SECOND PROVISIONAL PATENT APPLICATION

of

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EXPANDED POLYPROPYLENE MATERIAL FOR AN INSULATED CONTAINER

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EXPANDED POLYPROPYLENE MATERIAL FOR AN INSULATED CONTAINER

BACKGROUND

[0001] The present disclosure relates to a polypropylene material which can be manufactured into containers, and in particular to insulated containers, such as cups, for containing hot or cold beverages or food. More particularly, in one embodiment the present disclosure relates to an expanded polypropylene material.

SUMMARY

[0002] One aspect of the present disclosure provides an expanded polypropylene material having predominately closed cells. The sheet can be formed into a cup or other container. For convenience, a cup may be referred to illustratively herein, and the term is intended to broadly include conventional cups, bottles, tubs, bowls, and other containers and structures.

[0003] One aspect of the present disclosure provides a composition for forming a foamed sheet, comprising (a) a first material comprising at least one high melt strength polypropylene polymer; (b) a second material comprising at least one polypropylene polymer selected from the group consisting of impact copolymers and high crystalline homopolymers; (c) at least one nucleating agent selected from the group consisting of chemical nucleating agents, physical nucleating agents and combinations thereof; (d) a slip agent; and, (e) an inert gas.

[0004] One aspect of the present disclosure provides a composition for forming a foamed sheet, comprising (a) a first material comprising a polylactic acid; (b) at least one nucleating agent selected from the group consisting of chemical nucleating agents, physical nucleating agents and combinations thereof; (c) at least one slip agent; and, (d) at least one gas.

[0005] One aspect of the present disclosure provides a foamed sheet material formed by a process, comprising (a) providing a first material comprising at least one high melt strength polypropylene polymer; (b) providing a second material comprising at

least one polypropylene polymer selected from the group consisting of impact copolymers and high crystalline homopolymers; (c) mixing the first and second material to form a resin mixture; (d) adding to the resin mixture at least one nucleating agent selected from the group consisting of chemical nucleating agents, physical nucleating agents and combinations thereof; (e) adding to the resin mixture a slip agent; (f) adding to the resin mixture an inert gas; (g) expanding the resin mixture to form a foamed mixture having cells therein; and, (h) forming a sheet of the foamed mixture.

[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 DESCRIPTION OF THE DRAWINGS

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

[0008] Fig. 1 is a perspective view of an insulated cup formed of a material in accordance with the present disclosure showing a cup including a body formed to include an interior region, a rolled brim coupled to a top portion of a side wall included in the body, and a floor having an integrated support flange coupled to a bottom portion of the side wall;

[0009] Fig. 2 is a partial sectional view taken along line 3-3 of Fig. 1 showing the rolled brim coupled to the top portion of the side wall;

[0010] Fig. 3 is a sectional view taken along line 3-3 of Fig. 1 showing that the side wall included in the body of the insulated cup includes a generally uniform thickness and showing that the floor is coupled to the cup side wall which has been folded under the cup so that the floor is suspended above the bottom portion of the side wall;

[0011] Fig. 4 is an exploded assembly view of the insulated cup of Fig. 1 showing the insulated cup includes a body including the rolled brim, the side wall, and the floor;

[0012] Fig. 5 is a top plan view of a brim of a cup formed according to one exemplary embodiment of the present disclosure;

[0013] Fig. 6 is a detailed view of a portion of side wall of a cup of Fig. 5 showing two compressed portions which overlap when bonded; and

[0014] Fig. 7 is a detailed view of a portion of a side wall according to one exemplary embodiment of the present disclosure showing one compressed portion.

[0015] Fig. 8 is a graph of insulation temperature test results.

DETAILED DESCRIPTION

[0016] One exemplary embodiment of the present disclosure provides an expanded polypropylene material. The material may be made of a single resin or may be comprise a base resin and a secondary resin. It is also possible to use more than two resins.

[0017] One exemplary embodiment provides a two-resin material system. The base resin may be a polypropylene resin, such as, but not limited to, a high melt strength polypropylene. Polypropylene resins which are generally considered high melt strength resins that have a high molecular branched structure (typically an altered base resin resulting in a branched structure). Suitable resins can hold the gas, produce desirable cell size, have a satisfactory smooth surface finish, have an acceptable odor level, and have sufficient long chain branching 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 using the Borealis test method), melting temperature = 163°C [using ISO 11357]).

Borealis DAPLOY properties:

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	60	°C	ISO 75-2
Heat Deflection Temperature	110	°C	ISO 75-2

[0018] Other polypropylene polymers having similar structure, melt strength, and melting temperature to the above may also be used.

[0019] Other possible high melt strength base resins include, but are not limited to, high melt strength homopolymers available from Total Petrochemicals USA under the trade name 3354 and N11106. In one exemplary embodiment with either of these resins one can incorporate additives to retain and/or improve resin properties, including but not limited to zinc stearate (ZnSt) and calcium stearate (CaSt). Other base resins may include high melt strength homopolymers available from LyndellBasell Industries Holdings, B.V., available as X11844-30-1 and X11844-35-1. It is possible to use a resin stabilizer named X11844-34-1, also available from LyndellBasell Industries Holdings, B.V., to be used with both resins.

[0020] The secondary resin may be, for example, a high crystalline polypropylene homopolymer or an impact copolymer. One illustrative example is a polymer commercially available as PRO-FAX SC204™ (available from LyndellBasell Industries Holdings, B.V.).

[0021] Other possible secondary resins include impact copolymers and high crystalline homopolymers. Examples include, but are not limited to, Homo PP - INSPIRE

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