

SUBSTRATE CONTAINER SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

5 [0001] This application claims the benefit of Taiwan Application No. 108124813 filed on July 13, 2019, which is hereby incorporated by reference herein and made a part of specification.

FIELD

10 [0002] This present disclosure relates to transportable container suitable for keeping delicate objects, e.g., a wafer, from environmental contamination during storage, transport, and shipment, and, in particular, to container system capable of evenly distributing purging gas within the container system.

BACKGROUND

15 [0003] Delicate work pieces (e.g., wafers, photo mask/ reticles) are subjected to numerous fabrication steps through multiple processing equipment during modern semiconductor manufacturing processes before integrated circuits can be manufactured. 20 The wafers are often transported or shipped from a wafer manufacturing facility to another site where they are further processed. The relocation of such delicate devices is often done through dedicated substrate containers, such as FOUPs (front opening unified pods).

 [0004] Front opening unified pods (FOUPs) are often used for containing 300 25 mm or 450 mm wafers between processing stations. FOUPs conventionally have a shell that defines an open interior and shelves in the shell for holding a spaced stack of wafers. Moreover, the shell defines a front opening that is coverable by a front door member, which incorporates a sealing member and a latch mechanism to establish hermetical engagement between the door and the shell.

30 [0005] It is desirable to control the intrusion of ambient contaminant (e.g., air/dust/moisture) into the substrate container during the insertion or removal of substrates (e.g., when the front door is removed and the interior is exposed). The

intrusion of ambient contaminant into the pod can adversely affect the yield of the resident substrates, even when the ambient environment is that of a clean room. To this end, purging equipment is incorporated into the carrying pod system to support a purging process during loading/unloading of the pod payload.

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BRIEF DESCRIPTION OF DRAWINGS

[0006] The invention can be more fully understood by reading the following detailed description of the embodiment, with reference made to the accompanying drawings as follows:

10 Fig. 1 illustrates an isometric view of a substrate container system in accordance with some embodiments of the instant disclosure;

Fig. 2 illustrates an isometric view of a back cover for a substrate container system in accordance with some embodiments of the instant disclosure;

15 Fig. 3 illustrates a cross-sectional view of a substrate container system in accordance with some embodiments of the instant disclosure;

Fig. 4 to 6 respectively illustrates an isometric view of a back cover of a substrate container system in accordance with some embodiments of the instant disclosure;

Fig. 7a illustrates an isometric view of a container body for a substrate container system in accordance with some embodiments of the instant disclosure;

20 Fig. 7b illustrates an enlarged regional view of Fig. 7a;

Fig. 7c illustrates an isometric view of a filter member arranged on a substrate container system in accordance with some embodiments of the instant disclosure;

Fig. 7d illustrates an enlarged regional view Fig. 7c;

25 Fig. 7e illustrates an isometric view of a substrate container system in accordance with some embodiments of the instant disclosure;

Fig. 8 illustrates an isometric view of a sealing member for a substrate container system in accordance with some embodiments of the instant disclosure;

Fig. 9a illustrates an isometric view of a back cover for a substrate container system in accordance with some embodiments of the instant disclosure;

30 Fig. 9b illustrates a cut view of the back cover for a substrate container system in accordance with some embodiments of the instant disclosure;

Fig. 10 illustrates a perspective view of a substrate container system in accordance with some embodiments of the instant disclosure;

Fig. 11 illustrates a cross-sectional view of a substrate container system in accordance with some embodiments of the instant disclosure;

5 Fig. 12 illustrates a perspective view of a substrate container system in accordance with some embodiments of the instant disclosure;

Fig. 13 illustrates a cross-sectional view of a substrate container system in accordance with some embodiments of the instant disclosure;

10 Fig. 14 illustrates a perspective view of a substrate container system in accordance with some embodiments of the instant disclosure;

Fig. 15 illustrates a cross-sectional view of a substrate container system in accordance with some embodiments of the instant disclosure;

Fig. 16 illustrate a cross-sectional view of a back cover for the substrate container system in accordance with some embodiments of the instant disclosure;

15 Fig. 17 illustrates a reginal cross-sectional view of a substrate container system in accordance with some embodiments of the instant disclosure; and

Fig. 18 illustrates data of an experiment using a substrate container system in accordance with some embodiments of the instant disclosure.

[0007] It is to be noted, however, that the appended drawings illustrate only
20 exemplary embodiments of this disclosure and are therefore not to be considered limiting of its scope, for the disclosure may admit to other equally effective embodiments.

[0008] It should be noted that these figures are intended to illustrate the general characteristics of methods, structure and/or materials utilized in certain example
25 embodiments and to supplement the written description provided below. These drawings are not, however, to scale and may not precisely reflect the precise structural or performance characteristics of any given embodiment, and should not be interpreted as defining or limiting the range of values or properties encompassed by example
embodiments. For example, the relative thicknesses and positioning of layers, regions
and/or structural elements may be reduced or exaggerated for clarity. The use of similar
30 or identical reference numbers in the various drawings is intended to indicate the presence of a similar or identical element or feature.

DETAILED DESCRIPTION

[0009] The present disclosure will now be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the disclosure are shown. This disclosure may, however, be embodied in many different
5 forms and should not be construed as limited to the exemplary embodiments set forth herein. Rather, these exemplary embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the disclosure to those skilled in the art. Like reference numerals refer to like elements throughout.

[0010] The terminology used herein is for the purpose of describing particular
10 exemplary embodiments only and is not intended to be limiting of the disclosure. As used herein, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises” and/or “comprising,” or “includes” and/or “including” or “has” and/or “having” when used herein, specify the presence of stated features, regions,
15 integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, regions, integers, steps, operations, elements, components, and/or groups thereof.

[0011] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary
20 skill in the art to which this disclosure belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and the present disclosure, and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0012] The description will be made as to the exemplary embodiments in
25 conjunction with the accompanying drawings in FIGs. 1 to 18. Reference will be made to the drawing figures to describe the present disclosure in detail, wherein depicted elements are not necessarily shown to scale and wherein like or similar elements are designated by same or similar reference numeral through the several views and same or
30 similar terminology.

[0013] Fig. 1 illustrates an isometric view of a substrate container system **100** in accordance with some embodiments of the instant disclosure. For illustrational

simplicity and clarity, some detail/subcomponents of the exemplary system are not explicitly labeled/shown in the instant figure. In some embodiments, the substrate container system comprises a front opening unified pod (FOUP). The exemplary container system **100** defines a front opening **111** (obstructed from current view) that enables passage of substrates (e.g., wafers, reticles, or other semiconductor fabrication related work piece). In some embodiments, the front opening may be wider than a substrate. In the illustrated embodiment, substrate container system **100** includes a container body **110** suitable for housing substrates and a back cover **120** configured to enclose the back of the container body **110**. In some embodiments, the container body is a unitary member formed as an integral one-piece structure, e.g., by technique such as injection molding. The container body **100** further defines a back opening **113** opposing the front opening, which can be covered (and eventually sealed) by the back cover **120**. The back opening is provided to allow purged gas flow into the interior of the container body. As shown in the exemplary embodiment, the back opening **113** has a width (e.g., in the x-axis direction) smaller than that of the front opening **111**. For instance, the container body **110** of the illustrated embodiment includes a front flange **115** proximate its frontal face (on which the front opening **111** is formed), which give the container body **100** a general outer profile that gradually widens toward the front port (e.g., opening **111**) thereof. In the exemplary figure, the wider frontal face of the container body **110** accommodates a wider front opening **111** compared to the narrower opposing back opening **113**.

[0014] In some embodiments, the container body **110** is configured to receive a filter element (e.g., filter member **130**) at the back face thereof configured to cover the back opening **113**. For example, the container body **110** further comprises a pair of flange portions **112** capable of receiving a filter member **130**. In the exemplary embodiment, the flange portions **112** are respectively arranged adjacent to the back opening **113** along a width direction (e.g., x-direction indicated in Fig. 1) of the back cover **120** (e.g., extending toward the center of the back opening **113** from the two side walls **117** of the container body **110**). Specifically, the inner fringes **112a** of the flange portions **112** cooperatively define the back opening **113**, and are configured to provide physical support for the received filter member **130** such that the filter member **130** may be evenly retained. Meanwhile, the filter member **130** in the illustrated embodiment

comprises a filter plate **131** and an annular frame **132** that encircles the filter plate **131**, which is provided with a sufficient planar dimension to cover the back opening **113**. In the illustrated embodiment, the annular frame **132** is configured to establish sealing engagement with the inner fringe **112a** of the flange portions **112** upon assembly. In some embodiments, the filter member (e.g., filter **130**) includes a porous material. In some embodiments, the filter member may be integrally formed from a porous sintered material. In some embodiments, the porous sintered material may be manufactured by sintering granular materials. Suitable materials may include ceramic materials and polymer based materials, such as High-density polyethylene (HDPE), Polytetrafluoroethylene (PTFE), Ultra-high molecular weight polyethylene (UHMW), Nylon 6 (N6), Polypropylene (PP), Polyvinylidene fluoride (PVDF), Polyethersulfone (PES) and a combination thereof.

[0015] In some embodiments, the main body (e.g., container body **110**) is configured to engage the back cover to enclose the back opening and the filter member. In the exemplary embodiment, the back cover **120** comprises a generally planar body configured to be mounted over the flange portions **112** at the back face of the container body **110**. For instance, the laterally symmetrical flange portions **112** may be provided with a plurality of fastening members **116** (e.g., threaded holes) that correspond to a plurality of fastening pieces **124** (e.g., screws). As such, the back cover **120** may be coupled to container body **110** through the fasteners (e.g., **124**) on flange portions **112**. In some embodiments (such as the one shown in Fig. 17), the fastening mechanisms (e.g., member **116**) may be arranged on other locations (e.g., side walls) of the container body **110** (e.g., at locations proximate the flange portions). For instance, in some embodiments, the fastening mechanisms may be arranged on a side wall **117** of the container body **110** rather than on the back face thereof.

[0016] In some embodiments, the back cover **120** comprises at least one gas inlet structure **121** configured to engage an external purging apparatus, thereby enabling the receipt of purging gas into the interior of the container system. In some embodiments, the gas inlet structure **121** maybe integrally constructed as an extended portion of the back cover **120** (e.g., extending from the planar portion of the back cover **120** that covers the filter member). In the illustrated embodiment, the gas inlet structure

121 comprises a gas intake port (e.g., downward facing port **121a**) for connecting the purging apparatus.

[0017] The system **100** may further comprise a sealing member (e.g., member **140**) configured to sustain a predetermined level of air-tightness between the back cover **120** and the container body **110**. In some embodiments, the sealing member (e.g., member **140**) incorporates a double loop configuration and is to be arranged between the back cover **120** and the container body **110**. For instance, the exemplary sealing member **140** is shown to include a first (outer) seal ring portion **141** configured to be arranged between the back cover **120** and the container body **110**. In the illustrated embodiment, the shape of the first seal ring portion **141** is shown to correspond to an outer fringe region **112b** of the flange portions **112** and is configured to establish the sealing engagement along the outer fringe region **112b** of the flange portions **112**. In some embodiments, the first seal ring portion **141** may be further provided with a section configured to enhance the sealing engagement between the gas inlet structure (e.g., inlet **121**) and the container body (e.g., body **110**). For instance, the first seal ring portion **141** may be provided with a bending loop section that extends between the bottom face of the container body **110** and the gas inlet structures **121** upon assembly (e.g., that bends substantially 90 degrees from the plane defined by the back cover **120**) to maintain gas sealing around the intake port (e.g., port **121a**). In the illustrated embodiment, the first seal ring portion **140** comprises a main section **141a** and two bended sections **141b** that bends from the main section **141a** (e.g., corresponding to the pair of downward facing intake ports **121a**).

[0018] In some embodiments, the sealing member (e.g., member **140**) may be configured to enable sealing between the filter member (e.g., member **130**) and the container body (e.g., body **110**). For instance, the sealing member **140** shown in the instant figure further comprises a second (inner) seal ring portion **142** configured to be seated between the filter member **130** and the container body **110**. In some embodiments, the first and second ring portions **141,142** are integrally connected (e.g., integrally formed as a unitary gasket member through, e.g., a same molding process). In the illustrated embodiment, the first and the second seal ring portions **141, 142** share a same common section **144**. In some embodiments, the second ring portion may be a separate component that is not integrally connected to the first ring portion. In the

illustrated embodiment, the sealing member **140** further comprises a plurality of third seal ring portions **143** configured to be seated around the fastening members (e.g. members **116**, **124**) to ensure sealing engagement at the jointing region between the main body (e.g., body **110**) and the back plate (e.g., cover **120**). In some embodiments, the first and third ring portions are integrally connected.

[0019] Fig. 2 illustrates an isometric view of a back cover for a substrate container system in accordance with some embodiments of the instant disclosure. In the illustrated embodiment, back cover **220** comprises a pair of inlet structures. By way of example, the exemplary back cover **220** are provided with a first gas inlet structure **221** and a second gas inlet structure **222**, each having a downward facing gas intake port **221a/222a**. The first and the second gas inlet structures **221**, **222** are substantially symmetrically arranged along a width direction (e.g., x direction indicated in Fig. 2) of the back cover **220**.

[0020] The back cover **220** comprises an inner face **223** oriented toward the container body (e.g., container body **110**) upon assembly. In some embodiments, the back cover **220** covers the back opening of the container body and establishes sealing engagement with the container body upon assembly. For example, in the illustrated embodiment, a sealing lip **224** is formed at the periphery of the inner face **223** for directly contacting an outer sealing ring of a sealing member (e.g., the first seal ring portion **141**) upon assembly.

[0021] In some embodiments, the gas intake structure may further comprise at least one guiding portion configured to guide the gas intake port to a correct position/orientation over the bottom face of the container body (e.g., body **110**), thereby ensuring alignment between the onboard gas intake port (e.g., ports **221a/b**) and a gas outlet port of an external purging apparatus during docking. For example, the illustrated gas intake structure **221** is provided with a pair of guiding portions **221b** (e.g., have an annular/ring profile) arranged neighboring the port **221a**.

[0022] Fig. 3 illustrates a cross-sectional view of a substrate container system **300** in accordance with some embodiments of the instant disclosure. For instance, the illustrated cross section may reflect a cut-away view taken, e.g., in the y-z plane as illustrated in FIG. 1.

[0023] As shown in FIG. 3, the container body **310** has a bottom face **314**. Upon assembly, the intake structure (e.g., gas intake structure **321**) of the back cover **320** (shown by a darker shading tone for ease of recognition) bendingly extends under the bottom face **314**. The gas intake port **321a** is configured to face a direction opposing the bottom face **314** of the container body **310**.

[0024] The container body **310** further defines a front opening **311** and a back opening (e.g., **112**) opposing the front opening **311**. The front opening **311** is shaped and sized to enable passage of the container payload (e.g. substrates). In some embodiments, the assembled filter member **330** has a gas dispensing surface **331** that is provided with a curved profile (e.g., depicted more clearly in FIG. 9b and FIG. 13). In some embodiments, the curved gas dispensing face (e.g., face **331**) is configured to extend toward the container body **310** through the back opening (e.g., back opening **113**).

[0025] In some operational scenarios, purged gas may be provided to the interior of system **100** via the gas intake port **321a**, then pass through the filter member **330**, then expelled out of the system **300** through extraction hole (e.g., extraction holes **714a** illustrated in Fig. 7) formed in the bottom face **314**.

[0026] Fig. 4 shows an exemplary back cover for a substrate container system in an isometric view in accordance with some embodiments of the instant disclosure. The exemplary back cover **420** is further provided with a pair of partition structures **425** extending along the height direction (e.g., the z-direction).

[0027] The partition structure **425** may form a gas guiding channel that extend along the height direction (e.g., the z-direction) of the back cover **420** and in fluid communication with the downward facing inlet structures (e.g., gas inlet structures **221/222**). For example, upon assembly, the partition structures **425** of the back cover **420** are respectively oriented adjacent the back opening (e.g., **313**) in the width direction (e.g., the x-direction) of the back cover **420**, and is further arranged in contact with the filter member (e.g., along the filter frame **132** and over the inner fringe region **112a** of the flange portions **112** in Fig.1). Meanwhile, the back cover **420** at least partially overlaps the pair of the flange portions (e.g., flange portions **112** in Fig.1) of the container body.

[0028] Sealing engagement between the exemplary back cover **420** and the main body (e.g., container body **110**) may be established along the outer fringe regions

(e.g., **112b**) of the flange portions. In some embodiments, a pair of gas guiding channels from the gas inlet structures (e.g., **221/222**) may be formed in the overlapped regions between the back cover **420** and the flange portions (e.g., **112**) of the container body. As such, the flange portions (e.g., **112**) are entirely covered by the back cover **420**, whereby
5 the gas guiding channel may have a width substantially equal to that of the flange portion (e.g., **112**).

[0029] The back cover **420** and a filter member (e.g., filter member **130**) may cooperatively form a buffering compartment connected to gas guiding channel via an outlet (e.g., **425c**, which will be described in further detail below). For example, the
10 pair of partition structures **425** laterally separates the back cover **420** into three regions. The region between the partition structures **425** of the back cover **420** and a back surface of a filter member (e.g., filter member **130**) may cooperatively form a buffering compartment.

[0030] In the instant embodiment, purging gas may be provided into the
15 buffering compartment from the gas intake port (e.g., **221a**) through gas outlet **425c** arranged at a middle section of the gas guiding channel (e.g., along the height/z-axis direction). The sintered porous structure in a filter member (e.g., member **130**) helps to regulate gas flow there-through, thus maintains pressure inside the buffering compartment at a stable value during the purging operation. For instance, the filter
20 member would allow passage of gas flow there-through when the pressure of the intake gas (e.g., from the intake port **221a/222a**) reaches a certain threshold. As sufficient internal pressure builds up in the buffering compartment (e.g., the chamber formed between the back cover **120** and the filter member **130**), the filter member would evenly distribute the purge gas into the interior of the main body (e.g., body **110**) in an regulated
25 manner.

[0031] In the exemplary embodiment, each of the partition structures **425** is provided with an outlet **425c** substantially at the middle of the height of the back cover **420**. In the exemplary embodiment, the outlet **425c** is arranged substantially midway between a top end **425t** and a bottom end **425b** of the partition structure **425** (relative to
30 the center of the outlet **425c**).

[0032] Figs. 5 and 6 respectively show isometric illustration of exemplary back covers for a substrate container system in an isometric view in accordance with some embodiments of the instant disclosure.

[0033] Referring to FIG. 5, each of the partition structures **525** of the exemplary back cover **520** has three outlets **525c** provided therein. The outlets **525c** in the opposing partition structures **525** are formed substantially in a lateral symmetrical manner (e.g., along the x-axis direction).

[0034] Referring to Fig. 6, each of the partition structures **625** of the exemplary back cover **620** is provided with one outlet **625c**. However, the outlets **625c** are designed in a substantially non-symmetrical lateral arrangement (e.g., along the x-axis direction). For instance, the outlets **625c** are respectively formed at a top and a bottom location along the height of the back cover **620** (e.g., along the z-axis).

[0035] It is found that the outlet configuration (e.g., location and number) may affect gas flow distribution in the container body (e.g., body **110**). Moreover, proper placement of the gas outlet may facilitate reduction of intrusion of ambient air into the interior of the container body during purged loading/unloading operations. In some operational scenarios, purging gas may be symmetrically introduced into the buffering compartment through the two outlets **425c** (e.g., arranged substantially at the middle of the height of the back cover **420**) to the geometry center of the back cover **420**. It is found that such configuration helps to alleviate the intrusion of ambient air in the front door removal process during loading/unloading of payload into/out of the container interior.

[0036] Fig. 7a illustrates an isometric view of a sealing member seating arrangement (e.g., for a sealing member **140/840** shown in FIGS. 1 and 8, respectively) for a substrate container system in accordance with some embodiments of the instant disclosure. Fig. 7b illustrates an enlarged regional view of Fig. 7a.

[0037] In the illustrated embodiment, a first groove structure (e.g., outer groove **717**) is arranged along the outer periphery (e.g., region **712b**) of the pair of flange portions of the container body (e.g., flange **712**), while a second groove structure (e.g., inner groove **718**) is arranged along the inner fringe **712a** of the flange portion(s) **712**. For instance, the exemplary container body **710** includes a first (outer) annular groove

structure **717** that forms an annular loop that accommodates an outer seal ring (e.g., the first seal ring portion **141**).

[0038] In some embodiments, the inner periphery of the first annular groove structure **717** is further provided with a plurality of gaps **717a** positioned in
5 correspondence with the location of the fastening members **716**, thereby allowing additional seal ring(s) (e.g., third seal ring portions **143**) to be arranged surround the respective fastening member **716**.

[0039] In the illustrated embodiment, the first groove structure **717** further includes a bottom section **717b** that defines a partially enclosed loop pattern over the
10 bottom face **714** (as shown in FIG. 7b). In addition, the bottom face **714** is provided with a pair of exhaust ports (e.g., through holes **714a**). On the other hand, the bottom face **714** is not provided with through holes at the location of the enclosed loop pattern region (of the bottom section **717b**). Accordingly, a bended section (e.g., sections **141b**) of an outer seal ring (e.g., seal ring **140**) may be positioned in the bottom sections **717b**
15 of the first groove structure **717**, whereby, the bended sections (e.g., sections **141b**) of seal ring may be retained under the bottom face **714** of the container body **710**.

[0040] The container body **710** further includes a second (inner) groove structure **718** that surrounds the back opening **713**, configured to accommodate an inner seal ring (e.g., the second seal ring portion **142**). Such arrangement enables the filter
20 member (e.g., filter member **130**) to establishes a sealing engagement with the container body **710** surrounding the back opening **713** upon assembling.

[0041] In some embodiments, the second groove structure **718** may be further provided with a plurality of gaps **718a** and a plurality of pillars **718b** arranged respectively in the gaps **718a** for filter element (e.g., filter member **130**)
25 positioning/retention purposes.

[0042] Fig. 7c illustrates an isometric view of a filter member **730** adapted on a substrate container system in accordance with some embodiments of the instant disclosure. Fig. 7d illustrates an enlarged regional view of Fig. 7c.

[0043] The exemplary filter member **730** includes a filter plate **731** and an
30 annular frame **732**. In some embodiments, the filter member **730** is further provided with a plurality of anchor rings **733** that extends outwardly from the annular frame **732**. The anchor rings **733** may be symmetrically arranged along a width direction (e.g., the x-

direction) of the filter member **730**. Upon assembly, the annular frame **732** may physically contact an inner seal ring (e.g., second sealing ring portion **142**) there-under, while the anchor rings **733** may engage the pillars **718b** through the gaps **718a** in the second groove structure **718**. Such arrangement may restrain lateral movement of the filter member **730** upon assembly, thereby further ensuring sealing engagement between the annular frame **732** and the container body **710**. In some embodiments, the anchor rings **733** are integrally formed with the annular frame **732** of the filter member **730**.

[0044] Fig.7e illustrates an isometric view of a substrate container system **700** in assembled configuration, in accordance with some embodiments of the instant disclosure. Up on assembly, the first/second gas inlet structure **721/722** of back cover **720** bendingly extends under the bottom face **714** of the container body **710** and covers the bended section (e.g., **141b**) of the seal ring member, whereby the bended section (**141b**) is arranged between the bottom face **714** and the gas inlet structure **721** to ensure air-tightness around the gas intake port(s). Moreover, a pair of gas intake ports **721a**, **722a** open toward a downward direction (e.g., z-direction) opposing the bottom face **714**.

[0045] Fig. 8 illustrates an isometric view of a sealing member **840** for the substrate container system in accordance with some embodiments of the instant disclosure. The exemplary sealing member **840** comprises a first (outer) seal ring portion **841**, a second (inner) seal ring portion **842**, and a plurality of third (auxiliary) seal ring portions **843**. Moreover, the sealing member **840** is provided with an out-of-plane bending configuration.

[0046] In the illustrated example, a pair of substantially symmetrical main sections **841a** of the first ring portion **841** (along with the shared subsection **841g**) of the first ring portion **841** cooperatively defines a plane **P81**. The second (inner) ring portion **842**, which is shown to extend substantially in the same plane **P81**, is generally enclosed within the periphery of the first (outer) ring portion **841**. Meanwhile, the shared section **841g** (of the outer ring portion) that extends along a width direction (e.g., along the x-axis direction) is where the inner and outer ring portions (e.g., first portion **841** and second portion **842**) integrally join each other. Moreover, the first ring portion **841** includes a pair of substantially symmetrical out-of-plane (bended) sections **841b** bendingly extend toward a substantially orthogonal plane **P42** with respect to plane **P41**.

[0047] As shown in the exemplary embodiment, each one of the bended section **841b** includes two neck subsections **841d** that are separately arranged along the width direction (e.g., x-axis direction) and respectively join the main section **841a** at a substantially 90 degree bending angle. Between the pair of neck subsections **841d** forms a gap **841c** opposing the shared subsection **841g**. The bended section **841b** generally forms a loop that rests in plane **P82** (substantially orthogonal with respect to plane **P81**), and is configured to surround and enclose a downward facing gas intake port (e.g., port **421a** as previously depicted).

[0048] The third seal ring portions **843**, which is arranged generally in-plane with the main sections **841a** (i.e., resting substantially in plane **P81**), is integrally connected to the inner periphery of the first seal ring portion **841** and extend inwardly toward the second seal ring portion **842**.

[0049] Fig.9a illustrates an isometric view of an exemplary back cover for a substrate container system in accordance with some embodiments of the instant disclosure.

[0050] In some embodiments, back cover **920** comprises a pair of partition structures **925** extending along the height direction (e.g., along the z-axis) of the back cover **920**. In some embodiments, an outlet (opening) **925c** is formed in the partition structure **925**. In some embodiments, the outlet **925c** is arranged substantially in a middle section along the height of the back cover **920** (e.g., along the z-axis). In the illustrated embodiment, the two partition structures **925** are further connected to each other through an upper bridge partition structure **927a** and a bottom bridge partition structure **927b**.

[0051] In some embodiments, the partition structure (e.g., structures **925** or **927a/b**) may include a plurality of generally concentric rib features. For instance illustrated partition structure **925** comprises a pair of generally concentrically arranged rib features **925a**, **925b**.

[0052] In addition, a plurality of ribs **928** extends along the width direction (e.g., along a x-axis shown in Fig.9a) are further provided on the inner face **923** of the back cover **920** configured to enhance the structural integrity of the back cover **920**. In some embodiments, the back cover **920** further includes a plurality of fins **926** arranged

apart from each other and respectively intersect the rib features **925a/b** of the partition structures **925**.

[0053] In the illustrated embodiment, outlet **925c** is divided by the fins **926** that are arranged normal to (e.g., along the width direction of the back cover) the partition structures **925**. As such, the fins **926** may serve as air-guide and direct the gas passing through the outlet **925c** toward the center of the back cover **920**.

[0054] Fig. 9b illustrates a cutaway section view (e.g., along cutline L9 shown in FIG. 9a) of a back cover being coupled to a filter member for a substrates container system in accordance with some embodiments of the instant disclosure.

[0055] In the illustrated embodiment, the rib feature **925a** of the partition structure physically contacts the filter member **930** and defines a boundary of a gas component (obstructed from current view; indicated by the dotted line **960**) between the back cover **920** and the filter member **930**. In the illustrated embodiments, the outlet **925c** is cooperatively defined by the rib feature **925a** and the filter member **930**. The outlet **925c** is divided by the fins **926**.

[0056] Fig. 10 illustrates a perspective view of an assembled substrate container system **1000** in accordance with some embodiments of the instant disclosure. Fig. 11 illustrates a cross-sectional regional view of an assembled substrate container system **1100** in accordance with some embodiments of the instant disclosure. Fig. 11 may be a cross-sectional view taken from a plane parallel to the plane **P10** indicated in Fig. 10.

[0057] In the illustrated embodiment, the back cover **1120** and the container body **1110** cooperatively defines a gas guiding channel **1116** that extends along a height direction of the back cover. The gas inlet structure **1121** is connected to the gas guiding channel **1116**. The gas guiding channel **1116** extends over the bottom face **1113** (e.g., along y-direction) of the container body **1110**. Thus, when a purging apparatus (not shown) is connected to the gas intake port **1121a**, the path of gas (e.g., indicated by the arrows shown in Fig. 11) released from the purging apparatus changes its direction inside the gas guiding channel **1116** (e.g., around the bottom face **1113** of the container body **1110** and the bendingly extending gas intake structure **1121** of the back cover **1120**). In some embodiments, a second gas guiding channel with comparable arrangement may be provided on the back cover **1120**. In some embodiments, the plurality of gas guiding

channels may be arranged on the back cover of the container system in a substantially mirror symmetrical manner, e.g., as shown in FIGS. 2 or 4.

[0058] Fig. 12 illustrates a perspective view of a substrate container system **1200** in accordance with some embodiments of the instant disclosure. Fig. 13 illustrates a cross-sectional regional view of an assembled substrate container system in accordance with some embodiments of the instant disclosure. In some embodiments, the Fig. 13 may be a cross-sectional view taken from a plane parallel to the plane **P12** indicated in Fig. 12.

[0059] In Fig. 13, the exemplary back cover **1320** is shown to be engaged with a container body **1310**, thereby forming a sealing engagement between the filter member **1330** and the container body **1310**. In the instant embodiment, the back cover **1320** is provided with a sealing lip **1324** at its periphery. The sealing lip **1324** is configured to establish physical contact with an outer sealing ring (e.g., first sealing ring portion **1341**) arranged on the flange portions **1312** of a container body **1310**. In the illustrated embodiment, a partition structure **1325** (e.g., outer rib **1325b**) of the back cover **1320** is configured to exert pressing force on a filter member **1330** (e.g., along a frame **1332** of the filter member **1330**) against an inner sealing ring **1342** (e.g., the inner seal ring portion) embedded on the container body **1310** (e.g., on the flange portions **1312**). As such, sealing engagement between the container body **1310** and the filter member **1330** may be ensured.

[0060] Moreover, the partition structures **1325** (e.g., inner rib **1325a**) of the back cover **1320** is shown to be in physical contact with the filter member **1330** thereby serving as a structural separation between the gas guiding channel **1351/1352** and the buffering compartment **1360**. The buffering compartment **1360** is in fluid communication with the gas guiding channel **1351/1352** via outlets formed on the partition structures (e.g., outlets **925c** has shown in FIG. 9). The structural profile and placement of the gas guiding channels **1351**, **1352** are substantially symmetrical along a width direction of the back cover **1320** (e.g., x-direction indicated in Fig.13). As such, the flow of purging gas may be symmetrically directed into the buffering compartment via the two outlets (e.g., outlet **926**) during loading/unloading of the container interior.

[0061] A gas dispensing face **1331** of the filter member **1330** is configured to extend into the back opening **1313** defined between the flange portions **1312** of the

container body **1310**. For instance, the gas dispensing face **1331** is arranged toward the interior of the container body **1310**, and reaches past the opening boundary defined by the fringe portions **1312**. Accordingly, the gas dispensing surface **1331** has a surface area greater than the planar projection of the back opening **1313**. As such, purging gas
5 (indicated by the arrows shown in Fig. 13) may be released from the gas dispensing surface **1331** at a wider dispensing angle. In some embodiments, the gas dispensing face **1331** is provided with a curved cross-sectional profile (e.g., a parabolic) that extends toward the interior of the container body **1310**.

[0062] Fig. 14 illustrates a perspective view of a substrate container system
10 **1400** in accordance with some embodiments of the instant disclosure. Fig. 15 illustrates a cross-sectional regional view of a substrate container system in accordance with some embodiments of the instant disclosure. In some embodiments, the Fig. 15 may be a cross-sectional view taken from a plane parallel to the plane **P14** indicated in Fig. 14.

[0063] In some embodiments, a back cover of a container system may be
15 further provided with a plurality of fins configured to retain a filter member received in the container system. For example, back cover **1520** is further provided with fin member **1526** (e.g., comparable to fins **926** depicted with respect to FIG. 9) that forms a L-shaped corner **1526a** configured to establish urging contact with an inner edge **1531a** of a frame **1531** of a filter member **1530**, so as to laterally restrain the filter member **1530**.

[0064] Fig. 16 illustrates a cross-sectional view of an exemplary back cover for
20 a substrate container system in accordance with some embodiments of the instant disclosure. In some embodiments, a back cover of a container system may incorporate a self-contained gas guiding channel. For example, the exemplary back cover **1620** comprises two tubular structures **1629**, each of which forms a gas guiding channel **1651**
25 in fluid connection with a gas intake structure **1621/1622**, respectively.

[0065] Fig. 17 illustrates a regional cross section view of a substrate container system in accordance with some embodiments of the instant disclosure. For instance, FIG. 17 may be a regional enlarged sectional view in the dashed box shown in FIG. 15.

[0066] In the illustrated embodiment, back cover **1720** is further provided with
30 a wall **1727** that extends away from the inner face **1723** of the back cover **1720** along a width direction (e.g. along a x-direction) of the back cover **1720**, to the partition structure **1725**. In the illustrated embodiment, the partition structure **1725**, the wall **1727** and

inner surface **1723** constitutes a tubular structure that forms the gas guiding channel **1751**. In some embodiments, the back cover **1720** may be mounted with a side wall **1719** of the container body **1710**, whereby a buffering compartment **1760** is formed beside the gas guiding channel **1751**.

5 [0067] Referring to Fig. 18, which shows experimental data of internal humidity level versus time in a substrate container system as illustrated in Fig. 4.

 [0068] Particularly, the container body is setup to receive twenty five substrates under continuous purging conditions for an illustrated time period of ten units (e.g., from zero to ten in the time axis). For purpose of the experiment, a plurality of testing substrates with onboard sensors (e.g., 3 in the instant illustration, respectively indicated by their loaded slots 1/13/25) are loaded into the container body. Each of the testing substrate is provided with 5 sensors arranged at different locations (e.g., indicated by labels B/C/F/L/R). The front door is then installed, thus sealing the front opening of the container system.

15 [0069] A purging process starts at time zero, during which one or more purging gas is provided to the interior of the container system (e.g., through gas port **221a**). As a result, the internal humidity level of the container system is observed to drop noticeably during the initial period (e.g., dropped from about 40% to substantially 0 at around the 3rd time unit mark).

20 [0070] Subsequently, the front door of the system that seals the front opening is removed in the middle of the time period (e.g., at the 5th notch along the time axis). It was observed that proper placement of gas outlet (e.g., outlet **425c**) in the gas guiding channel helps to prevent entrance of external gas from ambient environment into the container system, thereby ensuring/maintaining low moisture level in the container system even during loading/unloading process.

25 [0071] Accordingly, one aspect of the instant disclosure provides a substrate container system, which comprises a container body having a bottom face, a front opening that enables passage of a substrate, and a back opening opposing the front opening, the back opening having a width smaller than that of the front opening; and a back cover that covers the back opening and establishes sealing engagement with the container body, wherein the back cover comprises a first gas inlet structure that bendingly extends under the bottom face of the container body upon assembly; wherein the first gas inlet structure

comprises a downward facing gas intake port opposing the bottom face of the container body.

[0072] In some embodiments of the instant disclosure, the back cover further comprises a second gas inlet structure, wherein the first and the second gas inlet structures
5 are substantially symmetrically arranged along a width direction of the back cover.

[0073] In some embodiments of the instant disclosure, the container body is configured to receive a filter member that covers the back opening of the container body.

[0074] In some embodiments of the instant disclosure, each one of the first and the second gas inlet structure is connected to a gas guiding channel that extends along a
10 height direction of the back cover.

[0075] In some embodiments of the instant disclosure, the gas guiding channel has an outlet arranged substantially in a middle section along the height of the back cover.

[0076] In some embodiments of the instant disclosure, the back cover and the filter member cooperatively define a buffering compartment connected to the gas guiding
15 channel via the outlet.

[0077] In some embodiments of the instant disclosure, the back cover comprises a pair of partition structures respectively adjacent the back opening in the width direction, extending along the height direction; wherein the outlet of the gas guiding channel is formed in the partition structure.

[0078] In some embodiments of the instant disclosure, the container body further comprises a pair of flange portions arranged opposing the front opening and respectively adjacent the back opening along a width direction; wherein the back cover at least partially overlaps the pair of flange portions, wherein the gas guiding channel is formed in an overlapped region between the back cover and the flange portions of the
20 container body.

[0079] In some embodiments of the instant disclosure, the system further comprises a filter member having a gas dispensing surface that extends toward the container body through the back opening.

[0080] In some embodiments of the instant disclosure, the system further comprises a sealing member having a first seal ring portion arranged between the back
30 cover and the container body, wherein the first seal ring portion comprises a section that

bendingly extends between the bottom face of the container body and the gas inlet structures.

[0081] In some embodiments of the instant disclosure, the sealing member further comprises a second seal ring portion arranged between the filter and the container body, wherein the first and the second seal ring portions are integrally connected.

[0082] Accordingly, one aspect of the instant disclosure provides a substrate container system, which comprises a container body having a bottom face, a front opening that enables passage of a substrate, and a back opening opposing the front opening, wherein the container body is configured to receive a filter member that covers the back opening of the container body; a back cover that establishes sealing engagement with the container body; wherein the back cover and the filter member cooperatively defines a buffering compartment; and a first gas guiding channel that extends along a height direction of the back cover; wherein the first gas guiding channel has an outlet connected to the buffering compartment.

[0083] In some embodiments of the instant disclosure, the outlet is arranged substantially in a middle section along the height of the back cover.

[0084] In some embodiments of the instant disclosure, the back cover comprises a pair of partition structures respectively adjacent the back opening in the width direction, extending along the height direction; wherein the outlet of the first gas guiding channel is formed in the partition structure.

[0085] In some embodiments of the instant disclosure, the container body further comprises a pair of flange portions arranged opposing the front opening and respectively adjacent the back opening along a width direction; wherein the back cover at least partially overlaps the pair of flange portions, wherein the first gas guiding channel is formed in an overlapped region between the back cover and the flange portions of the container body.

[0086] In some embodiments of the instant disclosure, the system further comprises a second gas guiding channel, wherein the first and the second gas guiding channels are substantially symmetrically arranged along a width direction of the back cover.

[0087] In some embodiments of the instant disclosure, the back cover further comprises a first gas inlet structure that bendingly extends under the bottom face of the

container body upon assembly; and wherein the first gas inlet structure connects the first gas guiding channel and comprises a downward facing gas intake port opposing the bottom face of the container body.

[0088] In some embodiments of the instant disclosure, the system further comprises a filter member having a gas dispensing surface, wherein a surface area of the gas dispensing surface is greater than that of the back opening.

[0089] In some embodiments of the instant disclosure, the system further comprises a sealing member having a first seal ring portion arranged between the back cover and the container body, wherein the first seal ring portion comprises a section that bendingly extends between the bottom face of the container body and the first gas inlet structures.

[0090] In some embodiments of the instant disclosure, the sealing member further comprises a second seal ring portion arranged between the filter and the container body, wherein the first and the second seal ring portions are integrally connected.

[0091] The embodiments shown and described above are only examples. Therefore, many such details are neither shown nor described. Even though numerous characteristics and advantages of the present technology have been set forth in the foregoing description, together with details of the structure and function, the disclosure is illustrative only, and changes may be made in the detail, especially in matters of shape, size, and arrangement of the parts within the principles, up to and including the full extent established by the broad general meaning of the terms used in the claims. It will therefore be appreciated that the embodiments described above may be modified within the scope of the claims.

WHAT IS CLAIMED IS:

1. A substrate container system, comprising:

a container body having a bottom face, a front opening that enables passage of a substrate, and a back opening opposing the front opening,

the back opening having a width smaller than that of the front opening; and

a back cover that covers the back opening and establishes sealing engagement with the container body,

wherein the back cover comprises a first gas inlet structure that bendingly extends under the bottom face of the container body upon assembly;

wherein the first gas inlet structure comprises a downward facing gas intake port opposing the bottom face of the container body.

2. The substrate container system of claim 1, wherein the back cover further comprises a second gas inlet structure, wherein the first and the second gas inlet structures are substantially symmetrically arranged along a width direction of the back cover.

3. The substrate container system of claim 2, wherein the container body is configured to receive a filter member that covers the back opening of the container body.

4. The substrate container system of claim 3, wherein each of the first and the second gas inlet structures is connected to a gas guiding channel that extends along a height direction of the back cover.

5. The substrate container system of claim 4, wherein the gas guiding channel has an outlet arranged substantially in a middle section along the height direction of the back cover.

6. The substrate container system of claim 5, wherein the back cover and the filter member cooperatively define a buffering compartment connected to the gas guiding channel via the outlet.

7. The substrate container system of claim 5, wherein the back cover comprises a pair of partition structures respectively adjacent the back opening in the width direction, extending along the height direction, wherein the outlet of the gas guiding channel is formed in the pair of partition structures.

8. The substrate container system of claim 7, wherein the container body further comprises a pair of flange portions arranged opposing the front opening and respectively adjacent the back opening along the width direction;

wherein the back cover at least partially overlaps the pair of flange portions,
wherein the gas guiding channel is formed in an overlapped region between the
back cover and the pair of flange portions of the container body.

9. The substrate container system of claim 3, further comprising the filter member
having a gas dispensing surface that extends toward the container body through the
back opening.

10. The substrate container system of claim 3, further comprising a sealing
member having a first seal ring portion arranged between the back cover and the
container body, wherein the first seal ring portion comprises a section that
bendingly extends between the bottom face of the container body and both the first
and the second gas inlet structures.

11. The substrate container system of claim 10, wherein the sealing member
further comprises a second seal ring portion arranged between the filter member
and the container body.

12. A substrate container system, comprising:

a container body having a bottom face, a front opening that enables passage of
a substrate, and a back opening opposing the front opening,
wherein the container body is configured to receive a filter member that covers the
back opening of the container body;

a back cover that establishes sealing engagement with the container body;

wherein the back cover and the filter member cooperatively defines a buffering compartment; and

a first gas guiding channel that extends along a height direction of the back cover;

wherein the first gas guiding channel has an outlet connected to the buffering compartment.

13. The substrate container system of claim 12, wherein the outlet is arranged substantially in a middle section along the height direction of the back cover.

14. The substrate container system of claim 12,

wherein the back cover comprises a pair of partition structures respectively adjacent the back opening in a width direction, extending along the height direction,

wherein the outlet of the first gas guiding channel is formed in the pair of partition structures.

15. The substrate container system of claim 12,

wherein the container body further comprises a pair of flange portions arranged opposing the front opening and respectively adjacent the back opening along a width direction;

wherein the back cover at least partially overlaps the pair of flange portions,

wherein the first gas guiding channel is formed in an overlapped region between the back cover and the pair of flange portions of the container body.

16. The substrate container system of claim 12, further comprising a second gas guiding channel, wherein the first and the second gas guiding channels are substantially symmetrically arranged along a width direction of the back cover.

17. The substrate container system of claim 12,
wherein the back cover further comprises a first gas inlet structure that bendingly extends under the bottom face of the container body upon assembly; and
wherein the first gas inlet structure connects the first gas guiding channel and comprises a downward facing gas intake port opposing the bottom face of the container body.

18. The substrate container system of claim 12, further comprising the filter member having a gas dispensing surface, wherein a surface area of the gas dispensing surface is greater than that of the back opening.

19. The substrate container system of claim 17, further comprising a sealing member having a first seal ring portion arranged between the back cover and the container body, wherein the first seal ring portion comprises a section that bendingly extends between the bottom face of the container body and the first gas inlet structure.

20. The substrate container system of claim 19, wherein the sealing member further comprises a second seal ring portion arranged between the filter member and the container body.