickness) while regions (812, 814, 816, 818, 820, 822, 824, 826, 830, 832, 834) each have a second thickness. The second thickness, through plastic deformation, is about 50% of the generally uniform first thickness. In one illustrative example, front wall 836 is folded about connecting web 820 relative to base 838 during an illustrative container-forming process.

[0020] Blanks may be used to form other containers in accordance with the present disclosure. Disclosure of other containers formed using blanks may be found in U.S. Patent Application No. 13/491,007 and is incorporated by reference in its entirety herein. One suitable container-manufacturing process that makes blanks and containers is disclosed in U.S. Patent Application no. 13/526,444 and is incorporated

by reference in its entirety herein. Another process for forming blanks is disclosed in U.S. Patent Application No. 61/737,222 which is incorporated by reference in its entirety.

[0021] 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.

[0022] 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.

[0023] 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).

[0024] 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).

[0025] 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

[0026] Other polypropylene polymers having suitable melt strength, branching, and melting temperature may also be used. Several base resins may be used and mixed together.

[0027] 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.

[0028] 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.

[0029] 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, CaCO_3 , 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.

[0030] 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.

[0031] 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.

[0032] 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.

[0033] 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.

[0034] 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.

[0035] 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.

[0036] 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.

[0037] The polymer resins may be blended with any additional desired components and melted to form a resin formulation mixture.

[0038] The following numbered clauses include embodiments that are contemplated and non-limiting:

[0039] Clause 1. A blank for a container comprising

[0040] a base including at least a first edge, a second edge spaced apart from the first edge, a third edge, and a fourth edge spaced apart from the third edge,

[0041] a first side wall coupled to the base along the first edge,

[0042] a second side wall coupled to the base along the second edge,

[0043] a front wall couple to the base along the third edge, and

[0044] a back wall coupled to the base along the fourth edge,

[0045] wherein the blank is made from a sheet of insulative cellular non-aromatic polymeric material.

[0046] Clause 2. The blank of claim 1, wherein each of the first side wall, the second side wall, the front wall, and the back wall all have a first thickness and separated from the base by a respective region that has a second thickness that is less than the first thickness.

[0047] Clause 3. The blank of claim 2, further comprising first and second flaps positioned at side edges of the front wall, the first flap being separated from the front wall by an area having the second thickness, and the second flap being separated from the front wall by an area having the second thickness.

[0048] Clause 4. The blank of claim 2, further comprising a flap at an outboard edge of the first side wall, the flap being separated from the first side wall by an area having the second thickness.

[0049] Clause 5. The blank of claim 2, further comprising a flap at an outboard edge of the second side wall, the flap being separated from the first side wall by an area having the second thickness.

[0050] Clause 6. The blank of claim 2, further comprising first and second flaps positioned at side edges of the back wall, the first flap being separated from the back wall by an area having the second thickness, and the second flap being separated from the back wall by an area having the second thickness.

[0051] Clause 7. The blank of claim 2, wherein each of the first side wall, the second side wall, the front wall, and the back wall all have a first thickness and the blank further comprises a cover coupled to the back wall at an outboard edge of the cover, the cover separated from the back wall by an area having a second thickness, and the second thickness is less than the first thickness.

[0052] Clause 8. The blank of claim 1, wherein each of the first side wall, the second side wall, the front wall, and the back wall all have a first thickness and the blank further comprises first and second flaps positioned at side edges of the front wall, the first flap being separated from the front wall by an area having the second thickness and the second flap being separated from the front wall by an area having the second thickness.

[0053] Clause 9. The blank of claim 8, further comprising a flap at an outboard edge of the first side wall, the flap being separated from the first side wall by an area having the second thickness.

[0054] Clause 10. The blank of claim 8, further comprising a flap at an outboard edge of the second side wall, the flap being separated from the first side wall by an area having the second thickness.

[0055] Clause 11. The blank of claim 8, further comprising first and second flaps positioned at side edges of the back wall, the first flap being separated from the back wall by an area having the second thickness and the second flap being separated from the back wall by an area having the second thickness.

[0056] Clause 12. The blank of claim 8, further comprising a cover coupled to the back wall at an outboard edge of the cover, the cover separated from the back wall by an area having the second thickness.

[0057] Clause 13. The blank of claim 1, wherein each of the first side wall, the second side wall, the front wall, and the back wall all have a first thickness and the blank further comprises a flap at an outboard edge of the first side wall, the flap being separated from the first side wall by an area having a second thickness, and the second thickness being less than the first thickness.

[0058] Clause 14. The blank of claim 13, further comprising a flap at an outboard edge of the second side wall, the flap being separated from the first side wall by an area having the second thickness.

[0059] Clause 15. The blank of claim 13, further comprising first and second flaps positioned at side edges of the back wall, the first flap being separated from the back wall by an area the second thickness and the second flap being separated from the back wall by an area having the second thickness.

[0060] Clause 16. The blank of claim 13, further comprising a cover coupled to the back wall at an outboard edge of the cover, the cover having the first thickness, and the cover being separated from the back wall by an area having the second thickness.

[0061] Clause 17. The blank of claim 1, wherein each of the first side wall, the second side wall, the front wall, and the back wall all have a first thickness and the blank further comprises a flap at an outboard edge of the second side wall, the

flap being separated from the first side wall by an area having a second thickness, and the second thickness is less than the first thickness.

[0062] Clause 18. The blank of claim 17, further comprising first and second flaps positioned at side edges of the back wall, the first flap being separated from the back wall by an area having the second thickness and the second flap being separated from the back wall by an area having the second thickness.

[0063] Clause 19. The blank of claim 17, further comprising a cover coupled to the back wall at an outboard edge of the cover, the cover separated from the back wall by an area having the second thickness.

[0064] Clause 20. The blank of claim 1, wherein each of the first side wall, the second side wall, the front wall, and the back wall all have a first thickness and the blank further comprises first and second flaps positioned at side edges of the back wall, the first flap being separated from the back wall by an area having a second thickness, the second flap being separated from the back wall by an area having the second thickness, and the second thickness is less than the first thickness.

[0065] Clause 21. The blank of claim 20, further comprising a cover coupled to the back wall at an outboard edge of the cover, the cover separated from the back wall by an area having the second thickness.

[0066] Clause 22. The blank of claim 1, wherein each of the first side wall, the second side wall, the front wall, and the back wall all have a first thickness and the blank further comprises a cover coupled to the back wall at an outboard edge of the cover, the cover separated from the back wall by an area having the second thickness, and the second thickness is less than the first thickness.

[0067] Clause 23. The blank of claim 22, further comprising a flap at an outboard edge of the cover, the flap being separated from the cover by an area having the second thickness.

[0068] Clause 24. The blank of claim 1, wherein each of the first side wall, the second side wall, the front wall, and the back wall all have a first thickness and the blank further comprises first and second flaps positioned at side edges of the front wall, the first flap being separated from the front wall by an area having a second thickness and the second flap being separated from the front wall by an area having the second thickness, a third flap at an outboard edge of the first side wall, the flap being separated from the first side wall by an area having the second thickness, a

fourth flap at an outboard edge of the second side wall, the flap being separated from the first side wall by an area having the second thickness, a cover coupled to the back wall at an outboard edge of the cover, the cover separated from the back wall by an area having the second thickness, fifth and sixth flaps positioned at side edges of the back wall, the fifth flap being separated from the back wall by an area having the second thickness and the sixth flap being separated from the back wall by an area having the second thickness, a seventh flap at an outboard edge of the cover, the flap being separated from the cover by an area having the second thickness, wherein the second thickness is less than the first thickness.

[0069] Clause 25. The blank of claim 24, wherein each area having the second thickness provides relief for folding one member of the blank relative to another member of the blank.

[0070] Clause 26. The blank of claim 25, wherein the sheet has a generally uniform first thickness.

[0071] Clause 27. The blank of claim 26, wherein each area having the second thickness is reduced to about 50% of the generally uniform first thickness.

[0072] Clause 28. The blank of claim 26, wherein each area having the second thickness is plastically deformed.

[0073] Clause 29. The blank of claim 26, wherein each area having the second thickness is deformed to take a permanent set.

[0074] Clause 30. The blank of claim 26, wherein each area having the second thickness comprises a localized area of higher density.

[0075] Clause 31. The blank of claim 26, wherein cells of the insulative cellular non-aromatic polymeric material remain unbroken in the areas having the second thickness.

[0076] Clause 32. The blank of claim 1, wherein the sheet has a generally uniform first thickness.

[0077] Clause 33. The blank of claim 32, wherein at least one of the first side wall, the second side wall, the front wall, and the back wall are coupled to the base by an area having a second thickness and the second thickness is about 50% of the generally uniform first thickness.

[0078] Clause 34. The blank of claim 32, wherein each area having the second thickness is plastically deformed.

[0079] Clause 35. The blank of claim 32, wherein each area having the second thickness is deformed to take a permanent set.

[0080] Clause 36. The blank of claim 32, wherein each area having the second thickness comprises a localized area of higher density.

[0081] Clause 37. The blank of claim 32, wherein cells of the insulative cellular non-aromatic polymeric material remain unbroken in each area having the second thickness.

[0082] Clause 38. The blank of claim 1, wherein the insulative cellular non-aromatic polymeric material includes a base resin having a high melt strength, a polypropylene copolymer, and a cell forming agent.

[0083] Clause 39. The blank of claim 38, wherein the insulative cellular non-aromatic polymeric material further includes a homopolymer resin.

[0084] Clause 40. The blank of claim 38, wherein the base resin comprises broadly distributed molecular weight polypropylene.

[0085] Clause 41. The blank of claim 40, wherein the broadly distributed molecular weight polypropylene is characterized by a molecular weight distribution that is unimodal.

EXAMPLES

[0086] 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

[0087] 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 Hyrocero TM CF-40E TM
0.5%	Nucleation Agent: Heritage Plastics HT4HP Talc
1%	Colorant: Colortech 11933-19 TiO ₂ PP
2%	Slip agent: Ampacet TM 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

[0088] Density of the strip formed ranged from about 0.140 g/cm³ to about 0.180 g/cm³.

[0089] 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.

[0090] 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

[0091] DAPLOYTM 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: HydroceroTM CF-40ETM as a primary nucleation agent, HPR-803i fibers (available from Milliken) as a secondary nucleation agent, CO₂ as a blowing agent, AmpacetTM 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

[0092] 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

[0093] 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 for a container comprising
a base including at least a first edge, a second edge spaced apart from the first edge, a third edge, and a fourth edge spaced apart from the third edge,
a first side wall coupled to the base along the first edge,
a second side wall coupled to the base along the second edge,
a front wall couple to the base along the third edge, and
a back wall coupled to the base along the fourth edge,
wherein the blank is made from a sheet of insulative cellular non-aromatic polymeric material.
2. The blank of claim 1, wherein each of the first side wall, the second side wall, the front wall, and the back wall all have a first thickness and separated from the base by a respective region that has a second thickness that is less than the first thickness.
3. The blank of claim 2, further comprising first and second flaps positioned at side edges of the front wall, the first flap being separated from the front wall by an area having the second thickness, and the second flap being separated from the front wall by an area having the second thickness.
4. The blank of claim 2, further comprising a flap at an outboard edge of the first side wall, the flap being separated from the first side wall by an area having the second thickness.
5. The blank of claim 2, further comprising a flap at an outboard edge of the second side wall, the flap being separated from the first side wall by an area having the second thickness.
6. The blank of claim 2, further comprising first and second flaps positioned at side edges of the back wall, the first flap being separated from the back wall by an area having the second thickness, and the second flap being separated from the back wall by an area having the second thickness.
7. The blank of claim 2, wherein each of the first side wall, the second side wall, the front wall, and the back wall all have a first thickness and the blank further comprises a cover coupled to the back wall at an outboard edge of the cover, the cover separated from the back wall by an area having a second thickness, and the second thickness is less than the first thickness.

8. The blank of claim 1, wherein each of the first side wall, the second side wall, the front wall, and the back wall all have a first thickness and the blank further comprises first and second flaps positioned at side edges of the front wall, the first flap being separated from the front wall by an area having the second thickness and the second flap being separated from the front wall by an area having the second thickness.

9. The blank of claim 8, further comprising a flap at an outboard edge of the first side wall, the flap being separated from the first side wall by an area having the second thickness.

10. The blank of claim 8, further comprising a flap at an outboard edge of the second side wall, the flap being separated from the first side wall by an area having the second thickness.

11. The blank of claim 8, further comprising first and second flaps positioned at side edges of the back wall, the first flap being separated from the back wall by an area having the second thickness and the second flap being separated from the back wall by an area having the second thickness.

12. The blank of claim 8, further comprising a cover coupled to the back wall at an outboard edge of the cover, the cover separated from the back wall by an area having the second thickness.

13. The blank of claim 1, wherein each of the first side wall, the second side wall, the front wall, and the back wall all have a first thickness and the blank further comprises a flap at an outboard edge of the first side wall, the flap being separated from the first side wall by an area having a second thickness, and the second thickness being less than the first thickness.

14. The blank of claim 13, further comprising a flap at an outboard edge of the second side wall, the flap being separated from the first side wall by an area having the second thickness.

15. The blank of claim 13, further comprising first and second flaps positioned at side edges of the back wall, the first flap being separated from the back wall by an area the second thickness and the second flap being separated from the back wall by an area having the second thickness.

16. The blank of claim 13, further comprising a cover coupled to the back wall at an outboard edge of the cover, the cover having the first thickness,

and the cover being separated from the back wall by an area having the second thickness.

17. The blank of claim 1, wherein each of the first side wall, the second side wall, the front wall, and the back wall all have a first thickness and the blank further comprises a flap at an outboard edge of the second side wall, the flap being separated from the first side wall by an area having a second thickness, and the second thickness is less than the first thickness.

18. The blank of claim 17, further comprising first and second flaps positioned at side edges of the back wall, the first flap being separated from the back wall by an area having the second thickness and the second flap being separated from the back wall by an area having the second thickness.

19. The blank of claim 17, further comprising a cover coupled to the back wall at an outboard edge of the cover, the cover separated from the back wall by an area having the second thickness.

20. The blank of claim 1, wherein each of the first side wall, the second side wall, the front wall, and the back wall all have a first thickness and the blank further comprises first and second flaps positioned at side edges of the back wall, the first flap being separated from the back wall by an area having a second thickness, the second flap being separated from the back wall by an area having the second thickness, and the second thickness is less than the first thickness.

21. The blank of claim 20, further comprising a cover coupled to the back wall at an outboard edge of the cover, the cover separated from the back wall by an area having the second thickness.

22. The blank of claim 1, wherein each of the first side wall, the second side wall, the front wall, and the back wall all have a first thickness and the blank further comprises a cover coupled to the back wall at an outboard edge of the cover, the cover separated from the back wall by an area having the second thickness, and the second thickness is less than the first thickness.

23. The blank of claim 22, further comprising a flap at an outboard edge of the cover, the flap being separated from the cover by an area having the second thickness.

24. The blank of claim 1, wherein each of the first side wall, the second side wall, the front wall, and the back wall all have a first thickness and the

blank further comprises first and second flaps positioned at side edges of the front wall, the first flap being separated from the front wall by an area having a second thickness and the second flap being separated from the front wall by an area having the second thickness, a third flap at an outboard edge of the first side wall, the flap being separated from the first side wall by an area having the second thickness, a fourth flap at an outboard edge of the second side wall, the flap being separated from the first side wall by an area having the second thickness, a cover coupled to the back wall at an outboard edge of the cover, the cover separated from the back wall by an area having the second thickness, fifth and sixth flaps positioned at side edges of the back wall, the fifth flap being separated from the back wall by an area having the second thickness and the sixth flap being separated from the back wall by an area having the second thickness, a seventh flap at an outboard edge of the cover, the flap being separated from the cover by an area having the second thickness, wherein the second thickness is less than the first thickness.

25. The blank of claim 24, wherein each area having the second thickness provides relief for folding one member of the blank relative to another member of the blank.

26. The blank of claim 25, wherein the sheet has a generally uniform first thickness.

27. The blank of claim 26, wherein each area having the second thickness is reduced to about 50% of the generally uniform first thickness.

28. The blank of claim 26, wherein each area having the second thickness is plastically deformed.

29. The blank of claim 26, wherein each area having the second thickness is deformed to take a permanent set.

30. The blank of claim 26, wherein each area having the second thickness comprises a localized area of higher density.

31. The blank of claim 26, wherein cells of the insulative cellular non-aromatic polymeric material remain unbroken in the areas having the second thickness.

32. The blank of claim 1, wherein the sheet has a generally uniform first thickness.

33. The blank of claim 32, wherein at least one of the first side wall, the second side wall, the front wall, and the back wall are coupled to the base by an area having a second thickness and the second thickness is about 50% of the generally uniform first thickness.

34. The blank of claim 32, wherein each area having the second thickness is plastically deformed.

35. The blank of claim 32, wherein each area having the second thickness is deformed to take a permanent set.

36. The blank of claim 32, wherein each area having the second thickness comprises a localized area of higher density.

37. The blank of claim 32, wherein cells of the insulative cellular non-aromatic polymeric material remain unbroken in each area having the second thickness.

38. The blank of claim 1, wherein the insulative cellular non-aromatic polymeric material includes a base resin having a high melt strength, a polypropylene copolymer, and a cell forming agent.

39. The blank of claim 38, wherein the insulative cellular non-aromatic polymeric material further includes a homopolymer resin.

40. The blank of claim 38, wherein the base resin comprises broadly distributed molecular weight polypropylene.

41. The blank of claim 40, wherein the broadly distributed molecular weight polypropylene is characterized by a molecular weight distribution that is unimodal.