

MASK CONTAINER

Related Application

The present application claims the benefit of U.S. Provisional Application No. 60/657,314 filed February 27, 2005, which is incorporated herein in its entirety by
5 reference.

Field of the Invention

This invention relates to sealable hinged latchable containers for storing and transporting masks used in manufacturing integrated circuits.

Background

10 Semiconductor components, such as integrated circuits, are made using semiconductor wafers. To this end, relatively fragile masks (or reticles) are used to project and define dimensions and locations of the structures in the final product. These masks are generally in the form of a substantially planar substrate. During manufacture, small particles of foreign material may settle upon the masks or substrate, hence damaging
15 the mask or the product being manufactured or otherwise interfering with the manufacturing process. These foreign particles are present in the environments in which masks are stored and transported. Because of the fragile nature of masks and the necessity to prevent adherence of foreign particles to the masks, containers are used. These containers serve the dual purpose of protecting the masks from damage and
20 providing a dust-free microenvironment. Containers for masks have conventionally been manufactured from separate top cover or lid and a bottom or base. The portions are molded separately with each having a hinge portion integral on the back side thereof. The containers are then assembled utilizing a metal hinge pin to complete the hinge. A simple manually slidable C-shaped latch positioned on a rail on the front of the base piece is
25 manually slid to capture a tab on the top cover when closed to secure the package shut. The hinge portions are conventionally formed of the same materials as the top cover and base and typically has plastic to plastic rubbing contact as well as plastic to metal rubbing contact which can cause abrading and particle generation. A latch that secures a lid to a base automatically and a hinge that could be incorporated with minimal assembly steps

and without the plastic to plastic or plastic to metal rubbing contact and thus without the associated particle generation would be quite desirable.

Summary of the Invention

The invention addresses the needs of the industry in part by a providing a container
5 for storing and transporting masks and a process for making the container by sequentially
molding its components using overmolding techniques and a living hinge. The container
includes a lid, a base, a hinge, and a latching mechanism. In one embodiment, the hinge is
formed of a first material by injection molding. The hinge is placed in a mold to overmold
the base and cover thereon. Thus the base and lid formed integrally—or connected
10 mechanically by the overmolding—to the hinge by a second injection molding. The
hinge has a living hinge portion that functions with no rubbing or abrading contact. The
latching mechanism, which includes a sliding latch member configured as a C-shaped
latch carriage and an integrally formed spring, slidably engages a rail on the front side of
the base. The spring biases the latch member to an original normal position that is the
15 “latch” position. The latch can be automatically actuated, that is, moved out of the latch
position to accept and latch with the top cover, when a ramp-shaped extension, that is a
cam surface, of the lid presses against a ramp-shaped beveled surface, a cooperating cam
surface, of the latch as the lid is being closed to the base. The force of the downward
moving lid extension contacts a cam surface and urges each of the two latch carriages
20 outboard until the lid tab extensions enters notches in the latch carriages, thereby releasing
the latch carriage to its original position under the force of the spring. When the lid
extension is thus seated, it is aligned with the rail and the latch spring retains the latch
mechanism in a locked and closed position. Another downwardly facing ramp-shaped
beveled edge of the latch may be used to automatically open the latch mechanism by an
25 actuator moving upwardly from below.

A feature and advantage of the invention is that the latch mechanism may be
manually or robotically operated and robotically operated with simple vertical moving
actuating arms extending either upwardly from below or downwardly from above.

A feature and advantage of the invention is a minimal number of parts. For
30 example each latch mechanism consists of only one additional component in addition to

the portions of the top cover and base that are utilized. This facilitates simplicity, easy cleaning, and minimizes manufacturing costs such as assembly costs.

A feature and advantage is the lack of rubbing components in the hinge.

5 A feature and advantage of preferred embodiments of the invention is that the latch carriages both are biased inwardly to their latched position facilitating robotic actuation for opening by inserting between the two latch carriages an actuator with cam surfaces that can simultaneously urge outwardly both latch carriages by a simple vertical motion coming either from above or below the container.

10 A feature and advantage of preferred embodiments is that the latch carriages have cam surfaces that can be both actuated by an actuator cam portion on the top lid and also robotically. Moreover the latches are readily operated manually.

These and other objects, features, and advantages of this invention will become apparent from the description which follows, when considered in view of the accompanying drawings.

15 Brief Description of the Drawings

Figure 1 is a perspective view of one embodiment of a container according to the inventions herein when in a closed position;

Figure 2 is a perspective view of the inside of the container of Figure 1 when in an open position;

20 Figure 3 is a plan view of the outside of the container of Figure 1 when in an open position.

Figure 4 is a side, cross sectional view of the container of Figure 1 when in an open position.

25 Figure 5 is a perspective view illustrating the function of the latch mechanism with the container partially open and the latch carriage in its normal position.

Figure 6 is a perspective view illustrating the function of the latch mechanism with the top cover commencing to engage the base at the latching mechanism deflecting the latch carriage outwardly.

5 Figure 7 is a perspective view illustrating the function of the latch mechanism with the top cover closed on the base at the latch carriage of the latching mechanism returned to its normal position.

Figure 8 is an view of the hinge before incorporation in the container.

Figure 9 is a view of the hinge before incorporation in the container.

10 Figure 10 is perspective view of the top of the hinge before incorporation in the container.

Figure 11 is perspective view of the bottom of the hinge before incorporation in the container.

Figure 12 is an end view of the hinge in a fully extended position before incorporation in the container.

15 Figure 13 is an end view of the living hinge portion of the hinge.

Figure 14 is an end view of the hinge in a fully folded position before incorporation in the container.

Figure 15 is an end view of the hinge in a fully folded position before incorporation in the container.

20 Figure 16 is a cross sectional side view of the hinge mechanism integrally molded with the lid and base of this invention;

Figure 17 is a perspective view of the container from the back side illustrating the hinge in the fully folded position.

Figure 18 is a front elevational view of the latch carriage.

Figure 19 is a top plan view of the latch carriage.

Figure 20 is a rear side elevational view of the latch carriage.

Figure 21 is an end view of the latch carriage.

Figure 22 is a perspective view of a corner of the base illustrating the latch carriage
5 retracted from its normal position.

Figure 23 is a perspective view of the mechanism engaging lid extension of the
present latch mechanism.

Figure 24 is a side view of a rail of the base as part of the latch mechanism.

Figure 25 is an illustration as to how both latch mechanisms can be simultaneously
10 operated by a simple cam actuator either from above or below the container.

It is understood that the above-described figures are only illustrative of the present
invention and are not contemplated to limit its scope.

Detailed Description

Figures 1-4 show an embodiment of the mask (reticle) container of the invention.
15 The container is depicted generally at 100 and includes an upper member such as a cover
or lid 102, a lower member or base 104, a hinge 106, and a pair of latching mechanisms
108.

The lid 102, in turn, has a shell 110 with a generally planar top 112, opposed
longitudinal sides 114 and 116 and opposed lateral sides 118 and 120, thereby defining a
20 lid cavity 121. Disposed within the lid cavity 121 are opposed recess structure 122 and
124 and laterally opposed reticle restraints or cushions 126 and 128. Exemplary cushions
suitable for some embodiments of the invention are disclosed in U.S. Patent 6,216,873,
hereby incorporated by reference.

The base 104 has a shell portion 129 having a generally planar bottom 130,
25 opposed longitudinal sides 132 and 134, and generally opposed lateral sides 136 and 138,
thereby defining a base cavity 140. Posts 142, 144, 146, and 148 are attached to the

bottom 130 proximate the four comers of the base cavity 140. Laterally opposed recessed structure 150 and 152 are positioned at the lateral sides 136 and 138, respectively. A rim 154 is defined at the periphery of the lid 102 and a ledge 156 is defined at a periphery of the base 104. The rim 154 sealingly contacts the ledge 156 when the container is closed.

5 In use, a mask is placed in the cavity 140 and is supported and confined by the posts 142-148. When the lid 102 is closed, cushions 126 and 128 resiliently confine the mask vertically and laterally.

Referring to Figures 2, 3, 4, and 8-17, the hinge 106 unitarily (or otherwise integrally) has a first hinge member 170 and a second hinge member 172, which are
10 separated by a hinge portion 174 as shown in Figures 6-16. The hinge portion 174, as described in more detail below, is an area of reduced thickness to enable the hinge to functionally and pivotally flex when attached to the lid and base and constitutes a "living hinge." First hinge member 170 may be considered to include a planar portion 180 terminating in a lip 182. A second hinge member 172 has respective first, second, and
15 third planar portions 186, 188, and 190 and a lip 192. As can be seen the first, second, and third planar portions 186, 188, and 190 angularly adjoin and the third planar portion 190 terminates at the lip 192. As best shown in Figure 13, the hinge portion 174 is defined by a generally arcuate groove 194 and a generally opposed notch 196.

Referring to figures 1, 2, 4-7, and 18-24, each latching mechanism 108 has a latch
20 carriage 200, a rail 202, and a top cover projection or extension 204. Latch carriage 200, as best shown in includes a C shaped in the vertical cross-section) body 208 accommodating a spring 210. The spring is preferably serpentine in shape and is compressible within the body. The latch carriage 200 has beveled (angled) generally converging, inboard lateral edges 214 and 216 that function as cam surfaces. The latch
25 carriage 208 also has a generally curvilinear front member 218, with a plurality of gripping extensions 220, and a rear member 222. The rear member 222 defines upper and lower notches 224 and 226 via respective extensions 228 and 230 and lip 232 and 234 extending inwardly from the extensions 226 and 228.

The rail 202, as best shown in figure 5-7, 22, and 24, has a first extension 240
30 extending from the longitudinal side 132 of the base 104. Respective second and third extensions 242 and 244 extend from the first extension 240 and are dimensioned to

slidingly accommodate the notches 226 and 228 of the latch 200. The rail 202 may also include a spring mount 246 outboard the structure formed by the first second and third extensions 240, 242, and 244.

Extension 250 extends from the longitudinal side 114 of the lid 102 and presents a
5 generally angled surface 252 as shown in Figures 23 and 25. A lip 254 extends from a main portion 256 of the extension 250. When the container is fully closed the lip 254 generally aligns with the third extension 244 of the base latch assembly.

Latch 200 is slidingly disposed on rail 202 such that the spring 210 abuts and biases the latch 200 away from the spring mount 246. When the container is closed, the
10 angled surface 252 of the lid extension 204 contacts the angled lateral edge 214 of the latch 200, thereby forcing the latch 200 to slide away there from and compressing the spring 210 against the adjacent spring mount 246. When the lid is completely closed, the spring 210 decompresses to allow the latch 200 to be displaced away from the spring mount 246 such that the notch 224 of the latch 200 is accommodated partially by the rail
15 254. In this position, the latch 200 spans the extension 215 and the rail 202, thereby securing the lid in a closed position. The beveled edge 216 is useful for automatically opening the latch from above or below, such as by automatic handling equipment 257 as shown in Figure 26. The handling equipment forces the latch 200 open by exerting an upward force on the beveled edge 216, thereby urging the latch outboard and allowing the
20 lid and base rail portions to disengage. Similarly, referring to Figures 5, 6, and 7, the beveled edge 252 or cam surface of the projection of the top lid automatically causes the latch carriage to retract as indicated by the arrow 251 in Figure 6 by engagement with the beveled surface 214 of the latch carriage. The projection then clears the beveled surface allowing the latch carriage to snap back to its normal position as indicated by the arrow
25 253 of Figure 7.

In one embodiment, the container is made by a process that includes sequential molding operations. In one exemplary process, the hinge is molded and allowed to cure. Then the hinge is removed from the first mold and placed in a second mold. The second mold is injected with a second polymer suitable for the lid and base members. Figure 16
30 shows how the hinge is embedded in the present lid and base and how the lips 182 and 192 anchor and secure the hinge—in addition to mechanical or chemical bonding between the

polymers used to form the hinge, lid and base. The latch 200 is molded separately, with the latch carriage and spring formed integrally. The integral lid, base, and hinge are removed from the second mold after being allowed to cure. The latch is installed on the rail 202. Finally, cushions are affixed to the lid 102. Suitable sequential molding processes are disclosed in U.S. Patent 6,428,729, 6,719,381, 6,402,552, and 6,077,124, and U.S. Patent Application 20030025244, each hereby incorporated by reference.

Figure 16 shows the conformation of the hinge when the container of this invention is fully opened. Figure 14 shows the hinge in a closed position and Figure 15 depicts the hinge generally mid-way between the open and closed positions. These figures illustrate how hinging is accomplished when the hinge flexes at portions having reduced thickness at the hinge portion 174. In certain embodiments the flexible hinge material may be mechanically attached to the base and top cover in a separate operation, rather than during an overmolding operation. In some embodiments the living hinge may be formed with two materials: a flexible material for the living hinge and another material suitable for attachment to the base and top cover by means such as welding or by a second overmolding operation.

Suitable materials used to form the hinge include polypropylene and polyurethane, optionally with an inherently dissipative polymer to dissipate static electricity. Suitable materials for the lid, base, and hinge include acrylonitrile butadiene-styrene (ABS), optionally with a static dissipative property, e.g., StatPro 435™ is such a material utilized in molding these types of products by Entegris, Inc. the owner of this application. Other polymers may also be used, depending on the specific application intended for the container. Polymers suitable for these and other applications are disclosed in Handbook of Plastics, Elastomers, and Composites, Charles A. Harper, Editor-in-Chief, Third Edition, 1996, McGraw-Hill, hereby incorporated by reference.

Although not illustrated in the figures, an elastomeric seal may be utilized with the container to seal between the top cover and base when the container is closed. In certain embodiments, the seal may be formed before the top cover and base are molded and may be inserted in the molds for said top cover and base to be joined by overmolding.

Because numerous modifications of this invention may be made without departing from the spirit thereof, the scope of the invention is not to be limited to the embodiments

illustrated and described. Rather, the scope of the invention is to be determined by the appended claims and their equivalents.

WHAT IS CLAIMED IS:

1. A mask-package container, the container comprising:

a lid and a base defining a storage area, the lid and the base each having a hinge face and a latch face, wherein the lid and base are hingedly connected at their hinge faces;

the latch face of the base including a rail extending distally from the base and a spring mount extending from the rail, the rail having a rail base, a rail platform fixed to the rail base, and a rail endpoint spaced from the spring mount;

the latch face of the lid including a latch-engagement member extending distally from the lid, the latch-engagement member having a guide portion; and

a latch mechanism for securing the base to the lid, the latch mechanism defining an enclosure and including a latch carriage and a spring, the latch carriage slidably engaging the rail, wherein the latch carriage has a lid-engagement member including a guide portion and a notch portion sized to receive the lid's guide portion, the latch mechanism's spring being disposed within the latch carriage extending from an enclosed side of the latch carriage to the spring mount on the latch face of the base, the latch mechanism being slidably disposed along the rail subject to the compression of the spring by an interaction of the lid's guide portion with the latch carriage's guide portion, the latch mechanism's movement being limited in one direction by the rail endpoint and in the other direction by spring forces resulting from displacement of the latch carriage and spring toward the spring mount.

2. The mask-package container of claim 1 wherein the latch carriage and spring are molded integrally.

3. The mask-package container of claim 1 wherein the latch carriage includes a second engagement member below the lid-engagement member for allowing the latch to be actuated from below.

4. The mask-package container of claim 1 wherein the lid's latch-engagement member has the form of a ramp and the latch carriage's lid-engagement member has the form of an opposing ramp.

5. A mask package having a latch mechanism, the mask package container having a lid and a base, each with latch faces that together form a rail having first and second endpoints and a spring mount spaced between the endpoints, the latch mechanism comprising:

a latch carriage slidably engaging the rail and enclosing the spring mount

a spring disposed within the latch carriage toward the spring mount

wherein the latch carriage has a first position that keeps the lid and base latch faces together or apart, the latch carriage's position on the rail being bounded by the first rail endpoint and retained by the spring's force on the spring mount;

wherein the latch carriage has second position that allows the lid and base latch faces to meet or separate, the second position being reached upon application of force urging the latch carriage against the spring force in a retracting direction and toward the second rail endpoint.

6. The mask-package container of claim 5 wherein the latch carriage and spring are molded integrally.

7. The mask-package container of claim 5 wherein the container has two of the latch mechanisms and they are arranged to have oppositely oriented retracting directions facilitating automatic actuation.

8. The mask-package container of claim 5 wherein the lid's latch-engagement member has the form of a ramp and the latch carriage's lid-engagement member has the form of an opposing ramp.

9. A mask package container including a base, a lid, and a hinge connecting the base to the lid, made by the process of:

providing a first mold and a first polymer for the hinge of a mask package container

providing a second mold and a second polymer for the base and lid of a mask package container;

molding the hinge in the first mold with the first polymer;

removing the hinge from the first mold;

placing the hinge in the second mold;

molding the lid and base around the hinge with the second polymer.

10. The mask package container of claim 9 made by a process further comprising the steps of:

providing a third mold and a third polymer;

molding a latch for securing the lid to the base in the third mold from the third polymer;

fitting the latch to a side of the lid or base without the hinge.

11. The mask package container made by the process of claim 9 wherein the second mold provides the base and lid each with latch faces and portions of a rail extending distally from the latch faces.

12. The mask package container made by the process of claim 10 wherein the second mold provides the base and lid each with latch faces and portions of a rail extending distally from the latch faces and wherein the step of fitting the latch includes the step of fitting the latch to a portion of the rail.

13. The mask package container made by the process of claim 9 wherein the first and second polymers are the same.

14. The mask package container made by the process of claim 9 wherein the first and second polymers are different.
15. The mask package container made by the process of claim 10 wherein the third polymer is the same as either the first or second polymers.
16. The mask package container made by the process of claim 10 wherein the third polymer is different from the first and second polymers.
17. The mask package container made by the process of claim 10 wherein the step of molding the latch includes molding a spring integral to the latch.
18. The mask package container made by the process of claim 9 wherein the first polymer comprises a plurality of polymers.
19. The mask package container made by the process of claim 10 wherein the first polymer comprises a plurality of polymers.
20. A method of opening a latched reticle container as described in claim 7 and including the step of forcing a mechanical actuator between the two latch carriages forcing them apart.