[0004] Although Type 1A and Type 1B glass compositions are commonly used in pharmaceutical packages, they do suffer from several deficiencies, including a tendency for the interior surfaces of the pharmaceutical package to shed glass particulates or "delaminate" following exposure to pharmaceutical solutions.

[0005] In addition, use of glass in pharmaceutical packaging may also be limited by the mechanical performance of the glass. Specifically, the high processing speeds utilized in the manufacture and filling of glass pharmaceutical packages may result in mechanical damage on the surface of the package, such as abrasions, as the packages come into contact with processing equipment, handling equipment, and/or other packages. This mechanical damage significantly decreases the strength of the glass pharmaceutical package resulting in an increased likelihood that cracks will develop in the glass, potentially compromising the sterility of the pharmaceutical contained in the package.

[0006] Accordingly, a need exists for alternative glass containers for use as pharmaceutical packages which have improved resistance to mechanical damage and which exhibit a reduced propensity to delaminate.

SUMMARY

[0006a] In a first aspect, there is provided a glass container comprising: a glass body having an interior surface and an exterior surface, wherein at least the interior surface of the glass body has a delamination factor of less than or equal to 10 and a threshold diffusivity of greater than about 16 $\mu m^2/hr$ at a temperature less than or equal to 450°C; wherein Al_2O_3 is present in a glass composition of the glass body in X mol.%, alkali oxides are present in the glass composition of the glass body in Y mol.%, and a ratio Y:X in the glass composition is greater than about 0.9; B_2O_3 is present in the glass composition of the glass body in an amount of less than or equal to 4 mol.%, or the glass composition is substantially free of B_2O_3; ZnO is present in the glass composition of the glass body in an amount of less than or equal to 1 mol.%, or the glass composition is substantially free of ZnO; the glass body has an interior region extending

from 10 nm below the interior surface of the glass body and into the thickness of at least about 100 nm; and the interior region has a persistent layer homogeneity such that an extrema in a layer concentration of each constituent component in the interiror region is greater than or equal to about 80% and less than or equal to about 120% of a concentration of a same constituent component at a midpoint of the thickness of the glass body; and a heat-tolerant coating bonded to at least a portion of the exterior surface of the glass body, wherein the heat-tolerant coating is thermally stable at a temperature of at least 260°C for 30 minutes; wherein the glass container is a pharmaceutical package.

[0007] According to one embodiment, a glass container may include a glass body having an interior surface and an exterior surface. At least the interior surface of the glass body may have a delamination factor of less than or equal to 10 and a threshold diffusivity of greater than about 16 $\mu m^2/hr$ at a temperature less than or equal to 450°C. A heat-tolerant coating may be bonded to at least a portion of the exterior surface of the glass body. The heat-tolerant coating may be thermally stable at a temperature of at least 260°C for 30 minutes.

[0008] In another embodiment, a glass container may include a glass body having an interior surface and an exterior surface. At least the interior surface of the glass body may have a delamination factor of less than or equal to 10 and a threshold diffusivity of greater than about 16 $\mu m^2/hr$ at a temperature less than or equal to 450°C. A heat-

CLAIMS

1. A glass container comprising:

a glass body having an interior surface and an exterior surface, wherein at least the interior surface of the glass body has a delamination factor of less than or equal to 10 and a threshold diffusivity of greater than about 16 $\mu m^2/hr$ at a temperature less than or equal to 450°C; wherein

Al_2O_3 is present in a glass composition of the glass body in X mol.%, alkali oxides are present in the glass composition of the glass body in Y mol.%, and a ratio Y:X in the glass composition is greater than about 0.9;

B_2O_3 is present in the glass composition of the glass body in an amount of less than or equal to 4 mol.%, or the glass composition is substantially free of B_2O_3;

ZnO is present in the glass composition of the glass body in an amount of less than or equal to 1 mol.%, or the glass composition is substantially free of ZnO;

the glass body has an interior region extending from 10 nm below the interior surface of the glass body and into the thickness of the glass body;

the interior region has a thickness of at least about 100 nm; and

the interior region has a persistent layer homogeneity such that an extrema in a layer concentration of each constituent component in the interior region is greater than or equal to about 80% and less than or equal to about 120% of a concentration of a same constituent component at a midpoint of the thickness of the glass body; and

a heat-tolerant coating bonded to at least a portion of the exterior surface of the glass body, wherein the heat-tolerant coating is thermally stable at a temperature of at least 260°C for 30 minutes;

wherein the glass container is a pharmaceutical package.

2. The glass container of claim 1, wherein the exterior surface of the glass body with the heat-tolerant coating has a coefficient of friction of less than about 0.7.

3. The glass container of claim 1, wherein the heat-tolerant coating has a mass loss of less than about 5% of its mass when heated from a temperature of 150°C to 350°C at a ramp rate of about 10°C/minute.

4. The glass container of claim 1, wherein the heat-tolerant coating comprises:

a coupling agent layer comprising at least one silane chemical composition; and

a low-friction layer contacting the coupling agent layer, the low friction layer comprising a polymer chemical composition.

5. The glass container of claim 1, wherein a light transmission through a coated portion of the glass container is greater than or equal to about 55% of a light transmission through an uncoated glass article for wavelengths from about 400 nm to about 700 nm.

6. The glass container of claim 1, wherein the glass body has:

at least a class S3 acid resistance according to DIN 12116;

at least a class A2 base resistance according to ISO 695; and

at least a type HgA2 hydrolytic resistance according to ISO 720.

7. The glass container of any of claims 1 through 6, wherein the glass body has a compressive stress greater than or equal to 300 MPa in at least the exterior surface of the glass body and a depth of layer of at least 30 μm.