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GLASS BOTTOM CERAMIC VESSEL

Abstract

A vessel comprises a ceramic body and a glass bottom. The glass bottom is formed of a first glass portion and a second glass portion which are fused together.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION [0001] This application claims priority to U.S. Provisional Application No. 63/551,891, filed Feb. 9, 2024, which is herein incorporated by reference in its entirety.

FIELD OF THE INVENTION

[0002] The field of the subject matter is a ceramic object or vessel, such as a mug, plate or vase, having a glass bottom.

DESCRIPTION OF RELATED ART

[0003] The field of the subject matter is a ceramic object or vessel, such as a mug, plate or vase, having a glass bottom. Tableware or dishware such as plates, bowls, mugs, cups and saucers are vessels designed to hold food or liquid without leaking. They can be formed from a variety of materials including ceramic, or clay hardened by heat (i.e. fire). Tableware must be functional. It should be able to hold food or liquid without leaking and be food safe. In some situations, it may also be desirable that such vessels are visually appealing.

[0004] Other vessels, such as vases and coasters may also be formed from ceramic. It may also be desirable that these items and others, such as suncatchers, be functional while also be visually appealing.

[0005] It is desirable to incorporate glass into ceramic vessels. However, the expansion rates and melting points of glass and ceramic typically differ, making them generally incompatible. Further, one way to combine ceramics and glass is in the cold state with the use of adhesives. However, these adhesives are seldom durable and food safe. A new method of incorporating glass into ceramic is needed.

SUMMARY OF THE INVENTION

[0006] These and other needs are addressed by the various aspects, embodiments, and configurations of the present disclosure.

[0007] In Example 1, a vessel includes a ceramic body having a top edge, a bottom edge, a wall extending from the top edge to the bottom edge to form an enclosed space and a floor extending inward from an inside surface of the wall, the floor having an inner surface, an outer surface and a vertical surface that defined an opening in the ceramic body; and a glass bottom covering the opening, the glass bottom formed of a first portion and a second portion which are fused together, wherein the first portion has a first top surface and a first bottom surface and the second portion has a second top surface and a second bottom surface; the first bottom surface of the first portion is in contact with at least a portion of the inner surface of the floor and at least a portion of the second top surface of the second portion; the second top surface of the second portion is in contact with at least a portion of the first bottom surface of the first portion and at least a portion of the outer surface of the floor.

[0008] In Example 2, the vessel of Example 1 wherein at least a portion of the inner surface of the floor which is in contact with the first glass portion and at least a portion of the outer surface of the floor which is in contact with the second glass portion include at least one glaze.

[0009] In Example 3, the vessel of Example 1 wherein the vessel is watertight.

[0010] In Example 4, The vessel of Example 1 wherein the ceramic body is cylindrical.

[0011] In Example 5, the vessel of vessel of Example 4 wherein the opening is circular.

[0012] In Example 6, the vessel of Example 5 wherein the floor includes one or more supports and the first portion and the second portion are in contact with the one or more supports.

[0013] In Example 7, the vessel of Example 6 wherein a diameter of the first portion is larger than a diameter of the opening, and wherein the diameter of the second portion is larger than the diameter of the first portion.

[0014] In Example 8, the vessel of Example 6 wherein the support forms a notch.

[0015] In Example 9, the vessel of Example 6 wherein the vessel includes two or more supports extend radially inward from the floor towards the opening and wherein the supports do not extend an entire perimeter of the opening.

[0016] In Example 10, the vessel of Example 1 wherein the bottom surface of the second portion is laterally upwards from the bottom edge.

[0017] In Example 11, the vessel of Example 1 wherein the inner surface of the floor and the top surface of the first portion form a flat or substantially flat surface.
[0018] In Example 12, the vessel of Example 1 wherein the vessel is a drinking vessel.
[0019] In Example 13, the vessel of Example 1 wherein the vessel is a mug.
[0020] In Example 14, the vessel of Example 1 wherein the glass bottom further comprises a third glass portion positioned between the first glass portion and the second glass portion, the first glass portion, second glass portion and third glass portion fused together.
[0021] In Example 15, the vessel of Example 1 and further comprising a sealant contacting the ceramic body and the glass bottom.
[0022] In Example 16, a method of forming a glass bottom vessel includes positioning a first glass portion in contact with at least a portion of an inner surface of a floor extending inward from an inside surface of a wall of a ceramic body and over an opening formed in a bottom of the ceramic body; positioning a second glass portion in contact with at least a portion of an outer surface of the floor; and fusing the first glass portion to the second glass portion to sandwich the floor between the first glass portion and the second glass portion.
[0023] In Example 17, a method of Example 16 wherein the step of positioning the first glass portion includes position the first glass portion in a notch.
[0024] In Example 18, the method of Example 16 wherein the step of positioning the second glass portion includes elevating the second glass portion so that an outer surface of the second glass surface is laterally upwards from a bottom edge of the ceramic body.
[0025] In Example 19, the method of Example 16 wherein the ceramic body has been glaze fired before the step of positioning the first glass portion.
[0026] In Example 20, the method of Example 16 wherein the outer surface and the inner surface have a glaze.
[0027] In Example 21, the method of Example 16 wherein the vessel is cylindrical and the opening has a circular cross-sectional shape.
[0028] In Example 22, the method of Example 16 wherein the vessel is a drinking vessel for human use.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0029] The accompanying drawings are incorporated into and form a part of the specification to illustrate several examples of the present disclosure. These drawings, together with the description, explain the principles of the disclosure. The drawings simply illustrate preferred and alternative examples of how the disclosure can be made and used and are not to be construed as limiting the disclosure to only the illustrated and described examples. The drawings may not be to scale. Further features and advantages will become apparent from the following, more detailed, description of the various aspects, embodiments, and configurations of the disclosure, as illustrated by the drawings referenced below.
[0030] FIG. **1** is a schematic cross-sectional view illustrating an exemplary glass bottom vessel.
[0031] FIG. **2** is a schematic top view illustrating the exemplary glass bottom vessel of FIG. **1**.
[0032] FIG. **3** is a schematic cross-sectional, exploded view illustrating the exemplary glass bottom vessel of FIG. **1** prior to glass fusing.
[0033] FIG. **4** is a flow diagram of an exemplary process to form a glass bottom vessel.
[0034] FIG. **5** is a schematic cross-sectional view illustrating an alternative exemplary glass bottom vessel.
[0035] FIG. **6** is a schematic top view illustrating the glass bottom vessel of FIG. **5**.
[0036] FIG. **7** is a schematic cross-sectional view illustrating an alternative exemplary glass bottom

vessel.
[0037] FIG. **8** is a schematic top view illustrating the exemplary glass bottom vessel of FIG. **7**.
[0038] FIG. **9** is a schematic cross-sectional, exploded view illustrating the exemplary glass bottom vessel of FIG. **7** prior to glass fusing.
[0039] FIG. **10** is a schematic cross-sectional view illustrating a still further alternative exemplary glass bottom vessel.
DETAILED DESCRIPTION
[0040] The present disclosure provides a new, visually appealing vessel with a glass portion, such as a glass bottom. The glass bottom can form part of a leak-proof or water tight bottom. In some embodiments, the vessel is capable of holding food and/or liquid without leaking. FIG. **1** is a schematic cross-sectional view and FIG. **2** is a top view of glass bottom vessel **2**, which has ceramic body **4** and glass bottom **6**. Glass bottom **6** is connected to and forms a sealed bottom on ceramic body **4** such that glass bottom vessel **2** can hold food and/or liquid without leaking. In one embodiment, glass bottom vessel **2** is a drinking vessel, such as a mug which can hold a beverage for consumption by the user.
[0041] Ceramic body **4** includes lip **8**, recessed foot **10** (having bottom edge **11**), wall **30** (having inner surface **12**, outer surface **14**), and interior floor **15** (having support shelf **16**.) Ceramic body **4** is formed from ceramic, which is clay hardened by heat. In some embodiments, ceramic body **4** can be cylindrical or substantially cylindrical. In other embodiments, ceramic body **4** can have any cross-sectional shape and glass bottom **6** can have substantially the same cross-sectional shape or can have different cross-sectional shapes. Lip **8** is located at the top of ceramic body **4** and is opposite recessed foot **10**. Wall **30** extends between lip **8** and bottom edge **11** of recessed foot **10** and forms an enclosed space. As shown in FIG. **1**, this enclosed space can be generally cylindrical or tubular. When ceramic body **4** is a mug as illustrated in FIG. **1**, lip **8** is the mouth or drinking surface. Bottom edge **11** of recessed foot **10** is a flat surface for resting the ceramic body **4** on a surface, such as a table.
[0042] A glaze may be on all or substantially all surfaces of ceramic body **4**. For example, in some embodiments, the glaze may be present on all surfaces except bottom edge **11**. For example, the glaze may be present on outer surface **14**, inner surface **12**, interior floor **15**, and inner surface **34** and outer surface **36** of support shelf **16**. In some embodiments, the glaze is not present on vertical surface **38** so that the glaze is not positioned between first disk **18** and second disk **24**. In some embodiments, glaze **32** may be formed from one or more separate or different glazes. For example, a first glaze may be used on outer surface **14** and a second (different) glaze may be used on inner surface **12**.
[0043] Ceramic body **4** is formed with a hole or opening in the bottom (interior floor **15**). As such, ceramic body **4** cannot hold liquid and is not a leakproof vessel. However, glass bottom **6** together with ceramic body **4** may form a leakproof vessel. As shown in FIG. **1**, the opening in the bottom of ceramic body **4** is defined by vertical surface **38** of support shelf **16** (i.e., the inner diameter of support shelf **16** and floor **15**.)
[0044] The floor of ceramic body **4** has a stepped configuration, with floor **15** being vertically upward or above support shelf **16** and support shelf **16** extending radially inward from the vertical edge of floor **15**. Support shelf **16** extends radially inward or towards the center of ceramic body **4** from inner surface **12**. It is located vertically downward from lip **8** and vertically upward from recessed foot **10**. Support shelf **16** can have inner surface **34**, outer surface **36** and vertical surface **38**. Vertical surface **38** of support shelf **16** defines the opening in the bottom of ceramic body **4**. Glaze **32** can be present on inner surface **34**, outer surface **36** and vertical surface **38** of support shelf **16**. In some embodiments, glaze **32** may only be present on inner surface **34** and outer surface **36** such that glass from glaze **32** is not introduced between first disk **18** and second disk **24**.
[0045] In FIG. **1** and FIG. **2**, support shelf **16** is a single, continuous support that extends the entire perimeter of inner surface **12**. In other embodiments, support shelf **16** may include gaps such that

shelf does not extend continuously about the entire perimeter of the inner surface. In this way, support shelf **16** may be formed of two or more portions.

[0046] Glass bottom **6** includes first or inner disk or portion **18**, which has top or inner surface **20** and bottom surface **22** (shown in FIG. **3**) and second or outer disk or portion **24**, which has top surface **26** (shown in FIG. **3**) and bottom surface **28**. First disk **18** is positioned on top of second disk **24**. Inner surface **20** of first disk **18** forms the bottom inside surface of glass bottom vessel **2**, and bottom surface **28** of second disk **24** forms a portion of the bottom outside surface of glass bottom vessel **2**. Top surface **20** and interior floor **15** can form a flat or substantially flat bottom surface inside glass bottom vessel **2**. As used herein, the term substantially means within 0.5%, 1.0%, 2.0% or 5.0%. For example, substantially flat can describe a surface or object that is mostly, but not necessarily perfectly, level or even. It implies that the surface is generally flat with only minor deviations or irregularities that do not significantly affect its overall flatness. In some embodiments, the levelness of the surface may deviate by not more than 0.5%, 1.0%, 2.0% or 5.0%

[0047] First disk **18** and second disk **24** are formed from glass. Suitable glass includes various types of cold glass, such as artisanal glass. In one example, first disk **18** and second disk **24** are formed from glass having a COE of about 96. The glass of first disk **18** and second disk **24** can be transparent, semi-transparent or opaque. First disk **18** and second disk **24** can be level or flat. First disk **18** and second disk **24** can have a consistent thickness across the width or diameter of the disk. In some embodiments, the first disk **18** and second disk **24** have the same thickness. In other embodiments, first disk **18** and second disk **24** have different thicknesses.

[0048] First disk **18** and second disk **24** can be formed by any known method of making glass disks or objects. The glass of first disk **18** and second disk **24** do not need to be identical so long as the coefficient of expansion factor (COE) is the same or substantially the same and the glass is compatible with each other. COE refers to the rate at which the glass expands or contracts with changes in temperature. Mixing different standardized COE types may lead to first disk **18** and second disk **24** being incompatible. In some embodiments, first disk **18** and second disk **24** are formed from the same glass. In other embodiments, first disk **18** and second disk **24** are formed from different glass materials which have substantially similar COEs, as recognized by one of skill in the art.

[0049] First disk **18** and second disk **24** sandwich support shelf **16**. As explained herein, first disk **18** and second disk **24** are fused to one another. In some embodiments, first disk **18** and second disk **24** can also fuse to the glaze on support shelf **16**. Together glass bottom **6** (first disk **18** and second disk **24**) and ceramic body **4** can form a leakproof (or water tight) vessel **2** capable of holding food and/or liquid for example for human consumption.

[0050] The portion of wall **30** which extends between bottom edge **11** and outer surface **36** may be referred to as recessed foot **10**. In some embodiments, recessed foot **10** can be sized such that bottom surface **28** of second disk **24** does not touch a flat surface, such as a table surface, when glass bottom vessel **2** is placed on the flat surface. That is, bottom surface **28** may be located along a vertical plane that is vertically upward of the vertical plane of bottom edge **11**. In other embodiments, bottom surface **28** is level with bottom edge **11** such that the bottom surface **28** touches a table surface when glass bottom vessel **2** is placed on a table or other flat surface (i.e., bottom surface **28** and bottom edge **11** are in the same vertical plane).

[0051] In some embodiments, a sealant can be used between glass bottom **6** and ceramic body **4**. In some embodiments, the sealant further adds to the leak-proof seal formed between glass bottom **6** and ceramic body **4**. In some embodiments, the sealant can be positions around the outer edge(s) of glass bottom **6** and contacts glass bottom **6** and ceramic body **4**. For example, a sealant can be present along the outer edge of second disk **24** and in contact with, for example, outer surface **36** of support shelf **16**. In other embodiments, a sealant can be present on the inner surface of glass bottom vessel **2**, for example, along the outer edge of first disk **18** and in contact with interior floor **15** and/or support shelf **16**. When glass bottom vessel **2** is intended to hold items for human

consumption, such as food or beverage, the sealant should be food safe. The sealant should be capable of bonding to ceramic and glass and forming a water tight or waterproof seal. In some embodiments, the sealant is dishwasher safe, microwavable safe and/or food safe. Suitable sealants include Sil-Bond (RTV 4500), a one component room temperature vulcanizing RTV acetoxy cure silicone sealant and adhesive available from Silco Incorporated, Mentor, OH, USA and gold leaf.
[0052] FIG. **3** is a schematic cross-sectional, exploded view of glass bottom vessel **2**. As explained herein, during assembly, first disk **18** and second disk **24** are fused to form glass bottom **6**. In FIG. **1**, a dashed line represents the imaginary boundary between fused first disk **18** and second disk **24**. FIG. **3** illustrates glass bottom vessel **2** prior to the fusion. As shown, first disk **18** is positioned inside ceramic body **4** and on top of inner surface **34** of support shelf **16**. Second disk **24** is positioned on the outside of ceramic body **4** and below first disk **18**.
[0053] n some embodiments, first disk **18** has a cross sectional area and diameter smaller than that of second disk **24**. First disk **18** can be sized such that it fits within the notch formed by support shelf **16** and interior floor **15** in the radial direction, vertical direction or both the radial and vertical directions. For example, first disk **18** may have a diameter smaller than the interior diameter of interior floor **15** and larger than support shelf **16**. In this way, when first disk **18** is placed within ceramic body **4** and centered on the opening formed by support shelf **16**, it sits on inner surface **34** of support shelf **16**. First disk **18** can also be sized such that it fits within the notch formed by support shelf **16** and interior floor **15**. Still further, the thickness of first disk **18** can be sized such that inner surface **20** of first disk **18** and interior floor **15** form a substantially flat, level surface.
[0054] Second disk **24** is positioned below first disk **18** and on the opposite side of support shelf **16**. In some embodiments, second disk **24** has a diameter smaller than the inner diameter of ceramic body **4** (inner diameter formed by recessed foot **10**) and larger than the diameter of first disk **18**. When second disk **24** is centered on the opening formed by support shelf **16**, second disk **24** is larger than the opening formed by support shelf **16** and a portion of top surface **26** is adjacent to or is in contact with outer surface **36**. In other embodiments, second disk **24** and first disk **18** can have the same diameter.
[0055] The glass of first disk **18** and second disk **24** can be transparent, semi-transparent or opaque. Using glass that is transparent or semi-transparent allows the user of glass bottom vessel **2** to see through the bottom of the vessel, adding visual appeal. For example, when glass bottom vessel **2** is a mug, the user can see through the bottom of the mug when drinking from it. In some embodiments, designs can be created in glass bottom **6** by inserting suitable materials, such as frit or a metallic overglaze or lustre between first disk **18** and second disk **24**, before the first disk **18** and the second disk **24** are fused to one another. In some embodiments, the metallic overglaze or lustre is a low-fire (cone **18**) metallic overglaze or lustre.
[0056] FIG. **4** is a flowchart showing method **100** of making glass bottom vessel **2**, which includes forming a ceramic body in step **110** and forming a glass bottom on the ceramic body in step **120**. In step **110**, ceramic body **4** may be formed by forming clay into a desired shape, firing the clay to harden, applying glaze to the fired clay and then firing the piece a second time. There are three main types of clay: earthenware clay, stoneware clay, and porcelain. Each clay can be used to make ceramic. However, the firing temperatures and physical properties of the ceramic can vary. Two firing are completed to form the ceramic body in step **110**. The first firing, referred to as the bisque fire, transforms the clay into ceramic. During the bisque firing, glass is formed in the clay and this glass fills the pores between the clay particles. The bisque firing temperature is determined based on the type of clay used. While the bisque firing forms glass within clay body, this is not sufficient to create a watertight surface. Thus, a glaze is further required to create a watertight surface on the ceramic body. After applying a glaze, the vessel is fired a second time. The second firing can be referred to as the glaze firing. A glaze typically contains four types of components: silica, alumina, flux, and colorant. The silica is a glass-forming ingredient. During the glaze firing, the silica in the glaze melts and forms a glass-like surface on the piece. The alumina affects the viscosity of the

glaze, and the flux controls the melting point of the glaze. Similar to the bisque firing temperature, the glaze firing temperature varies depending on the type of glaze and the type of clay used.
[0057] As described herein, the ceramic vessel or body is created with a through-hole. For example, a hole is formed in the bottom of the ceramic body. In step **120**, a glass bottom is formed on the ceramic body **4** to create the glass bottom vessel and to close or fill the hole in the ceramic body. In some embodiments, first disk **18** is positioned inside ceramic body **4** such that it is in contact with inner surface **34** of support shelf **16** and completely covers the opening in the bottom of ceramic body **4**. Second disk **24** is positioned from the opposite side of support shelf **16** such that it is in contact with outer surface **36** of support shelf **16**. This forms a sandwich structure in which support shelf **16** is positioned between first disk **18** and second disk **24**. In some embodiments, designs can be created by inserting suitable materials, such as frit or a metallic overglaze or lustre between first disk **18** and second disk **24** as this stage.
[0058] The assembly (i.e., ceramic body **4**, first disk **18** and second disk **24**) is placed in a kiln and fired at a low temperature. This third firing, or fusing firing, is conducted at a sufficient temperature and for a sufficient length to fuse first disk **18** to second disk **24**. In some embodiments, a suitable temperature for the third firing is about 1200-1300° F. The glaze or glazes on ceramic body **4** should be compatible with the temperatures necessary to fuse first disk **18** and second disk **24**. For example, the fusing temperature of the first disk **18** and the second disk **24** is low enough such that the first disk **18** and second disk **24** slump, and the melting point of the glaze is sufficiently high enough such that the third firing does not reactivate the glaze. In some embodiments, the bisque temperature (the temperature required to transform the clay into ceramic) is higher than the glaze firing temperature (the temperature required to melt the silica in the glaze) and the glaze firing temperature is higher than the fusing firing temperature (the temperature required to slump the glass of the glass bottom).
[0059] After the third firing, glass bottom vessel **2** is allowed to cool to room temperature and then removed from the kiln. One skilled in the art will recognize that certain types of glass may need to be cooled at different rates to avoid the piece cracking.
[0060] The first disk **18** may sink as it fuses with second disk **24**. This sinking may be more prominent in the middle than at the edges of first disk **18**. This may create glass bottom **6** in which the edges of first disk **18** are flush or substantially flush with interior floor **15** and then dips or sinks towards the radial center of first disk **18** such that a depression is formed at the center of first disk **18**.
[0061] The third firing can create a watertight bottom on glass bottom vessel **2** because first disk **18** and second disk **24** fuse together. It is also believed that first disk **18** and second disk **24** fuse to the glaze on support shelf **16**, which increases the quality or strength of the bond. In some embodiments, bottom surface **28** of second disk **24** can be flush with bottom edge **11** before the third firing. In these embodiments, second disk **24** can sit on a kiln shelf and a separator, such as kiln paper, can be used between second disk **24** and the kiln shelf during the third firing. In other embodiments, bottom surface **28** of second disk **24** is recessed such that it is vertically above bottom edge **11** before and after the third firing. In these embodiments, second disk **24** can be elevated from the kiln shelf, for example, with a stack of kiln paper during the third firing.
[0062] The thickness of first disk **18** and second disk **24** may change during the firing. In some embodiments, the thickness of second disk **24** is selected so that prior to firing, the thickness of second disk **24** is less than the height of recessed foot **10**. This creates a recessed glass bottom on glass bottom vessel **2**.
[0063] In some embodiments, after the vessel **2** has cooled to room temperature, a sealant may be applied to create or enhance a watertight seal. For example, a sealant can be applied to the underside of vessel **2** between ceramic body **4** and glass bottom **6**.
[0064] Ceramics and glass typically have different expansion rates and melting points, making them generally incompatible. The method disclosed herein forms a vessel by fusing glass disks to

each other and, in some embodiments, to the glaze on the ceramic vessel. By fusing the glass disks after the second firing (e.g., the glaze firing), a lower firing temperature may be used for fusing the glass. In comparison, if glass was incorporated into the structure during or before the first or second firings, the glass would be exposed to higher temperatures, which may damage the glass. The lower temperature of the third firing is compatible with glass fusing. Additionally, in some embodiments, the temperature of the third firing does not impact the quality of the glaze. Further, the glass disks sandwich a portion of the clay body, providing further support for the bottom and connection between the glass disks and the clay body.

[0065] The resulting glass bottom vessel **2** can be leakproof or water tight. In some embodiments, water tight means when the vessel contains liquid, such liquid cannot escape, for example by leaking or seeping, through the vessel. For example, when the vessel is an open-top vessel, such as a mug, liquid may evaporate and leave the vessel through the open top but does not otherwise leave the vessel, such as by seeping or leaking through the walls or bottom of the vessel. In some embodiments, glass bottom vessel **2** is leakproof for at least 30 minutes, 1 hour, 2 hours, 3 hours, 4 hours, 5 hours or at least 10 hours. In some embodiments, glass bottom vessel **2** is leakproof for at least 1 day (24 hours). One way to determine if glass bottom vessel **2** is leakproof is to set glass bottom vessel **2** on a dry towel and check the towel for moisture (leaked liquid) periodically.

[0066] The resulting glass bottom vessel **2** may be food safe if appropriate materials and temperatures are used. That is, the glass does not make a previously food safe vessel not food safe if the glass used is food safe and the temperature of each of the three firings firing is appropriate for the materials present in glass bottom vessel **2**.

[0067] FIG. **5** is an alternative embodiment showing vessel **200** having ceramic body **40** and glass bottom **60**. Ceramic body **40** has wall **300** which extends from lip **80** to recessed foot **130**. Wall **30** includes inner surface **132** and outer surface **140**. Wall **300** can have a circular cross-sectional shape such that ceramic body **40** generally has a cylindrical shape. Interior floor **150** and support shelf **160** extend radially inward from inner surface **132** of wall **300**. Interior floor **150** and support shelf **160** are the same height. That is, a notch or step is not formed between interior floor **150** and support shelf **160**, and vertical surface **380** extends from inner surface **340** of interior floor **150** and support shelf **160** to exterior surface **360** of interior floor **150** and support shelf **160**.

[0068] First disk **180** and second disk **240** are fused together to form glass bottom **60**. Top surface **210** of first disk **180** is exposed on the inside of ceramic body **40** and bottom surface **280** of second disk **240** is exposed on the outside of ceramic body **40**. First disk **180** and second disk **240** sandwich interior floor **150**. In some embodiments, the diameter of first disk **180** and second disk **240** are the same. In other embodiments, the diameter of first disk **180** and second disk **240** are different. In some embodiments, first disk **180** and second disk **240** have diameters larger than the hole in the bottom of the vessel formed by vertical surface **380**.

[0069] Although certain pieces, such as ceramic body **4** (and **40**), first disk **18** (and **180**) and second disk **24** (and **240**) are discussed herein as having a circular or substantially circular cross-sectional shape, one skilled in the art will recognize that the pieces may have any suitable shape so long as the same sizing principles are applied as described herein with respect to diameters and/or widths. For example, the opening in the ceramic body **4**, first disk **18** and second disk **24** can have a triangular cross-sectional shape. Further, the cross-sectional shapes of ceramic body **4**, first disk **18** and second disk **24** can be the same or different as illustrated herein.

[0070] FIG. **6** is a schematic top view of glass bottom vessel **500** which has ceramic body **510** and glass bottom **512**. FIG. **6** illustrates a vessel having a non-circular hole in the bottom and a non-circular first glass disk. Glass bottom **512** is connected to and forms a sealed bottom on ceramic body **510** such that glass bottom vessel **500** can hold food and/or liquid without leaking. Glass bottom vessel **500** is similar to glass bottom vessel **2** or glass bottom vessel **200**. Glass bottom **512** is formed from first disk **514** fused to second disk **516**. One difference of glass bottom vessel **500** is that first disk **514** does not have a circular cross-sectional shape. First disk **514** in FIG. **6** has a

hexagonal cross-sectional shape. Second disk **516** can have a matching cross-sectional shape (i.e., hexagonal) or a different cross-sectional shape (i.e., circular). First disk **514** and second disk **516** should be shaped and sized such there are no gaps between glass bottom **512** and ceramic body **510**.

[0071] Another difference is that the opening formed in interior floor **518** of ceramic body **510** is not circular. In FIG. **6**, the opening formed by vertical surface **506** of support shelf **520** has a triangular cross-sectional shape. In use, this results in a non-circular design in interior floor **518** of glass bottom vessel **500**. In other embodiments, the vessel may have a circular hole in the bottom and a non-circular first glass disk or the vessel may have a non-circular hole in the bottom and a circular first glass disk.

[0072] FIG. **7** is an alternative embodiment showing vessel **702** having ceramic body **704** and glass bottom **706**. FIG. **8** is a top-view of vessel **702** and FIG. **9** is a cross-sectional, exploded view of vessel **702** prior to fusing the glass bottom **706**. Ceramic body **704** has wall **730** which extends from lip **708** to recessed foot **710**, which includes bottom edge **711**. Wall **730** includes inner surface **712** and outer surface **714**. Glaze **732** can be applied to wall **730**. Wall **730** can have a circular cross-sectional shape such that ceramic body **704** generally has a cylindrical shape. Interior floor **715** and support shelf **716** extend radially inward from inner surface **712** of wall **730**. Similar to FIG. **1**, a notch is formed by interior floor **715** and support shelf **716**. Support shelf includes inner surface **734**, outer surface **736** and vertical wall **738**.

[0073] Glass bottom **706** is formed from three separate glass disks or portions, first disk **718**, second disk **724** and third disk **742**. First disk **718** has top surface **720** and bottom surface **722**. Second disk **724** has top surface **726** and bottom surface **728**. Third disk **742** has top surface **744**, bottom surface **746** and outer edge **748**. In some embodiments, first disk **718** is immediately adjacent to third disk **742** which is immediately adjacent to second disk **724**. For example, bottom surface **722** may be immediately adjacent to or in contact with top surface **744**, and bottom surface **746** may be immediately adjacent to or in contact with top surface **726**. In some embodiments, outer edge **748** of third disk **742** can contact vertical wall **738**.

[0074] First disk **718**, second disk **724** and third disk **742** are fused together to form glass bottom **706**. Top surface **720** of first disk **718** is exposed on the inside of ceramic body **704** and bottom surface **728** of second disk **724** is exposed on the outside of ceramic body **704**. First disk **718**, second disk **724** and third disk **742** sandwich interior floor **715**. In some embodiments, first disk **718** is similar to first disk **18** in FIG. **1** and second disk **724** is similar to second disk **24** in FIG. **1**. In some embodiments, the diameter of first disk **718**, second disk **724** and third disk **742** are different. For example, the diameter of first disk **718** and second disk **724** can be larger than the diameter of third disk **742**. In some embodiments, the diameter of third disk **742** may be smaller than the diameter of the opening in the bottom of ceramic body **704** (the opening defined by vertical wall **738**). In some embodiments, the diameter of first disk **718** and second disk **724** are larger than the opening in the bottom of ceramic body **704** and the diameter of third disk **742** is smaller than the opening such that third disk **742** fits within the opening, first disk **718** is on top of the opening and second disk **724** is below the opening.

[0075] In some embodiments, first disk **718**, second disk **724** and third disk **742** can have the same thickness. In other embodiments, glass disks **718**, **724** and **742** can have different thicknesses. In some embodiments, third glass disk **742** can have a thickness less than the thickness of vertical wall **738**, and first and second disks **718** and **724** can have a thickness greater than third disk **742**.

[0076] Glass disks **718**, **724** and **742** can be slumped as described herein to fuse the glass disks together. During the slumping or fusing process, the glass of glass disks **718**, **724** and **742** can fill in the gaps between the glass disks and ceramic body **704** to create a leakproof seal.

[0077] FIG. **10** is an alternative embodiment showing vessel **900** having ceramic body **740** and glass bottom **760**. Ceramic body **740** has wall **1000** which extends from lip **780** to recessed foot **830**. Wall **1000** includes inner surface **832** and outer surface **840**. Wall **1000** can have a circular

cross-sectional shape such that ceramic body **740** generally has a cylindrical shape. Similar to vessel **200** of FIG. **5**, interior floor **850** and support shelf **860** extend radially inward from inner surface **832** of wall **1000**. Interior floor **850** and support shelf **860** are the same height. That is, a notch or step is not formed between interior floor **850** and support shelf **860**, and vertical surface **1080** extends from inner surface **1040** of interior floor **850** and support shelf **860** to exterior surface **1060** of interior floor **850** and support shelf **860**.

[0078] Glass bottom **760** is formed from three glass disks or portions, first disk **880** (having top surface **910** and a bottom surface), second disk **940** (having a top surface and bottom surface **980**), and third disk **842** (having top surface **844**, bottom surface **846** and outer or parameter surface **848**). First disk **880**, second disk **940** and third disk **842** are fused together to form glass bottom **760**. Top surface **910** of first disk **880** is exposed on the inside of ceramic body **740** and bottom surface **980** of second disk **940** is exposed on the outside of ceramic body **740**. Similar to vessel **702** of FIG. **7**, First disk **880**, second disk **940** and third disk **842** sandwich interior floor **850**. In some embodiments, the diameters of first disk **880**, second disk **940** and third disk **842** are different. In some embodiments, first disk **800** and second disk **940** can have diameters larger than the diameter of third disk **842**. For example, in some embodiments, first disk **880** and second disk **940** have diameters larger than the hole in the bottom of the vessel formed by vertical surface **1080** and third disk **842** has a diameter smaller than the hole such that third disk **842** can fit within the hole. In this way, first disk **800** and second disk **940** fuse or otherwise attach to ceramic body **740**.

[0079] Although the forgoing disclosure discusses a glass bottom mug, one skilled in the art will recognize that the glass bottom vessel may be any suitable vessel such as a vase, coaster, plate, bowl or cup.

[0080] Although the forgoing disclosure discusses a glass bottom made with two or three glass portions or disks, a glass bottom can be formed using more than three glass portions or disks, for example by using four, five or six glass portions or disks.

[0081] Although the forgoing disclosure described the glass portions as a bottom, the glass portions can be used at other locations on the ceramic body.

[0082] In the foregoing, all temperatures are set forth uncorrected in degrees Fahrenheit and, all parts and percentages are by weight, unless otherwise indicated.

[0083] From the foregoing description, one skilled in the art can easily ascertain the essential characteristics of this invention and, without departing from the spirit and scope thereof, can make various changes and modifications of the invention to adapt it to various usages and conditions.

Claims

1. A vessel comprising: a ceramic body having a top edge, a bottom edge, a wall extending from the top edge to the bottom edge to form an enclosed space and a floor extending inward from an inside surface of the wall, the floor having an inner surface, an outer surface and a vertical surface that defined an opening in the ceramic body; and a glass bottom covering the opening, the glass bottom formed of a first glass portion and a second glass portion which are fused together, wherein the first glass portion has a first top surface and a first bottom surface and the second glass portion has a second top surface and a second bottom surface; the first bottom surface of the first glass portion is in contact with at least a portion of the inner surface of the floor and at least a portion of the second top surface of the second glass portion; the second top surface of the second glass portion is in contact with at least a portion of the first bottom surface of the first glass portion and at least a portion of the outer surface of the floor.

2. The vessel of claim 1 wherein at least a portion of the inner surface of the floor which is in contact with the first glass portion and at least a portion of the outer surface of the floor which is in contact with the second glass portion include at least one glaze.

3. The vessel of claim 1 wherein the vessel is watertight.

4. The vessel of claim 1 wherein the ceramic body is cylindrical.
5. The vessel of claim 4 wherein the opening is circular.
6. The vessel of claim 5 wherein the floor includes one or more supports and the first glass portion and the second glass portion are in contact with the one or more supports.
7. The vessel of claim 6 wherein a first diameter of the first glass portion is larger than a diameter of the opening, and wherein a second diameter of the second glass portion is larger than the first diameter of the first glass portion.
8. The vessel of claim 6 wherein the support forms a notch.
9. The vessel of claim 6 wherein the vessel includes two or more supports extend radially inward from the floor towards the opening and wherein the supports do not extend an entire perimeter of the opening.
10. The vessel of claim 1 wherein the second bottom surface of the second portion is laterally upwards from the bottom edge.
11. The vessel of claim 1 wherein the inner surface of the floor and the first top surface of the first glass portion form a flat or substantially flat surface.
12. The vessel of claim 1 wherein the vessel is a drinking vessel.
13. The vessel of claim 1 wherein the glass bottom further comprises a third glass portion positioned between the first glass portion and the second glass portion, the first glass portion, the second glass portion and the third glass portion fused together.
14. The vessel of claim 1 and further comprising a sealant contacting the ceramic body and the glass bottom.
15. A method of forming a glass bottom vessel, the method comprising: positioning a first glass portion in contact with at least a portion of an inner surface of a floor extending inward from an inside surface of a wall of a ceramic body and over an opening formed in the floor of the ceramic body; positioning a second glass portion in contact with at least a portion of an outer surface of the floor and in contact with the first glass portion; and fusing the first glass portion to the second glass portion to sandwich the floor between the first glass portion and the second glass portion.
16. The method of claim 15 wherein the step of positioning the first glass portion includes position the first glass portion in a notch.
17. The method of claim 15 wherein the step of positioning the second glass portion includes elevating the second glass portion so that an outer surface of the second glass portion is laterally upwards from a bottom edge of the ceramic body.
18. The method of claim 15 wherein the ceramic body has been glaze fired before the step of positioning the first glass portion.
19. The method of claim 15 wherein the outer surface and the inner surface have a glaze.
20. The method of claim 15 wherein the ceramic body is cylindrical and the opening has a circular cross-sectional shape.