HIGH TRANSMISSION GLASSES

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of priority under 35 U.S.C. § 119 of U.S. Provisional Application Serial No. 62/479497 filed on March 31, 2017, the content of which is relied upon and incorporated herein by reference in its entirety.

BACKGROUND

[0002] Side lit back light units include a light guide plate (LGP) that is usually made of high transmission plastic materials such as polymethylmethacrylate (PMMA). Although such plastic materials present excellent properties such as light transmission, these materials exhibit relatively poor mechanical properties such as rigidity, coefficient of thermal expansion (CTE) and moisture absorption.

[0003] Accordingly, it would be desirable to provide an improved light guide plate having attributes that achieve an improved optical performance in terms of light transmission, solarization, scattering and light coupling as well as exhibiting exceptional mechanical performance in terms of rigidity, CTE, and moisture absorption.

SUMMARY

[0004] Examples of the subject matter pertain to compounds, compositions, articles, devices, and methods for the manufacture of light guide plates and back light units including such light guide plates made from glass. In some examples, light guide plates (LGPs) are provided that have similar or superior optical properties to light guide plates made from PMMA and that have exceptional mechanical properties such as rigidity, CTE and dimensional stability in high moisture conditions as compared to PMMA light guide plates.

[0005] Principles and examples of the present subject matter relate in some examples to a light guide plate for use in a backlight unit. In some examples the glass article or light guide plate (in some examples) can comprise a glass sheet with a front face having a width and a height, a back face opposite the front face, and a thickness between the front face and back face, forming four edges around the front and back faces, wherein the glass sheet comprises between about 70 mol % to about 85 mol% SiO_2, between about 0 mol% to about 5 mol% Al_2O_3, between about 0 mol% to about 5 mol% B_2O_3, between about 0 mol% to about 10 mol% Na_2O, between about 0 mol% to about 12 mol% K_2O, between

about 0 mol% to about 4 mol% ZnO, between about 3 mol% to about 12 mol% MgO, between about 0 mol% to about 5 mol% CaO, between about 0 mol% to about 3 mol% SrO, between about 0 mol% to about 3 mol% BaO, and between about 0.01 mol% to about 0.5 mol% SnO_2.

[0005a] In one aspect, the present disclosure relates to a glass article comprising a glass sheet with a front face having a width and a height, a back face opposite the front face, and a thickness between the front face and back face, forming four edges around the front and back faces, wherein the glass sheet comprises between about 70 mol % to about 85 mol% SiO_2, between about 0 mol% to about 5 mol% Al_2O_3, between about 0 mol% to about 5 mol% B_2O_3, between about 0 mol% to about 10 mol% Na_2O, between about 0 mol% to about 12 mol% K_2O, between about 0 mol% to about 4 mol% ZnO, between about 3 mol% to about 12 mol% MgO, between about 0 mol% to about 5 mol% CaO, between about 0 mol% to about 3 mol% SrO, between about 0 mol% to about 3 mol% BaO, and between about 0.01 mol% to about 0.5 mol% SnO_2.

[0006] In another aspect, the present disclosure relates to a glass article comprising a glass sheet with a front face having a width and a height, a back face opposite the front face, and a thickness between the front face and back face forming four edges around the front and back faces, wherein the glass sheet comprises greater than about 80 mol % SiO_2, between about 0 mol% to about 0.5 mol% Al_2O_3, between about 0 mol% to about 0.5 mol% B_2O_3, between about 0 mol% to about 0.5 mol% Na_2O, between about 8 mol% to about 11 mol% K_2O, between about 0.01 mol% to about 4 mol% ZnO, between about 6 mol% to about 10 mol% MgO, between about 0 mol% to about 0.5 mol% CaO, between about 0 mol% to about 0.5 mol% SrO, between about 0 mol% to about 0.5 mol% BaO, and between about 0.01 mol% to about 0.11 mol% SnO_2.

[0007] In another aspect, the present disclosure relates to a glass article comprising a glass sheet with a front face having a width and a height, a back face opposite the front face, and a thickness between the front face and back face forming four edges around the front and back faces, wherein the glass sheet is substantially free of Al_2O_3 and B_2O_3 and comprises greater than about 80 mol % SiO_2, between about 0 mol% to about 0.5 mol% Na_2O, between about 8 mol% to about 11 mol% K_2O, between about 0.01 mol% to about 4 mol% ZnO, between about 6 mol% to about 10 mol% MgO, and between about 0.01 mol% to about 0.11 mol% SnO_2. In some examples, the glass sheet is substantially free of B_2O_3, Na_2O, CaO, SrO, or BaO, and combinations thereof.

[0008] In another aspect, the present disclosure relates to a glass article comprising a glass sheet with a front face having a width and a height, a back face opposite the front face, and a thickness between the front face and back face forming four edges around the front and back faces, wherein the glass sheet comprises an alumina free, potassium silicate composition comprising greater than about 80 mol % SiO_2, between about 8 mol% to about 11 mol% K_2O, between about 0.01 mol% to about 4 mol% ZnO, between about 6 mol% to about 10 mol% MgO, and between about 0.01 mol% to about 0.11 mol% SnO_2. In some examples, the glass sheet is substantially free of B_2O_3, Na_2O, CaO, SrO, or BaO, and combinations thereof.

[0009] In another aspect, the present disclosure relates to a glass article comprising a glass sheet with a front face having a width and a height, a back face opposite the front face, and a thickness between the front face and back face forming four edges around the front and back faces, wherein the

glass sheet comprises between about 72.82 mol % to about 82.03 mol% SiO_2, between about 0 mol% to about 4.8 mol% Al_2O_3, between about 0 mol% to about 2.77 mol% B_2O_3, between about 0 mol% to about 9.28 mol% Na_2O, between about 0.58 mol% to about 10.58 mol% K_2O, between about 0 mol% to about 2.93 mol% ZnO, between about 3.1 mol% to about 10.58 mol% MgO, between about 0 mol% to about 4.82 mol% CaO, between about 0 mol% to about 1.59 mol% SrO, between about 0 mol% to about 3 mol% BaO, and between about 0.08 mol% to about 0.15 mol% SnO_2. In further examples, the glass sheet is substantially free of Al_2O_3, B_2O_3, Na_2O, CaO, SrO, or BaO, and combinations thereof.

[00010] In another aspect, the present disclosure relates to a glass article comprising a glass sheet with a front face having a width and a height, a back face opposite the front face, and a thickness between the front face and back face forming four edges around the front and back faces, wherein the glass sheet is substantially free of Al_2O_3 and B_2O_3 and comprises greater than about 80 mol % SiO_2, and wherein the glass has a color shift < 0.005. In some examples, the glass sheet comprises between about 8 mol% to about 11 mol% K_2O, between about 0.01 mol% to about 4 mol% ZnO, between about 6 mol% to about 10 mol% MgO, and between about 0.01 mol% to about 0.11 mol% SnO_2.

[00011] In another aspect, the present disclosure relates to a glass article comprising a glass sheet with a front face having a width and a height, a back face opposite the front face, and a thickness between the front face and back face forming four edges around the front and back faces, wherein the glass sheet is substantially free of Al_2O_3, B_2O_3, Na_2O, CaO, SrO, and BaO, and wherein the glass has a color shift < 0.005. In some examples, the glass sheet comprises greater than about 80 mol % SiO_2. In some examples, the glass sheet comprises between about 8 mol% to about 11 mol% K_2O, between about 0.01 mol% to about 4 mol% ZnO, between about 6 mol% to about 10 mol% MgO, and between about 0.01 mol% to about 0.11 mol% SnO_2.

[00012] Additional features and advantages of the disclosure will be set forth in the detailed description which follows, and in part will be readily apparent to those skilled in the art from that description or recognized by practicing the methods as described herein, including the detailed description which follows, the claims, as well as the appended drawings.

[00013] It is to be understood that both the foregoing general description and the following detailed description present various examples of the disclosure, and are intended to provide an overview or framework for understanding the nature and character of

the claims. The accompanying drawings are included to provide a further understanding of the disclosure, and are incorporated into and constitute a part of this specification. The drawings illustrate various examples of the disclosure and together with the description serve to explain the principles and operations of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[00014] The following detailed description can be further understood when read in conjunction with the following drawings.

[00015] FIG. 1 is a pictorial illustration of an exemplary embodiment of a light guide plate;

[00016] FIG. 2 is a graph showing percentage light coupling versus distance between an LED and LGP edge;

[00017] FIG. 3 is a cross sectional illustration of an exemplary LCD panel with a LGP in accordance with one or more embodiments;

[00018] FIG. 4 is a cross sectional illustration of an exemplary LCD panel with a LGP according to another embodiment; and

[00019] FIG. 5 is a pictorial illustration showing an LGP with adhesion pads according to additional embodiments.

DETAILED DESCRIPTION

[00020] Described herein are light guide plates, methods of making light guide plates and backlight units utilizing light guide plates in accordance with embodiments of the present invention.

[00021] Current light guide plates used in LCD backlight applications are typically made from PMMA material since this is one of the best materials in term of optical transmission in the visible spectrum. However, PMMA presents mechanical problems that make large size (e.g., 50 inch diagonal and greater) displays challenging in term of mechanical design, such as, rigidity, moisture absorption, and coefficient of thermal expansion (CTE).

[00022] Exemplary LGPs made from glass, however, have an advantage over those made from plastics such as PMMA due to the increased rigidity, better moisture absorption, and low CTE of glass. Exemplary LGPs according to the instant disclosure can provide a