

A CARRIER AND A HOUSING METHOD FOR REDUCED PARTICLE CONTAMINATION

Field Of Invention

5 The present invention relates generally to carriers. In particular, the invention relates to a carrier and a housing method for substantially reducing particle contamination.

Background

Containers are often used to store and transport wafers or disks. In the semiconductor
10 industry, wafers are processed into circuit chips of integrated circuits whereas disks are manufactured into magnetic storage medium for use in storage devices of a computer. The wafers are typically made of material such as silicon or gallium arsenide and are subjected to many processing steps before they become the final product. Similarly, the disks can either be metal or glass substrates with process
15 coatings on one or both sides of the disks and are also subjected to a number of processing steps as well. During manufacturing, the disks or the wafers are transported from place of manufacture to processing facilities and are also transported within the processing facilities. The wafers are particularly fragile and there is always concern for the possibility of breakage and/or other damages.

20 The wafers and the disks are typically transported in containers. The containers are adapted and shaped to provide a generally sealed enclosure together with secure retention and cushioning means for the wafers and the disks. It is of paramount importance that the enclosure is very clean and also be able to preclude the entry of
25 particles or other contaminants. Any particles or other containments in the containers can adhere and cause damage to the wafers or the disks.

Currently, there are many substantially similar products on the market for such containers. Further, designs and configurations of such containers are generally
30 standardized. Typically, such containers comprise three principal parts, a cassette body, a top cover and a bottom cover. These components are preferably molded from thermoplastics such as polycarbonate and polypropylene. Despite the vast selection of containers products available, the majority of such containers still suffer from a

number of shortcomings. Mostly notably, such containers still face a common problem of generating microscopic particles when the top cover engages the cassette body during closure. This produces particles that contaminate the contents carried by the cassette body.

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U.S. Pat. No. 5,253,755 (Maenke) and U.S. Pat. No. 4,721,207 (Kikuchi) describe basic component configurations of containers for containing hard disks. The top cover described in each of Maenke and Kikuchi includes protrusions at lower ends of both flaps of the top cover that lock onto U-shaped recesses located at opposing ends of the cassette body. Although the U-shaped recesses are necessary for providing access to the confines of the cassette body, its design is undesirable and unwanted particles are produced when the protrusions snap-latches over the U-shaped recesses to substantially contaminate wafers or disks placed in the containers.

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U.S. Pat. No. 6,070,730 (Narisawa) attempts to overcome the shortcomings of the containers as described in Maenke and Kikuchi by using hinged flaps to secure onto protruding hook portions located at opposing ends of the cassette body. Although the design of the top cover of Narisawa substantially alleviates the problem of creating unwanted particles, a two-step action is needed to firmly secure the top cover to the cassette body. This creates inconvenience during handling of wafers or disks in manufacturing, which will then inevitably slow down the rate of production. Additionally, modifications to and reconfiguration to existing automation systems are required to enable performance of the two-step action. These are detrimental to the overall manufacturing operation.

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In accordance with the aforementioned issues, there is therefore a need for an improved container for substantially reducing particle contamination and for enabling seamless integration with existing automation systems.

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Summary

In accordance with a first aspect of the invention, there is disclosed a carrier comprising an enclosure. The enclosure comprises an end wall and defining a containment space. The enclosure forms an edge for defining an opening to the containment space with the opening being shaped and dimensioned for being covered by a cover. An end face defined on the end wall outwardly opposes the containment space. An ingress is formed in the end wall for providing access to the containment space. The ingress is shaped and dimensioned for being covered by a flap when the cover covers the opening with the flap being formed on the cover and having a lug. A separation wall extends substantially adjacent the ingress and substantially parallel the end face and a protrusion is formed substantially contiguous to the ingress for securing the cover to the carrier. The protrusion protrudes from the end wall and is disposed proximal the separation wall with the flap being guided over the ingress when the lug travels along the ingress towards the protrusion. The separation wall substantially forms a structural barrier between the protrusion and the containment space when the lug engages the protrusion for securing the cover to the carrier, whereby travel of contaminants from the protrusion to the containment space is substantially impeded by the separation wall.

In accordance with a second aspect of the invention, there is disclosed a carrier comprising an enclosure. The enclosure comprises an end wall and defining a containment space. The enclosure forms a top edge for defining a top opening and a bottom edge for defining a bottom opening to the containment space. The top opening is shaped and dimensioned for being covered by a cover. An end face defined on the end wall outwardly opposes the containment space. An ingress is formed in the end wall for providing access to the containment space with the ingress being shaped and dimensioned for being covered by a flap when the cover covers the opening. The flap is formed on the cover and has a lug. A separation wall extends substantially adjacent the ingress and substantially parallel the end face and a protrusion is formed substantially contiguous to the ingress for securing the cover to the carrier. The protrusion protrudes from the end wall is disposed proximal the separation wall. The flap is guided over the ingress when the lug travels along the ingress towards the protrusion. The separation wall substantially forms a structural

barrier between the protrusion and the containment space when the lug engages the protrusion for securing the cover to the carrier, whereby travel of contaminants from the protrusion to the containment space is substantially impeded by the separation wall.

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In accordance with a third aspect of the invention, there is disclosed a housing method comprising providing a carrier. The carrier comprises an enclosure comprising an end wall. The enclosure defines a containment space. The enclosure forms an edge for defining an opening to the containment space. An end face defined on the end wall outwardly opposes the containment space. An ingress is formed in the end wall for providing access to the containment space. The ingress is shaped and dimensioned for being covered by a flap when the cover covers the opening. A separation wall extends substantially adjacent the ingress and substantially parallel the end face. A protrusion is formed substantially contiguous to the ingress for securing the cover to the carrier with the protrusion protruding from the end wall and being proximal the separation wall. The housing method further comprises providing a cover having a flap extending perpendicularly therefrom with the cover being shaped and dimensioned for covering the opening of the carrier and the flap having a lug formed thereon, and inserting at least one article into the containment space of the carrier and guiding the flap over the ingress with the lug traveling along the ingress towards the protrusion. The separation wall substantially forms a structural barrier between the protrusion and the containment space when the lug engages the protrusion for securing the cover to the carrier, whereby travel of contaminants from the protrusion to the containment space is substantially impeded by the separation wall.

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In accordance with a fourth aspect of the invention, there is disclosed a carrier comprising an enclosure. The enclosure comprises an end wall and defines a containment space. The enclosure forms an edge for defining an opening to the containment space with the opening being shaped and dimensioned for being covered by a cover. An end face is defined on the end wall and outwardly opposes the containment space. An ingress formed in the end wall provides access to the containment space. The ingress is shaped and dimensioned for being covered by a flap when the cover covers the opening with the flap being formed on the cover and

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having a lug. A separation wall extends substantially adjacent the ingress and substantially parallel the end face and a flange is formed substantially contiguous to the ingress for securing the cover to the carrier. The flange protrudes from the end wall and extends substantially contiguous to at least a portion of the ingress with the flap being guided over the ingress when the lug travels along the ingress towards the flange. At least a portion of the flange is wedge-shaped for guiding the lug thereover when the lug engages the flange. The separation wall substantially forms a structural barrier between the flange and the containment space when the lug engages the flange for securing the cover to the carrier, whereby travel of contaminants from the protrusion to the containment space is substantially impeded by the separation wall.

Brief Description Of The Drawings

Embodiments of the invention are described hereinafter with reference to the following drawings, in which:

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FIG. 1 shows a partial an isometric view of a carrier;

FIG. 2 shows a front elevation of the carrier of FIG. 1;

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FIG. 3 shows a side elevation of the carrier of FIG. 1;

FIG. 4 shows a partial sectional view of a flange and a separation wall formed on an end wall of the carrier of FIG. 1 according to view 'A' of FIG. 2;

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FIG. 5 shows an exploded isometric view of the carrier of FIG. 1 disposed between a top cover and a bottom cover;

FIG. 6 shows a front elevation of the carrier of FIG. 5 with the top cover and the bottom cover being attached thereto;

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FIG. 7 shows a partial sectional view of a lug of the top cover being coupled to the flange of the carrier of FIG. 5 according to view 'B' of FIG. 6;

FIG. 8 is a process flow diagram of a cover coupling process for coupling the top cover to the carrier of FIG. 5;

FIG. 9 is a sectional side elevation of the carrier of FIG. 5 with the top cover and the bottom cover being coupled thereto and a disk disposed therein; and

FIG. 10 is a process flow diagram of a housing method utilising the carrier of FIG. 5.

Detailed Description

A carrier and a housing method are described hereinafter for addressing the foregoing problems.

An embodiment of the invention, a carrier 20 is described with reference to FIG. 1, which shows an isometric view of the carrier 20, and FIG. 2, which shows a front elevation of the carrier 20.

As shown in FIGS. 1 and 2, the carrier 20 comprises an enclosure 22 for defining a containment space 24. The enclosure 22 comprises two opposing end walls 26 and two side walls 28. Each of the two side walls 28 spans between the two opposing end walls 26. Ribs 30 are preferably formed on the two opposing side walls 28 inside the containment space 24 for supporting one or more disk (later shown). Alternatively, the carrier 20 is for containing articles other than disks and for use in other applications, for example, as a sterile container for medical apparatus or articles.

As shown in FIGS. 1, 2 and 3, the enclosure 22 comprises a top edge 34 for defining a top opening 36 and a bottom edge 38 for defining a bottom opening 40. Each of the end walls 26 has an end face 42 outwardly opposing the containment space 24. Furthermore, each of the end walls 26 has an ingress 44 formed therein for providing access to the containment space 24. The ingress 44 preferably has a U shape. A flange 46 extends from the end face 42 and is substantially contiguous to the ingress 44 of each of the end walls 26. As shown in FIGS 3 and 4, the flange 46 protrudes preferably substantially perpendicular to the end face 42. A separation wall 48

preferably extends along a portion of the ingress 44 with the separation wall 48 being substantially parallel to the end face 42.

Referring to FIGS. 5 and 6, the bottom opening 40 is shaped and dimensioned for being covered by a bottom cover 50. The bottom cover 50 is substantially planar and fit-couplable to the carrier 20.

A top cover 52 is securable to the top opening 36. The top cover 52 comprises a substantially planar lid portion 54 having two ends. A flap 56 extends from each of the two ends of the lid portion 54 and terminates at a free end 58. The flap 56 extends substantially perpendicularly to the lid portion 54 with the free end 58 thereof being preferably rounded to correspond with the U-shape of the ingress 44.

Referring to FIG. 7, a lug 60 is formed on the flap 56 adjacent the free end 58 thereof. The lug 60 protrudes towards the containment space 24 when the top cover 52 is disposed over the top opening 36 of the carrier 20.

The top cover 52 is couplable to the carrier 20 through a cover coupling process 100. FIG. 6 shows a process flow diagram of the cover coupling process 100. In a step 102 of the cover coupling process 100, the lid portion 54 is aligned over the top opening 36 with the flap 56 extending towards the ingress 44 of the carrier 20. In a step 104, the flap 56 is guided over the ingress 44 with the lug 60 travelling along the ingress 44 towards the flange 46.

When the lug 60 abuts the flange 46, further displacement of the lid portion 54 of the top cover 52 towards the top opening 36 in a step 106 resiliently bends the free end 58 of the flap 56 away from the flange 46 to allow the lug 60 to travel over the flange 46. The lug 60 preferably has a wedge shape to enable sliding of the lug 60 over the flange 46. To further facilitate sliding of the lug over the flange 46, a bottom portion of the U-shape of the flange 46 whereat the lug 60 abuts preferably has a ramp portion 62. The ramp portion 62 has substantially a wedge shape for further shape-complimenting the wedge shape of the lug 60. Once the lug 60 has travelled over the flange 46, the flap 56 biases the free end 58 thereof towards the end face 42 in a step

108. In the step 108, the lug 60 latches over the flange 46 for securing the top cover 52 to the carrier 20.

In the step 106, attrition between the lug 60 and the flange 46 results in particulation of the lug 60. Particles generated during particulation may travel into the containment space 24 of the carrier to contaminate contents held within the enclosure 22. Additionally, snapping effect of the free end 58 being biased towards the end face 42 in the step 108 further aids delivery of the particles towards the containment space 24.

Therefore, the separation wall 48 substantially forms a structural barrier between the lug 60 and the containment space 24 when the lug 60 engages the flange 46. The separation wall 48 substantially impedes travel of particles, specifically particles that are impact generated in the step 108, into the containment space 24. The ramp portion 62 of the flange 46 substantially smoothens travel of the lug 60 thereover to reduce frictionally generated particles. The ramp portion 62 of the flange 46 functions in tandem with the separation wall 48 to substantially reduce particulation from use of the carrier 20 and particle contamination of articles contained in the carrier.

To remove the top cover 52 from the carrier 20, the free end 58 of the flap 56 is displaced away from the end face 42 to allow initially traversing of the lug 60 across the flange 46 and subsequently displacement of the lug 60 along and away from the ingress 44.

As shown in FIG. 9, the carrier 20 enables a disk 64 to be housed therein using a housing method 200. FIG. 10 shows a process flow diagram of the housing method 200. The carrier 20 and the top cover 52 are first provided in a step 202 of the housing method 200. Next, one or more of the disk 64 is inserted into the containment space 24 of the carrier 20 in a step 204. A loading mechanism (not shown) preferably inserts the disk 64 into the carrier 20 and sits the disk 64 between the ribs 30. The ingress 44 facilitates access to the containment space 24 by the loading mechanism. Next, both the top opening 40 and the ingress 44 are covered by the top cover 52 using the cover coupling process 100.

In the foregoing manner, a carrier and a housing method are described according to an embodiment of the invention for addressing the foregoing disadvantages of conventional containers. Although only one embodiment of the invention is disclosed, it will be apparent to one skilled in the art in view of this disclosure that
5 numerous changes and/or modification can be made without departing from the scope and spirit of the invention.

Claims

1. A carrier comprising:

an enclosure comprising an end wall, the enclosure defining a containment space and for forming an edge for defining an opening to the containment space;

an end face defined on the end wall and outwardly opposing the containment space;

an ingress formed in the end wall for providing access to the containment space;

a separation wall extending substantially adjacent the ingress and substantially parallel the end face; and

a protrusion formed substantially contiguous to the ingress, the protrusion protruding from the end wall and being adjacent the separation wall,

wherein the opening is shaped and dimensioned for covering of the enclosure by a cover, the ingress is shaped and dimensioned for covering of the ingress by a flap when the cover covers the opening, the flap is formed on the cover and has a lug, the protrusion is for securing the cover of the carrier, the flap is guided over the ingress when the lug travels along the ingress towards the protrusion, the separation wall substantially forms a structural barrier between the protrusion and the containment space when the lug engages the protrusion for securing the cover to the carrier,

whereby travel of contaminants from the protrusion to the containment space is substantially impeded by the separation wall.

2. The carrier as in claim 1, the enclosure further comprising:

two opposing side walls; and

a plurality of ribs formed on the two opposing side walls within the containment space for supporting at least one article.

3. The carrier as in claim 1, the ingress having a U shape.

4. The carrier as in claim 1, the flap extends substantially perpendicular to the cover.
5. The carrier as in claim 1, the flap extending from the cover and terminating at an end portion and the lug being formed adjacent the periphery of the flap and away from the end portion of the flap.
6. The carrier as in claim 1, the separation wall being formed substantially perpendicular to the end face.
7. The carrier as in claim 1, the protrusion being a flange extending substantially contiguous to at least a portion of the ingress.
8. The carrier as in claim 1, at least a portion of the protrusion being wedge-shaped for guiding the lug thereover when the lug engages the protrusion for securing the cover to the carrier.
9. The carrier as in claim 1, further comprising:
 - a slide being formed as a portion of the protrusion for guiding the lug thereover when the lug engages the protrusion for securing the cover to the carrier.
10. The carrier as in claim 8, the lug being wedge-shaped.
11. A carrier comprising:
 - an enclosure comprising an end wall, the enclosure defining a containment space and for forming a top edge for defining a top opening and a bottom edge for defining a bottom opening to the containment space;
 - an end face defined on the end wall and outwardly opposing the containment space;
 - an ingress formed in the end wall for providing access to the containment space;

a separation wall extending substantially adjacent the ingress and substantially parallel the end face; and

a protrusion formed substantially contiguous to the ingress, the protrusion protruding from the end wall and being adjacent the separation wall,

wherein the top opening is shaped and dimensioned for covering of the enclosure by a cover, the ingress is shaped and dimensioned for covering of the ingress by a flap when the cover covers the opening, the flap is formed on the cover and has a lug, the protrusion is for securing the cover of the carrier, the flap being guided over the ingress when the lug travels along the ingress towards the protrusion, the separation wall substantially forms a structural barrier between the protrusion and the containment space when the lug engages the protrusion for securing the cover to the carrier,

whereby travel of contaminants from the protrusion to the containment space is substantially impeded by the separation wall.

12. The carrier as in claim 11, the enclosure further comprising:

two opposing side walls; and

a plurality of ribs formed on the two opposing side walls within the containment space for supporting at least one article.

13. The carrier as in claim 11, the ingress having a U shape.

14. The carrier as in claim 11, the flap extends substantially perpendicular to the cover and terminating at an end portion and the lug being formed adjacent the periphery of the flap and away from the end portion of the flap.

15. The carrier as in claim 11, the separation wall being formed substantially perpendicular to the end face.

16. The carrier as in claim 11, the protrusion being a flange extending substantially contiguous to at least a portion of the ingress and at least a

portion of the protrusion being wedge-shaped for guiding the lug thereover when the lug engages the protrusion for securing the cover to the carrier.

17. The carrier as in claim 16, the lug being wedge-shaped.

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18. The carrier as in claim 11, the bottom opening being shaped and dimensioned for being covered by a bottom cover.

19. A housing method comprising:

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providing a carrier comprising:

an enclosure comprising an end wall, the enclosure defining a containment space and for forming an edge for defining an opening to the containment space;

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an end face defined on the end wall and outwardly opposing the containment space;

an ingress formed in the end wall for providing access to the containment space, the ingress being shaped and dimensioned for covering of the ingress by a flap when the cover covers the opening;

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a separation wall extending substantially adjacent the ingress and substantially parallel the end face; and

a protrusion formed substantially contiguous to the ingress for securing the cover of the carrier, the protrusion protruding from the end wall adjacent the separation wall,

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providing a cover having a flap extending perpendicularly therefrom, the cover being shaped and dimensioned for covering the opening of the carrier, the flap having a lug formed thereon;

inserting at least one article into the containment space of the carrier;

and

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guiding the flap over the ingress with the lug traveling along the ingress towards the protrusion,

wherein the separation wall substantially forms a structural barrier between the protrusion and the containment space when the lug engages the protrusion for securing the cover to the carrier,

whereby travel of contaminants from the protrusion to the containment space is substantially impeded by the separation wall.

20. The method as in claim 19, the enclosure further comprising:
5 two opposing side walls; and
a plurality of ribs formed on the two opposing side walls within the containment space for supporting at least one article.
21. The method as in claim 19, the ingress having a U shape.
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22. The method as in claim 19, the flap extends substantially perpendicular to the cover and terminating at an end portion and the lug being formed adjacent the periphery of the flap and away from the end portion of the flap.
- 15 23. The method as in claim 19, the separation wall being formed substantially perpendicular to the end face.
24. The method as in claim 19, the protrusion being a flange extending substantially contiguous to at least a portion of the ingress and at least a
20 portion of the protrusion being wedge-shaped for guiding the lug thereover when the lug engages the protrusion for securing the cover to the carrier.
25. The method as in claim 19, the lug being wedge-shaped.
- 25 26. A carrier comprising:
an enclosure comprising an end wall, the enclosure defining a containment space and for forming an edge for defining an opening to the containment space;
an end face defined on the end wall and outwardly opposing the
30 containment space;
an ingress formed in the end wall for providing access to the containment space;

a separation wall extending substantially adjacent the ingress and substantially parallel the end face; and

a flange formed substantially contiguous to the ingress, the flange protruding from the end wall and extending substantially adjacent at least a portion of the ingress,

wherein the opening is shaped and dimensioned for covering of the enclosure by a cover, the ingress is shaped and dimensioned for covering of the ingress by a flap when the cover covers the opening, the flap is formed on the cover and has a lug, the flange is for securing the cover of the carrier, the flap is guided over the ingress when the lug travels along the ingress towards the flange, at least a portion of the flange is wedge-shaped for guiding the lug thereover when the lug engages the flange, the separation wall substantially forms a structural barrier between the flange and the containment space when the lug engages the flange for securing the cover to the carrier,

whereby travel of contaminants from the protrusion to the containment space is substantially impeded by the separation wall.