A COVER FOR REDUCED PARTICLE CONTAMINATION

Field of Invention

The present invention relates generally to container covers. More particularly, the present invention relates to a cover and a cover attachment method for substantially reducing particle contamination.

Background

To store and transport wafers, disks and other similar inventory, special containers, also known as carriers, cassettes or boats are needed. In the semiconductor industry, wafers are processed into circuit chips of integrated circuits, and disks are manufactured into magnetic storage mediums for use in storage devices of computers. Wafers are typically made of materials such as silicon or gallium arsenide and are subjected to many processing steps before they become finished products. Likewise, disks are typically made of metal or glass substrates, including silicon and gallium arsenide, with process coatings on one or both side of the disks. The disks are also subjected to many processing steps before becoming finished products.

Wafers and disks are valuable articles. However, they are also fragile articles, and therefore need to be stored and transported carefully. It is vital that the containers that are used to store and transport the wafers and disks are clean and are also able to prevent entry of particles and/or other contaminants from entering the container's containment space. The entry of particles and other contaminants into the container's containment space can result in contamination of and damage to the wafers and disks that are stored within the container's containment space.

A typical container comprises a disk cassette having two side walls and two end walls. Top edges of the two side walls and the two end walls define a top opening, and bottom edges of the two side walls and two end walls define a bottom opening. The typical container further comprises a top cover that is able to cover the top opening and a bottom cover that

is able to cover the bottom opening. The disk cassette, the top cover and the bottom cover are each formed separately by injection molding. The disk cassette is typically formed from rigid thermoplastics such as polycarbonate and polypropylene. The disk cassette typically has elongate sidewalls and substantially vertical end walls. The substantially vertical end walls have U-shaped contours that define a U-shaped ingress or opening. A flap that extends perpendicularly from a side of the top cover typically covers the U-shaped ingress.

Magnetic disk and wafer manufacturing process is largely automated and is generally standardized industry-wide. Therefore, core design of the container is typically unable to be altered significantly. For example, the U-shaped ingress is typically necessary in the core design of the container for facilitating access of an automated manipulator into the containment space. Additionally, any improvements or modifications made to the container's design or structure must take into careful consideration ease of improved or modified container's integration into the largely automated manufacturing process.

Currently, a majority of existing containers face a number of significant shortcomings. Most notably, the majority of existing containers still face a problem of significant particle generation and entry into the containment space of the container during engagement of the top cover with the disk cassette. Particles are generated during the engagement due to a snapping action that occurs when the top cover latches onto flanges that are located on the end walls of the disk cassette, usually proximal to the U-shaped ingresses. The particles generated then enter the containment space where they come into contact with the disks or wafers contained within, thereby contaminating and potentially destroying usability of the disks or wafers.

U.S. patent 5, 253, 755 by Maenke and U.S. patent 4,721,207 by Kikuchi describe variations of the container. The containers as described in Maenke's and Kikuchi's patents have protrusions at lower ends of the flaps that extend perpendicularly from the top cover. The protrusions snap-latches over the U-shaped ingresses that are located on the end walls of the disc cassette. However, snap-latching of the protrusions over the U-shaped ingresses

causes substantial particle generation. Generated particles then enter the containment space of the container, thereby significantly contaminating the disks or wafers that are contained within the container. As a result, manufacturers are often required to put “dummy” disks, or disks that are not intended for use in a product, on each side of the disk cassette that is closest to the end walls. However, precluding use of these “dummy” disks can enhance manufacturing throughput while lowering costs to the manufacturer.

There have been attempts made to reduce particle generation and entry into the containment space during attachment of the top cover to the disk cassette, and more specifically during the snap-latching of the protrusions over the U-shaped ingresses. One such attempt at reducing particle entry into the containment space provides a separation wall proximal a point of snap contact between the top cover and the U-shaped ingress of disk cassette, thereby substantially impeding travel and entry of generated particles into the containment space of the container.

However, these attempts, although successfully reducing particle generation and entry into the containment space, are unable to almost completely remove all entry of generated particles into the containment space. As precision and smaller tolerances become the expected norm in wafer and disk manufacturing, a method of cover attachment that almost completely removes entry of generated particles into the containment space is needed.

In accordance with the above-mentioned shortcomings, there is an apparent need to significantly reduce or eliminate particle contamination of disks or wafers within containers while allowing seamless integration with existing automation systems.

Summary

In accordance with a first aspect of the invention, there is disclosed a cover comprising a body and at least one clasp extending from the body. The at least one clasp is engagable with an at least one flap extending from a lid. A container is disposed between the body and the lid, the container having a plurality of walls being configured for defining a

containment space and being shaped for defining an at least one ingress for facilitating access to the containment space. The at least one flap substantially shape-matches the at least one ingress. The body is displaceable towards the lid with the container disposed therebetween for engaging the at least one clasp with the at least one flap. Engaging the at least one clasp with the at least one flap couples the container between the body and the lid and disposes the at least one flap adjacent the at least one ingress and between the at least one clasp and the containment space to thereby impede travel of contaminants into the containment space through the at least one ingress.

In accordance with a second aspect of the invention, there is disclosed a cover assembly comprising a first cover and a second cover. The first cover comprises a body and at least one clasp extending from the body. The second cover comprises a lid and at least one flap extending from the lid. The at least one clasp is engagable with the at least one flap with a container disposed between the body and the lid. The container has a plurality of walls being configured for defining a containment space and being shaped for defining at least one ingress for facilitating access to the containment space. The at least one flap substantially shape-matches the at least one ingress. The first cover is displaceable towards the second cover with the container disposed therebetween for engaging the at least one clasp with the at least one flap. Engagement of the at least one clasp with the at least one flap couples the container between the first cover and the second cover and disposes the at least one flap adjacent the at least one ingress and between the at least one clasp and the containment space to thereby impede travel of contaminants into the containment space through the at least one ingress.

In accordance with a third aspect of the invention, there is disclosed a system for cover attachment comprising a container having a plurality of walls being configured for defining a containment space and being shaped for defining at least one ingress for facilitating access to the containment space. The system for cover attachment further comprises a first cover and a second cover. The first cover comprises a lid and at least one flap, the at least one flap substantially shape-matching the at least one ingress. The second cover comprises

a body and at least one clasp extending from the body, the at least one clasp engagable with the at least one flap with the container disposed between the body and the lid. The first cover is displaceable towards the second cover with the container disposed therebetween for engaging the at least one clasp with the at least one flap. Engaging the at least one clasp with the at least one flap also disposes the at least one flap adjacent the at least one ingress and between the at least one clasp and the containment space to thereby impede travel of contaminants into the containment space through the at least one ingress.

In accordance with a fourth aspect of the invention, there is disclosed a method for cover attachment comprising providing a container having a plurality of walls being configured for defining a containment space and being shaped for defining at least one ingress for facilitating access to the containment space. The method further comprises covering the at least one ingress with an at least one flap extending from a lid, the at least one flap substantially shape-matching the at least one ingress. The method also comprises attaching a cover to the container, the cover comprising a body and at least one clasp extending from the body, the at least one clasp being engagable with the at least one flap with the container disposed between the body and the lid. Engaging the at least one clasp with the at least one flap then occurs in the method. Engagement of the at least one clasp with the at least one flap couples the container between the body and the lid and disposes the at least one flap adjacent the at least one ingress and between that at least one clasp and the containment space to thereby impede travel of contaminants into the containment space through the at least one ingress.

Brief Description of The Drawings

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

FIG. 1 shows a partial isometric view of a container;

FIG. 2 shows a partial front elevation of a bottom cover that is fit-couplable to the container of FIG. 1 and comprising a pair of clasps;

FIG. 3 shows a partial bottom view of the bottom cover of FIG. 2;

FIG. 4 shows a partial isometric view of the bottom cover of FIG. 2;

FIG. 5 shows another partial isometric view of the bottom cover of FIG. 2;

FIG. 6 shows a front elevation of one of a pair of clasps of the bottom cover of FIG. 2 according to view ‘A’;

FIG. 7 shows a partial front view of a top cover that is fit-couplable to the container of FIG. 1, the top cover comprising a pair of flaps;

FIG. 8 shows a partial isometric view of the top cover of FIG. 7;

FIG. 9 shows a partial front elevation of one of a pair of flaps of FIG. 7 according to view ‘B’;

FIG. 10 shows a partial isometric view of one of the pair of flaps of FIG. 7 according to the view ‘B’;

FIG. 11 is a process flow diagram of a cover attachment method for attaching the bottom cover of FIG. 2 and the top cover of FIG. 7 to the container of FIG. 1.

FIG. 12 is a process flow diagram of a cover detachment method for detaching the bottom cover of FIG. 2 and the top cover of FIG. 7 from the container of FIG. 1.

Detailed Description

With reference to the drawings, a cover and a cover attachment method for reduced particle contamination are described hereinafter.

A number of container cover designs and methods for cover attachment to containers storing media or substrates (hereinafter referred to as media) have been devised in an attempt to reduce particle generation and entry into such containers. However, most of these designs and devised methods have been unable to almost completely eliminate particle entry into containers. Currently manufactured covers for containers generate significant amount of particles during engagement with the container. Importantly, the generated particles thereafter enter the container's containment space thereby contaminating the media stored within. Accordingly, there is a need for the cover and the cover attachment method for reduced particle contamination provided by the present invention.

For purposes of brevity and clarity, description of the present invention is limited hereinafter to covers for containers that would allow significantly reduced or eliminated particle contamination of the media stored within the containers. This however does not preclude various embodiments of the invention from other applications that require similar operating performance. Functional and operational principles upon which embodiments of the invention are based on remain the same throughout the various embodiments.

An embodiment of the invention is described in greater detail hereinafter in accordance to illustrations provided in FIG. 1 to FIG. 10 of the drawings, wherein like elements are identified with like reference numerals.

FIG.1 shows a container 20, also typically known as a cassette, to which covers are fit-couplable. The container 20 comprises two opposing side walls 22 and two opposing end walls 24. The two opposing side walls 22 and the two opposing end walls 24 form a containment space 26 within which the media is contained. The two opposing side walls 22 and the two opposing end walls 24 collectively form a top edge 28 and a bottom edge 30. The top edge 28 defines a top opening 32 and the bottom edge 30 defines a bottom opening 34. The two opposing side walls 22 preferably have a number of ribs 36 facing the containment space 26 for supporting one or more media or article. Examples of media

include disks and wafers. Each of the end walls 24 has an ingress 38 for allowing access to the containment space 26. The ingress is preferably U-shaped.

FIG. 2 to FIG. 5 show a bottom cover 50 that is couplable to the bottom edge 30 of the disk container 20. Preferably, the bottom cover 50 is shaped and dimensioned to be fit-couplable with the bottom edge 30 of the container 20. Dimensions of the bottom edge 30, and hence the bottom cover 50, are generally fixed industry-wide, and varies according to range of sizes of the media that is contained within the container 20. The bottom cover 50 is preferably rectangular, for shape matching the bottom edge 30 of the container 20. Accordingly, the bottom cover 50 has two shorter opposing sides 52 of equal length and two longer opposing sides 54 of equal length. Further preferably, the bottom cover 50 comprises a body 56 that is substantially planar. The body 56 is dimensioned for covering the bottom opening 34 when coupled to the bottom edge 30.

The bottom cover 50 further comprises two clasps 58. The two clasps 58 are positioned at and extend from each of the two shorter opposing sides 52 of the bottom cover 50. The clasp 58 is preferably narrower at a base of the clasp 60 proximal to the two shorter opposing sides 52 of the bottom cover 50. The narrowed base of the clasp 60 facilitates bending of the clasp 58 towards and away from the other clasp 58 that is positioned at the opposing side of the bottom cover 50.

As is clearly illustrated by an enlarged view of the clasp as shown in FIG. 6, the clasp 58 has a tooth 62 or protrusion proximal to a free end of the clasp 64. The tooth 62 or protrusion extends from an interior surface of the clasp 66. The interior surface of the clasp 66 faces the clasp 58 that is positioned at the opposing side of the bottom cover 50. Preferably, the tooth 62 comprises a hooked end portion 68. The clasp 58 and the tooth 62 are preferably made from a resilient but flexible plastic polymer.

FIG. 7 and FIG. 8 show a top cover 70 couplable to the top edge 28 of the container 20. Preferably, the top cover is shaped and dimensioned to be fit-couplable to the top edge 28

of the container 20. The top cover 70 comprises a substantially planar lid portion 72. The top cover 70 is also preferably rectangular, for shape matching the top edge 28 of the container 20. The top cover 70 therefore has two shorter opposing sides 74 and two longer opposing sides 76. A flap 78 extends from each of the two shorter opposing sides 74 of the top cover 70 and terminates at a free end 80. The flap 78 extends substantially perpendicular to the lid portion 72. The flap 78 is preferably rounded at the free end 80 to correspond with edges of the U-shaped ingress 38 of the end walls 24 of the container 20. Alternatively, the flap 78 extends from a lid of the container 20.

FIG. 9 and FIG. 10 show enlarged partial views of the flap 78. The flap 78 is specifically designed to accommodate the clasp 58. The clasp 58 fixes onto a surface of the flap 82 that is exterior to the containment space 26 of the container 20. The exterior surface of the flap 82 has a ledge portion 84 onto which the clasp 58 is engagable or fixable. Preferably the ledge portion is specifically designed and shaped for engagement with the clasp 58. Further preferably, the ledge portion 84 has a slightly elevated hump 86. The hooked portion of the clasp 68 goes over and hooks onto the slightly elevated hump 86, thereby facilitating a secure engagement of the clasp 58 with the flap 78. Preferably, the flap 78 further comprises a base notch 88 for facilitating precise positioning and locating the clasp 58 therein during engagement of the clasp 58 with the flap 78. The engagement of the clasp 58 onto the flap 78 aids a secure attachment of the bottom cover 50 and the top cover 70 to the container 20.

As engagement or snapping action of the clasp 58 occurs on the surface of the flap 82 that is exterior to the containment space 26, particles generated during the engagement or snapping action is thereby prevented from entering into the containment space 26 of the container 20 by the flap 78. Therefore, particle contamination of the media stored within the containment space 26 of the container 20 is significantly reduced or even almost eliminated.

The container 20, the top cover 70 and the bottom cover 50 are each made of a molded polymer. The molded polymer is preferably flexible and resilient.

The top cover 70 and the bottom cover 50 are attached or engaged to the container 20 through a cover attachment method 100. FIG. 11 shows a process flow diagram of the cover attachment method 100. In a step 102 of the cover attachment method 100, the container 20 is provided. In a step 104, the bottom cover 50 is coupled to the bottom edge 30 of the container 20, thereby covering the bottom opening 34 of the container 20. In a preferred configuration, the clasp 58 at a resting state is naturally inclined in a final engaged position on the flap 78 thereby facilitating automatic snap latching of the clasp 58 onto the flap 78 during coupling of the bottom cover 50 to the bottom edge 30 of the container 20. In an alternative configuration, the resting state of the clasp 58 is slightly displaced from the flap 78. In this alternative configuration, the clasp 58 has to be displaced towards the flap 78 for engagement therewith.

The top cover 70 is then coupled to the top opening 32 of the container 20 in a step 106. The flaps 78 that extend substantially perpendicularly from each of the two shorter opposing sides 74 of the top cover 70 covers the two U-shaped ingresses 38.

In a step 108 of the cover attachment method 100, the clasp 58 is fixed onto or engages with the exterior surface of the flap 82. More specifically, the clasp 58 is fixed onto or engages with the ledge portion 84 of the flap 78. Even more specifically, the hooked portion of the clasp 68 goes over and hooks onto the slightly elevated hump 86. As previously mentioned, the base notch 88 facilitates a more precise positioning of the clasp 58. The engagement of the clasp 58 with the flap 78 couples the container 20 between the top cover 70 and the bottom cover 50. The flap 78 is positioned between the clasp 58 and the containment space 26 for thereby impeding travel of generated particles into the containment space 26 of the container 20.

FIG. 12 shows a process flow diagram of a cover detachment or disengagement method 200. In a step 210, the clasp 58 is displaced from the flap 78 thereby facilitating disengagement of the clasp 58 from the flap 78. The disengagement of the clasp 58 from the flap 78 enables a decoupling of the bottom cover 50 and the top cover 70 from the container 20 in a step 220.

As is apparent from the above detailed description, the disclosed cover and cover attachment method significantly reduces or even eliminates particle entry into the containment space of the container. The cover and cover attachment method as provided by the present invention eliminates snapping action of protrusions from a flap of a top cover with one of a U-shaped ingress of a disk container as is required with a typical disk or wafer container that is currently on the market. The cover and cover attachment method as provided by the present invention causes particle generation on the exterior surface from the containment space of the container, thereby significantly reducing or even eliminating particle entry into the containment space of the container.

In the foregoing manner, a cover attachable to a container and a cover attachment method are described according to an embodiment of the invention for addressing the foregoing disadvantages of conventional cover design and attachment methods. 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 numerous changes and/or modifications can be made without departing from the scope and spirit of the invention.

Claims

1. A cover comprising:

a body; and

at least one clasp extending from the body, the at least one clasp being engagable with at least one flap extending from a lid with a container disposed between the body and the lid, the container having a plurality of walls being configured for defining a containment space and being shaped for defining at least one ingress for facilitating access to the containment space, the at least one flap substantially shape-matching the at least one ingress,

wherein the body is displaceable towards the lid with the container disposed therebetween for engaging the at least one clasp with the at least one flap to thereby couple the container between the body and the lid and for disposing the at least one flap adjacent the at least one ingress and between the at least one clasp and the containment space to thereby impede travel of contaminants into the containment space through the at least one ingress.

2. The cover as in claim 1, wherein the at least one flap extends substantially perpendicularly from the lid.

3. The cover as in claim 1, wherein the at least one flap has a base notch for facilitating positioning of the at least one clasp therewith.

4. The cover as in claim 1, wherein the at least one flap extends and terminates at a free end, the free end having a ledge portion for engaging the at least one clasp therewith.

5. The cover as in claim 4, wherein the ledge portion comprises a hump for engaging the at least one clasp therewith.

6. The cover as in claim 1, wherein the at least one clasp has a free end, the free end comprising a tooth for facilitating engagement with the at least one flap.

7. The cover as in claim 5 and 6, wherein the tooth has a hooked end portion, the hooked end portion facilitating engagement with the hump of the at least one flap.

8. A cover assembly comprising:

a first cover comprising:

a body; and

at least one clasp extending from the body; and

a second cover comprising:

a lid; and

at least one flap extending from the lid, the at least one clasp engagable with the at least one flap with a container disposed between the body and the lid, the container having a plurality of walls being configured for defining a containment space and being shaped for defining at least one ingress for facilitating access to the containment space, the at least one flap substantially shape-matching the at least one ingress,

wherein the first cover is displaceable towards the second cover with the container disposed therebetween for engaging the at least one clasp with the at least one flap to thereby couple the container between the first cover and the second cover and for disposing the at least one flap adjacent the at least one ingress and between the at least one clasp and the containment space to thereby impede travel of contaminants into the containment space through the at least one ingress.

9. The cover assembly as in claim 8, wherein the at least one flap extends substantially perpendicularly from the lid.

10. The cover assembly as in claim 8, wherein the at least one flap has a base notch for facilitating positioning of the at least one clasp therewith.

11. The cover assembly as in claim 8, wherein the at least one flap extends and terminates at a free end, the free end having a ledge portion for engaging the at least one clasp therewith.

12. The cover assembly as in claim 11, wherein the ledge portion comprises a hump for engaging the at least one clasp therewith.

13. The cover assembly as in claim 8, wherein the at least one clasp has a free end, the free end comprising a tooth for facilitating engagement with the at least one flap.

14. The cover assembly as in claim 12 and 13, wherein the tooth has a hooked end portion, the hooked end portion enabling engagement with the hump of the at least one flap.

15. A system for cover attachment comprising:

a container having a plurality of walls being configured for defining a containment space and being shaped for defining at least one ingress for facilitating access to the containment space;

a first cover comprising:

a lid, and

at least one flap, the at least one flap substantially shape-matching the at least one ingress; and

a second cover comprising:

a body, and

at least one clasp extending from the body, the at least one clasp engagable with the at least one flap with the container disposed between the body and the lid,

wherein the second cover is displaceable towards the first cover with the container disposed therebetween for engaging the at least one clasp with the at least one flap to thereby couple the container between the first cover and the second cover and for disposing the at least one flap adjacent the at least one ingress and between the at least one clasp and the containment space to thereby impede travel of contaminants into the containment space through the at least one ingress.

16. The system for cover attachment as in claim 15, wherein the at least one flap extends substantially perpendicularly from the lid.

17. The system for cover attachment as in claim 15, wherein the at least one flap has a base notch for facilitating positioning of the at least one clasp thereto.

18. The system for cover attachment as in claim 15, wherein the at least one flap extends and terminates at a free end, the free end having a ledge portion for engaging the at least one clasp therewith.

19. The system for cover attachment as in claim 18, wherein the ledge portion comprises a hump for facilitating engagement with the at least one clasp therewith.

20. The system for cover attachment as in claim 15, wherein the at least one clasp has a free end, the free end comprising a tooth for facilitating engagement with the at least one flap.

21. The system for cover attachment as in claims 19 and 20, wherein the tooth has a hooked end portion, the hooked end portion enabling engagement with the hump of the at least one flap.

22. A method for cover attachment comprising:

providing a container having a plurality of walls being configured for defining a containment space and being shaped for defining at least one ingress for facilitating access to the containment space;

providing a first cover, the first cover comprising:

a lid, and

at least one flap, the at least one flap substantially shape-matching the at least one ingress;

providing a second cover, the second cover comprising:

a body, and

at least one clasp extending from the body, the at least one clasp engagable with the at least one flap, and

displacing the second cover towards the first cover with the container disposed therebetween for engaging the at least one clasp with the at least one

flap to thereby couple the container between the first cover and the second cover and for disposing the at least one flap adjacent the at least one ingress and between the at least one clasp and the containment space to thereby impede travel of contaminants into the containment space through the at least one ingress.

23. The method of cover attachment as in claim 22, further comprising:

supplying a force for disengaging the at least one clasp from the at least one flap, thereby facilitating decoupling of the container from the first cover and the second cover.

24. The method of cover attachment as in claim 22, wherein the at least one flap extends substantially perpendicularly from the lid.

25. The method of cover attachment as in claim 22, wherein the at least one flap has a base notch for facilitating positioning of the at least one clasp thereto.

26. The method of cover attachment as in claim 22, wherein the at least one flap extends and terminates at a free end, the free end having a ledge portion for engaging the at least one clasp therewith.

27. The method of cover attachment as in claim 26, wherein the ledge portion comprises a hump for facilitating engagement with the at least one clasp therewith.

28. The method of cover attachment as in claim 22, wherein the at least one clasp has a free end, the free end comprising a tooth for facilitating engagement with the at least one flap.

29. The method of cover attachment as in claim 27 and 28, wherein the tooth has a hooked end portion, the hooked end portion enabling engagement with the hump of the at least one flap.

A COVER FOR REDUCED PARTICLE CONTAMINATION

Abstract

A cover and a cover attachment method for reduced particle contamination. The cover is couplable to a container. The cover comprises a body and at least one clasp extending from the body. The at least one clasp is engagable with at least one flap extending from a lid. The container has a plurality of walls that are configured for defining a containment space and shaped for defining at least one ingress for facilitating access to the containment space. The at least one flap substantially shape-matches the at least one ingress. Engagement of the at least one clasp with the at least one flap couples the container between the lid and the cover and. The engagement also disposes the at least one flap adjacent to the at least one ingress and between the at least one clasp and the containment space, thereby impeding travel of contaminants into the containment space through the at least one ingress.

Figure 2