



US 20060138642A1

(19) **United States**

(12) **Patent Application Publication**

**Robbins et al.**

(10) **Pub. No.: US 2006/0138642 A1**

(43) **Pub. Date: Jun. 29, 2006**

**(54) MICROMECHANICAL GETTER ANCHOR**

(76) Inventors: **Roger A. Robbins**, McKinney, TX (US); **Jwei Wien Liu**, Plano, TX (US); **Jack C. Smith**, Parker, TX (US); **Edward Carl Fisher**, Lucas, TX (US); **Joyce Wong Holton**, Plano, TX (US)

Correspondence Address:

**TEXAS INSTRUMENTS INCORPORATED**  
**P O BOX 655474, M/S 3999**  
**DALLAS, TX 75265**

(21) Appl. No.: **11/343,395**

(22) Filed: **Jan. 31, 2006**

**Related U.S. Application Data**

(62) Division of application No. 10/007,964, filed on Nov. 13, 2001, now Pat. No. 6,992,375.

(60) Provisional application No. 60/250,913, filed on Nov. 30, 2000.

**Publication Classification**

(51) **Int. Cl.**

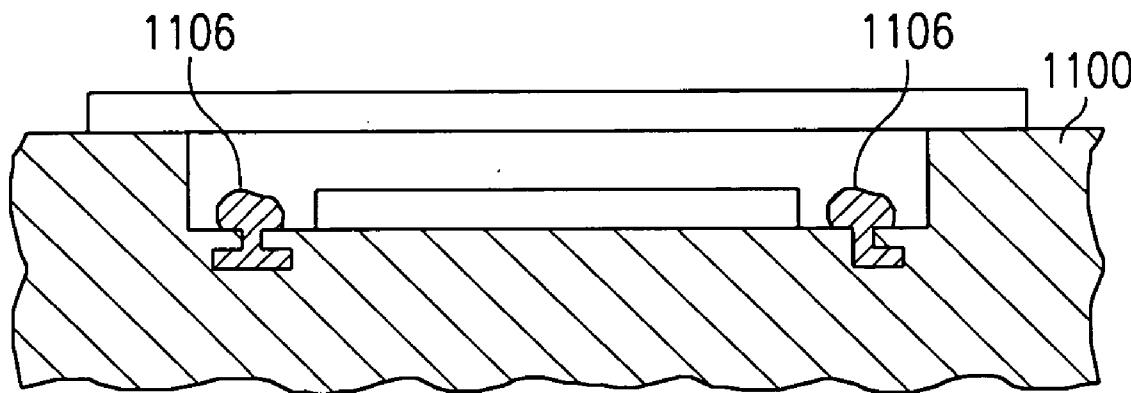
**H01L 23/12** (2006.01)

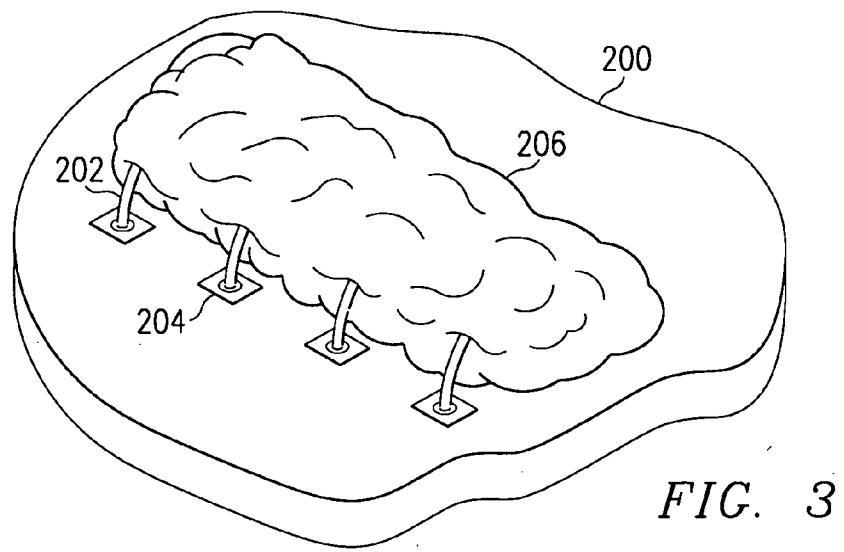
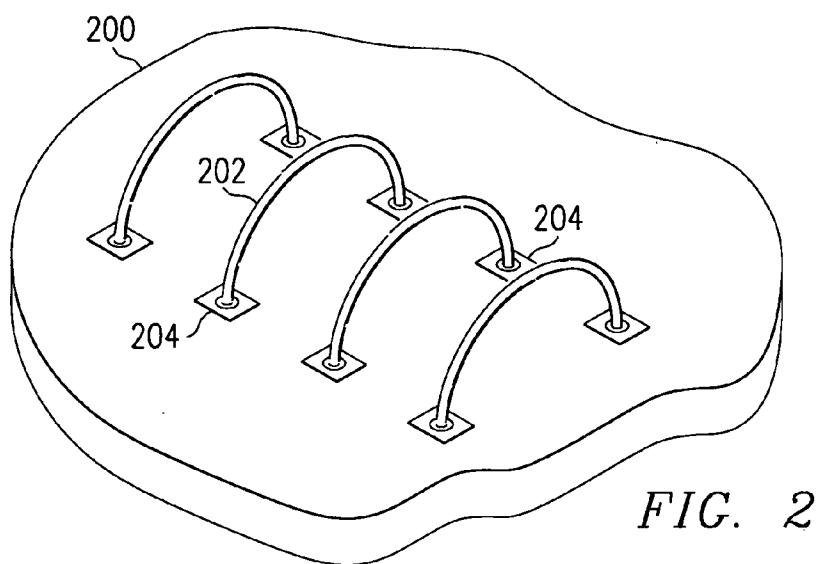
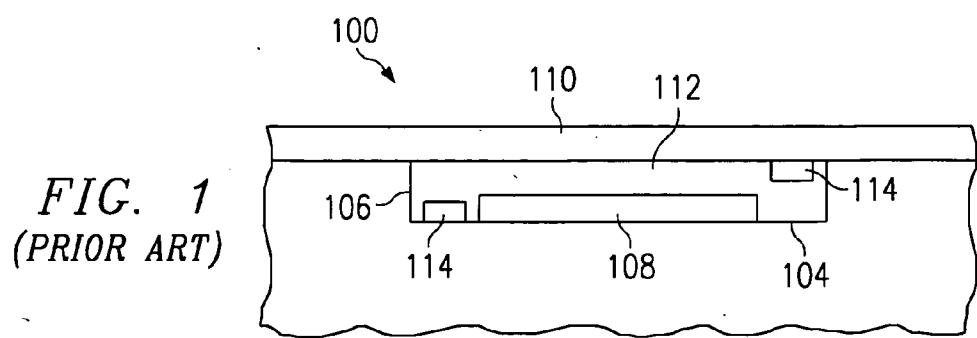
(52) **U.S. Cl.** ..... **257/704**; 257/E23; 257/913

**(57)**

**ABSTRACT**

One embodiment provides an anchor to hold getter materials in place within a micromechanical device package substrate, said anchor comprising: a first cavity face; and a second cavity face. The cavity faces define an anchor cavity and mechanically retain a getter away from a region holding the micromechanical device. Another embodiment provides an anchor to hold a getter in place within a micromechanical device package. The anchor comprises: a package substrate; and a member attached to the package substrate, the member shaped to provide mechanical retention of the getter material formed over said member. Another embodiment provides a micromechanical device package comprising: a package substrate; a package lid enclosing a package cavity; a micromechanical device in the package cavity; and a getter anchor in the package cavity. Other embodiments provide methods of packaging and forming packages having a getter anchor. One getter anchor is formed in a substrate 906 comprised of at least three layers. The layers form a cavity in the substrate 906 with a wide bottom portion-formed in the middle layer 902 and a relatively narrower top portion-formed by the top layer 904. The narrow portion helps to retain the getter in the cavity by creating a mechanical lock on the wide portion of getter in the bottom of the cavity. The preceding abstract is submitted with the understanding that it only will be used to assist in determining, from a cursory inspection, the nature and gist of the technical disclosure as described in 37 C.F.R. § 1.72(b). In no case should this abstract be used for interpreting the scope of any patent claims.





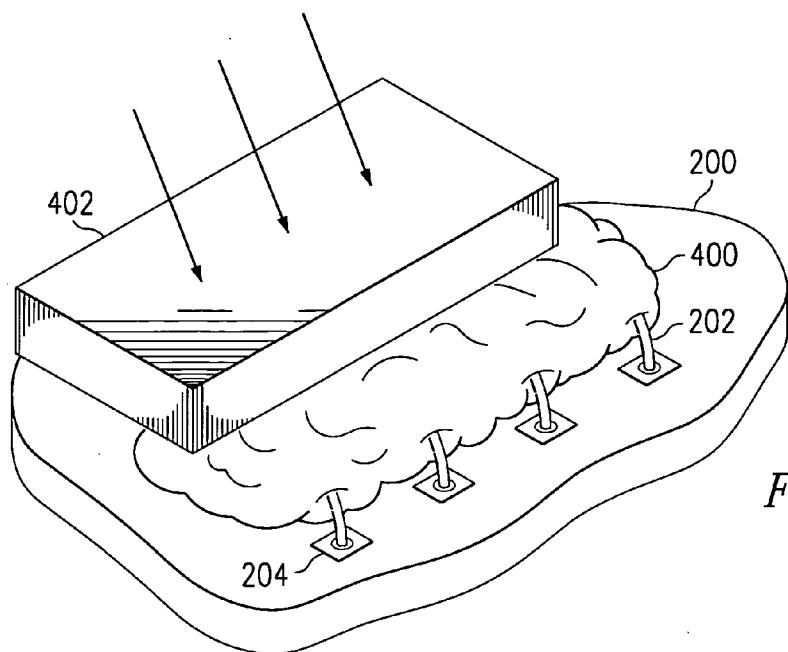


FIG. 4

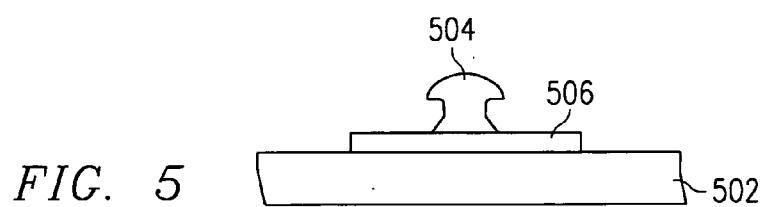


FIG. 5

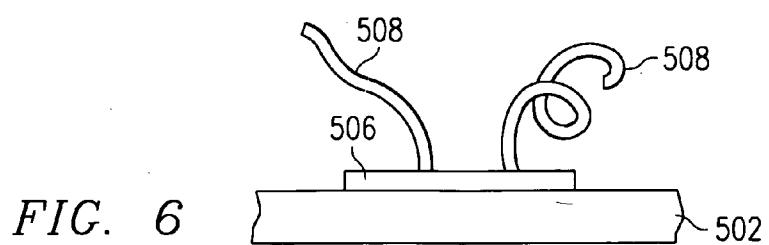


FIG. 6

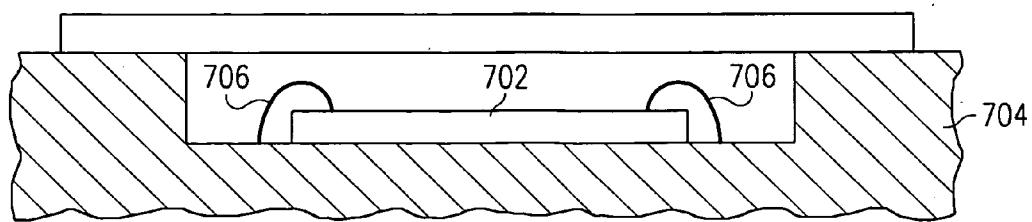


FIG. 7

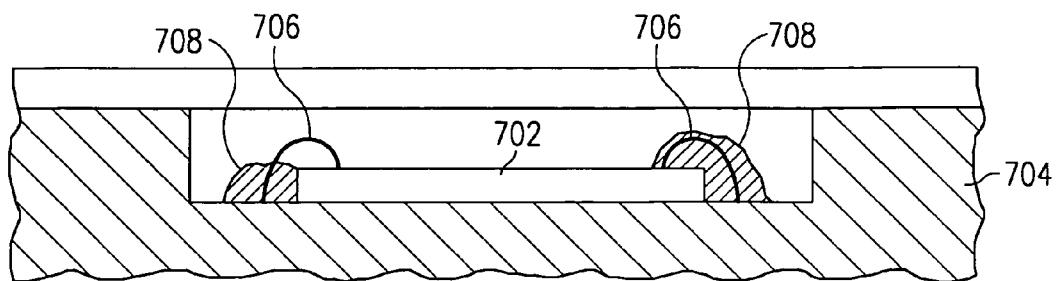


FIG. 8

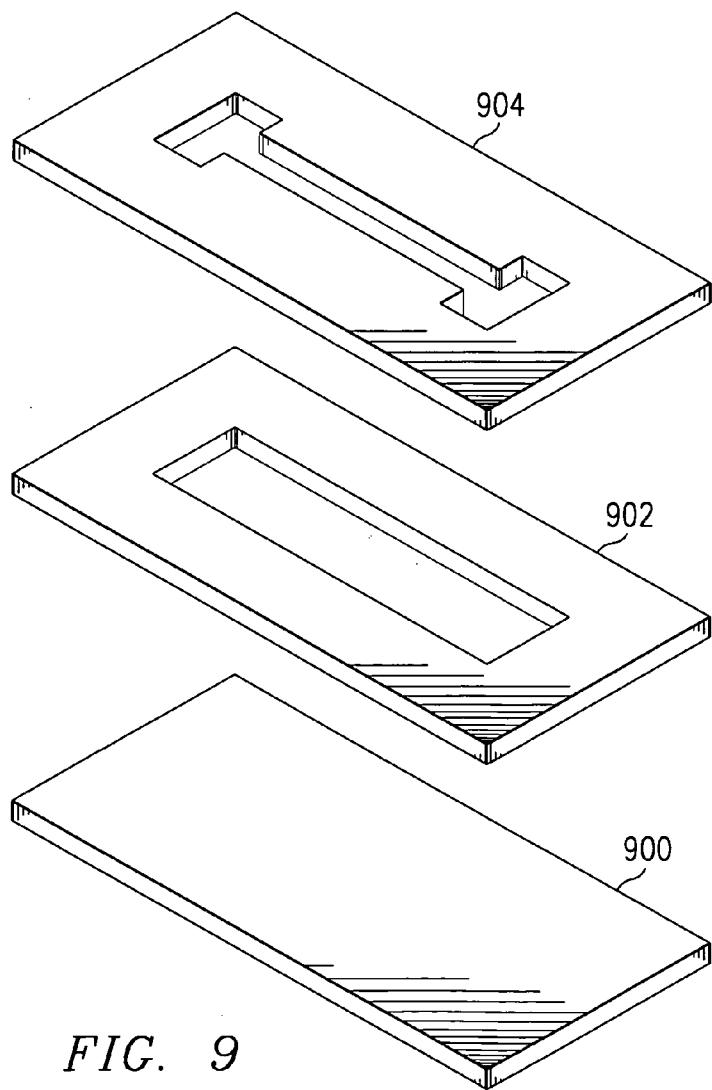


FIG. 9

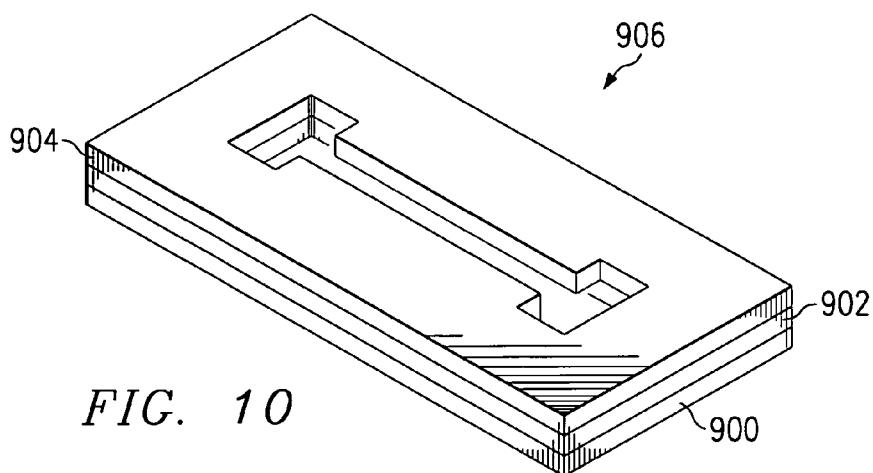


FIG. 10

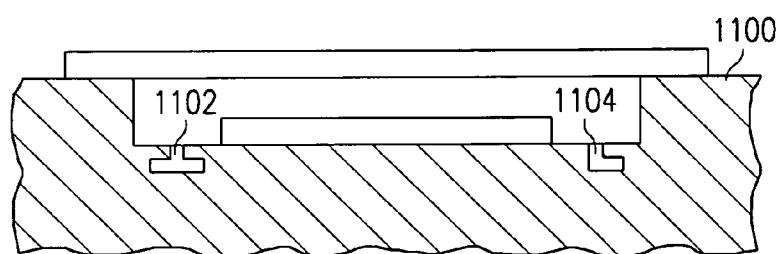


FIG. 11

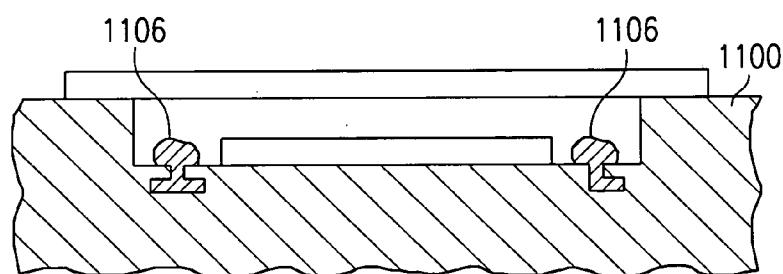


FIG. 12

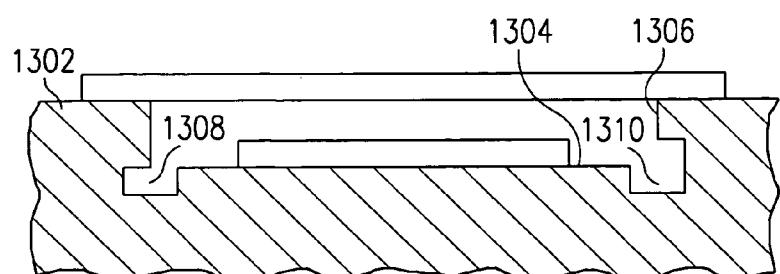


FIG. 13

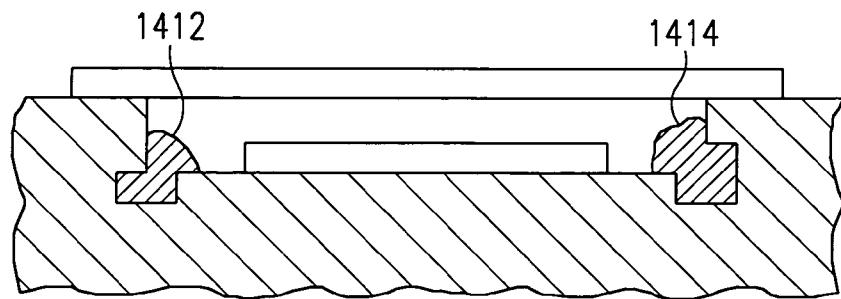


FIG. 14

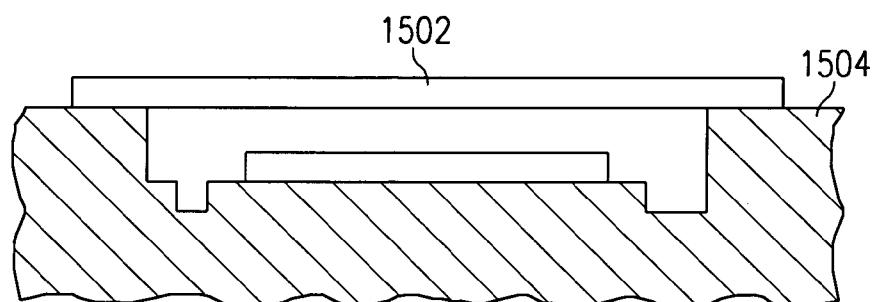


FIG. 15

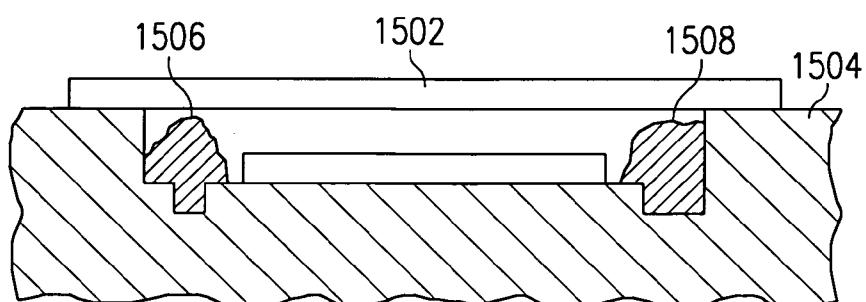


FIG. 16

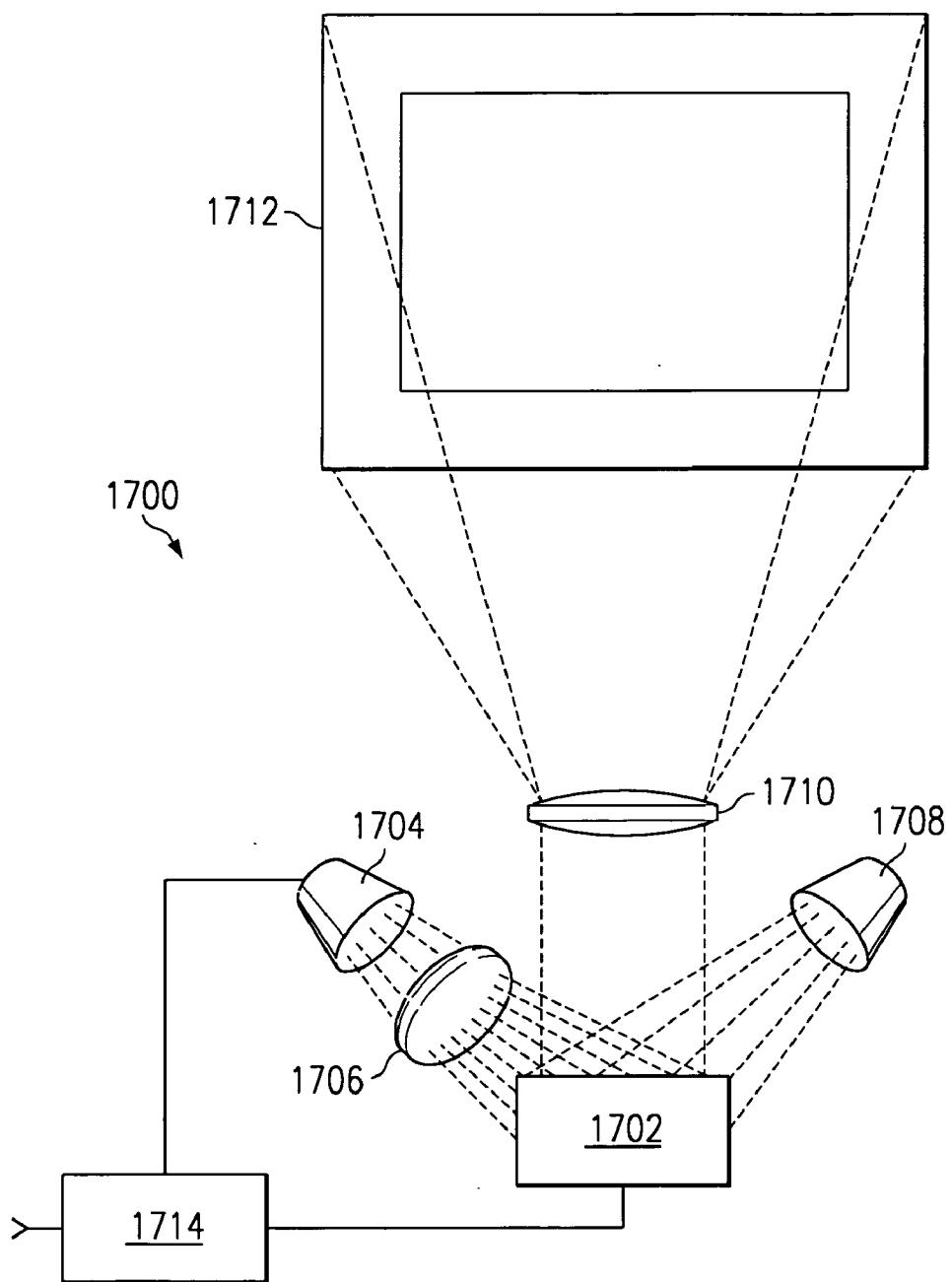


FIG. 17

**MICROMECHANICAL GETTER ANCHOR****CROSS-REFERENCE TO RELATED  
APPLICATIONS**

[0001] The following patents and/or commonly assigned patent applications are hereby incorporated herein by reference:

Patent No.	Filing Date	Issue Date	Title
5,061,049	Sept. 13, 1990	Oct. 29, 1991	Spatial Light Modulator and Method
5,583,688	Dec. 21, 1993	Dec. 10, 1996	Multi-Level Digital Micromirror Device

**FIELD OF THE INVENTION**

[0002] This invention relates to the field of micro-electro-mechanical systems (MEMS), more particularly to methods of attaching getters in packages containing lubrication for the MEMS device.

**BACKGROUND OF THE INVENTION**

[0003] Micromechanical devices are small structures typically fabricated on a semiconductor wafer using techniques such as optical lithography, doping, metal sputtering, oxide deposition, and plasma etching which have been developed for the fabrication of integrated circuits.

[0004] Micromirror devices, such as the Digital Micro-mirror Device™ (DMD™) produced by Texas Instruments, are a type of micromirror device. Other types of micromechanical devices include accelerometers, pressure and flow sensors, gears and motors. While some micromechanical devices, such as pressure sensors, flow sensors, and micro-mirrors have found commercial success, other types have not yet been commercially viable.

[0005] MEMS devices typically have moving mechanical components that rub against each other. Lubricants are required to prevent the small components from wearing out prematurely and to reduce stiction where the components touch. One effective lubricant is perfluorodecanoic acid, or PFDA. PFDA forms a monolayer over the components leaving a surface that is non-reactive. PFDA is often applied over the entire interior surface of a package, including the MEMS device. Unfortunately, once PFDA is applied to the package interior, it is very difficult to attach other components, such as moisture and gas getters, to the package. What is needed is a system and method for providing positive retention of getters to the package interior that does not rely on adhesion between the getter and the package.

**SUMMARY OF THE INVENTION**

[0006] Objects and advantages will be obvious, and will in part appear hereinafter and will be accomplished by the present invention which provides a method and system for a micromechanical getter anchor. One embodiment of the claimed invention provides an anchor to hold getter materials in place within a micromechanical device package substrate, said anchor comprising: a first cavity face; and a second cavity face. The first and second cavity faces define

an anchor cavity and are arranged to mechanically retain a getter away from a region holding the micromechanical device.

[0007] Another embodiment of the disclosed invention provides an anchor to hold a getter in place within a micromechanical device package. The anchor comprises: a package substrate; and a member attached to the package substrate, the member shaped to provide mechanical retention of the getter material formed over said member.

[0008] Another embodiment of the disclosed invention provides a micromechanical device package comprising: a package substrate; a package lid enclosing a package cavity; a micromechanical device in the package cavity; and a getter anchor in the package cavity.

[0009] Another embodiment of the disclosed invention provides a method of packaging a micromechanical device. The method comprises: providing a package substrate having a getter anchor; attaching a micromechanical device to the package substrate; attaching a getter material to the getter anchor; and attaching a package lid to the package substrate.

[0010] Another embodiment of the disclosed invention provides a method of forming a package having an anchor. The method comprises: forming a first package substrate layer; forming a second package substrate layer, the second layer having a void; forming a third package substrate layer; laminating the first, second, and third layers such that the void forms an anchor cavity suitable for holding a getter. A further embodiment further comprises: forming a fourth package substrate layer having a void. The second and fourth layers are adjacent when laminated such that a cavity anchor with a narrow top and a relatively wide bottom is formed by the voids in the second and fourth layers.

[0011] Another embodiment of the disclosed invention provides a method of packaging a micromechanical device. The method comprises: providing a package substrate; attaching a micromechanical device to the package substrate; attaching bond wires between the micromechanical device and the package substrate; attaching a getter material to the bond wires; and attaching a package lid to the package substrate.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0012] For a more complete understanding of the present invention, and the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which:

[0013] FIG. 1 is a cross section side view of a micromechanical package of the prior art showing the location of a getter within the package.

[0014] FIG. 2 is a perspective view of a portion of a micromirror package substrate showing an anchor mechanism according to one embodiment of the present invention.

[0015] FIG. 3 is a perspective view of the portion of a micromirror package substrate of FIG. 2 showing a getter applied to, and held by, the anchor of FIG. 2.

[0016] FIG. 4 is a perspective view of a portion of a micromirror package substrate showing and adhesive

applied to, and held by, a getter anchor, and a pre-formed getter being applied to the adhesive.

[0017] **FIG. 5** is a side view of a portion of a package substrate showing an alternate anchor member configuration.

[0018] **FIG. 6** is a side view of a portion of a package substrate showing an alternate anchor member configuration.

[0019] **FIG. 7** is a cross section side view of a micromechanical device package showing the bond wires used in the prior art.

[0020] **FIG. 8** is a cross section side view of a micromechanical device package showing the result of a novel application of the getter to the bond wires of **FIG. 7**.

[0021] **FIG. 9** is an exploded perspective view of a portion of a micromirror package substrate showing an anchor mechanism according to one embodiment of the present invention.

[0022] **FIG. 10** is a perspective view of the portion of a micromirror package substrate of **FIG. 9** showing the anchor of **FIG. 9**.

[0023] **FIG. 11** is a cross section side view of a portion of a micromechanical package substrate showing a cavity formed in the substrate to anchor the getter to the substrate.

[0024] **FIG. 12** is a cross section side view of the portion of a micromechanical package substrate of **FIG. 11** showing a getter held by the anchor of **FIG. 11**.

[0025] **FIG. 13** is a cross section side view of a portion of a micromechanical package substrate showing an alternate cavity formed in the substrate to anchor the getter to the substrate.

[0026] **FIG. 14** is a cross section side view of the portion of a micromechanical package substrate of **FIG. 13** showing a getter held by the anchor of **FIG. 13**.

[0027] **FIG. 15** is a cross section side view of a portion of a micromechanical package substrate showing an alternate cavity formed in the substrate to anchor the getter to the substrate.

[0028] **FIG. 16** is a cross section side view of the portion of a micromechanical package substrate of **FIG. 15** showing a getter held by the anchor of **FIG. 15**.

[0029] **FIG. 17** is a schematic view of a micromirror-based projection system utilizing an improved micromirror device package according to one embodiment of the present invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0030] A new package feature has been developed that forms an anchor to secure getters and other materials within a package. The anchor overcomes the limitations of the prior art which required the getter or other material to be adhered to the inside of the package prior to the application of a lubricant. When an anchor according to an embodiment of the present invention is used, the lubricant may be applied prior to, or simultaneously with, the getter.

[0031] **FIG. 1** is a cross section side view of a semiconductor or micromechanical package **100** of the prior art showing the location of a getter within the package. In **FIG. 1**, a package substrate **102** has an interior floor **104** and interior walls **106**. The package substrate **102** typically is formed of layers of ceramic. The layers of ceramic include metalization regions (not shown) that provide electrical connection between the device **108** contained in the package and circuitry external to the package. After patterning the metalization on the layers, the layers are assembled and the ceramic package substrate is fired.

[0032] After mounting the micromechanical device in the package, a window **110** or lid is placed over the package cavity **112** and sealed to the ceramic base. This hermetic seal provides a controlled environment within the package cavity. Semiconductor and MEMS devices typically require protection from moisture and various gasses or other chemicals that remain on the device or in the package after the assembly process, or are released by the package and its contents. Additionally, moisture that penetrates the packages must be prevented from harming the device.

[0033] In the case of a MEMS device, moisture is particularly harmful because a polarized molecule such as water adheres to the metal surfaces of the MEMS device. If it becomes sufficiently plentiful to form a meniscus, then it can capture the moving part of the MEMS by capillary force, causing it to cease moving and rendering the part nonfunctional.

[0034] To prevent moisture and other contaminants from harming the packaged device, one or more getters are used to trap the moisture and other contaminants. These getters include any environmental control materials such as desiccants and molecular sieves. **FIG. 1** shows two getters **114** attached to the inside of the package **100**. The getters **114** of **FIG. 1** adhere to the floor **104** of the package and the glass window **110**.

[0035] As mentioned above, the use of a lubricant in the package **100** affects the adhesion of the getters. For example, if the lubricant is already in place—coating the floor **104**, sides **106**, and window **110**—the getter **114** will be unable to adhere to the package. Alternatively, if the getter **114** is adhered to the interior of the package **100** prior to the use of the lubricant, it is possible for the lubricant to work its way between the getter **114** and package over a period of time, especially if the package is operated over a series of extreme temperature cycles, and reduce the adhesion of the getter **114**. Additionally, the lubricant may react with the substance adhering the getter **114** to the package and allow the getter to loosen.

[0036] In some circumstances it is desirable to deposit the getter and lubricant materials simultaneously. For example, mixing the lubricant and getters allows them to be deposited in one operation. After depositing the materials, and typically after installing the window or lid, the lubricant is distributed throughout the package interior, often by heating the package to distribute a lubricant vapor. In this case, the lubricant and getter materials are mixed together, often with a binder or other carrier and a solvent, and deposited in the package base. Once the package is sealed, it is heated to distribute the lubricant throughout the package interior leaving the getter materials in the place they were deposited. This mixed deposition is thwarted by the lubricant since the

getter materials fail to adhere to the package base when deposited while mixed with the lubricant.

[0037] A solution to the problem of keeping the getter materials in place is the use of an anchor in the package. An anchor is a feature used to mechanically lock the getter materials in the package and prevent them from moving. **FIG. 2** shows an embodiment of a solution to this problem. **FIG. 2** is a perspective view of a portion of a micromirror package substrate **200** showing an anchor mechanism according to one embodiment of the present invention. The anchor mechanism of **FIG. 2** comprises members **202** anchored to the substrate to provide a structure on which the getter can hold without the use of adhesion. Wire members, in particular bond wires **202**—that is, anchors formed from the same material as the electrically functional bond wires, are particularly well suited for use in forming the anchor since the typical process flow includes use of such wires to connect the semiconductor die or MEMS device with the package substrate.

[0038] In **FIG. 2**, special bond pads **204** are formed on the substrate **200** to receive the bond wires **202**. The bond pads **204** may not be necessary if the bond wires **202** will adhere to the substrate **200**, but typically are required to provide sufficient attachment between the gold bond wire **202** and a ceramic substrate **200**. Furthermore, the bond pads may have more than one bond wire attached, and one bond pad may be used by all of the wires. The bond pads **204** typically are a plated metal bond pad **204** formed from the same materials, and during the same process steps, forming other electrical bond pads on the surface of the substrate used to electrically connect the packaged micromechanical device with external circuitry via the interconnecting metalization formed in the ceramic package base.

[0039] The size, shape, and number of the bond wire **202** loops forming the anchor are determined by several factors including the material anchored, the mass of the material anchored, and the vibrational environment to which the device will be exposed. In some environments, the bond wire loops may be attached merely by one end. For example, coiled or kinked wires would be able to hold the getter without being connected to the substrate on both ends.

[0040] **FIG. 3** is a perspective view of the portion of a micromirror package substrate of **FIG. 2** showing a getter material applied to, and held by, the anchor of **FIG. 2**. The getter shown can be any desiccant, molecular sieve, or other absorbing or gettering material that can be deposited on, and attached to, the anchor. Often the getter materials are mixed with a carrier material and a solvent to aid the delivery of the getter material. Once the getter material is delivered, typically by a pneumatic syringe, it is allowed to cure and any solvents mixed with the getter are evaporated.

[0041] Preformed getters can be denser than directly dispensed getters that are cured in situ. The higher density of pre-cured getters may benefit the MEMS device by providing a higher capacity for gettering. The disclosed invention is applied to the attachment of preformed getters as shown in **FIG. 4**. In **FIG. 4**, bond wires **202** attached to a substrate **200** form a getter anchor. An adhesive **400** is applied to the bond wires **202**. A preformed getter **402** is then applied to the adhesive. This embodiment is important in situations where the adhesive **400** sticks to the getter **402**, usually by soaking into it, but does not stick well to the substrate **200**. The use

of a preformed getter **402** and an adhesive **400** is also applicable to all of the embodiment described below. In the embodiments describing cavity anchors, the adhesive is placed in the cavity and the getter is attached to the adhesive.

[0042] **FIGS. 5 and 6** are side views of a portion of a package substrate **502** showing alternate anchor member configurations. In **FIG. 5**, a mushroom shaped member **504** is formed on the package substrate **502** or a bond pad **506** to capture and retain getter material applied to the member **504**. In **FIG. 6**, one or more elongated members **508** are provided to capture and retain the getter material. The elongated members **508** typically are bond wires and generally are attached to the package substrate through an intermediate bond pad **506**.

[0043] **FIG. 7** is a cross section side view of a micromechanical device package showing the bond wires used in the prior art. In **FIG. 7**, a micromechanical device **702** is attached to a package substrate **704**. Bond wires **706** connect the device **702** to electrical conduits formed in the substrate **704** to enable electrical communication with circuitry outside the package. These bond wires are similar to the anchor formed of bond wires shown in **FIG. 2**. One aspect of the present invention provides a method of utilizing the existing bond wires as an anchor for the getter material.

[0044] **FIG. 8** is a cross section side view of a micromechanical device package showing the result of the novel application of the getter to the bond wires **706** of **FIG. 7**. When the micromechanical device **702** is packaged, it is first attached to the package substrate **704**. Bond wires **706** are then connected between bond pads on the device **702** and bond pads on the package substrate **704**. The getter **708**, mixed with any desired carriers and solvents, is then deposited over the bond wires **706** as shown in **FIG. 8**. The getter mixture is then cured, if necessary, to harden any carriers or evaporate any solvents.

[0045] Using the existing bond wires as an anchor prevents having to form a special purpose anchor for the getter and may increase the resistance of the device to vibration. The use of existing bond wires, however, also has several disadvantages and limitations. The getter and carrier used in the embodiment of **FIG. 8** must be non-conductive. Additionally, applying the getter onto the bond wires risks short circuiting the bond wires, or breaking the bond wires.

[0046] **FIG. 9** is an exploded perspective view of a portion of a micromirror package substrate showing an anchor mechanism according to one embodiment of the present invention. In **FIG. 9**, three layers of ceramic material are shown. The three layers make up a portion of a ceramic package substrate similar to those talked about throughout this patent application. In **FIG. 9**, the bottom layer **900** is a solid piece of ceramic. The middle layer **902** has a wide strip removed from the middle of the piece. The top layer **904** has a narrow strip removed from the middle of the piece. The narrow strip removed from the middle of the top piece may be widened as shown in **FIG. 9** at one or places.

[0047] **FIG. 10** is a perspective view of the portion of a micromirror package substrate of **FIG. 9** showing the anchor of **FIG. 9**. **FIG. 10** shows the assembled ceramic substrate **906** comprised of the layers of **FIG. 9**. The layers of **FIG. 9** form a cavity in the ceramic substrate **906** with a wide bottom portion—formed in the middle layer **902** and a

relatively narrower top portion—formed by the top layer 904. The narrow portion helps to retain the getter in the cavity by creating a mechanical lock on the wide portion of getter in the bottom of the cavity.

[0048] The examples shown in these figures merely are illustrative of simplified applications of the present invention. The number, materials, shapes and dimensions of the layers are provided for purposes of illustration and not for purposes of limitation. For example, the wide portions of the narrow slot are not necessary but are illustrated to show one structure that reduces the likelihood of pockets of air being captured in the getter anchor. Under certain conditions, air trapped beneath the getter may expand and could potentially force the getter out of the getter anchor.

[0049] **FIG. 11** is a cross section side view of a portion of a micromechanical package substrate 1100 showing two different anchor cavities 1102, 1104 formed in a substrate to anchor a getter to the substrate. The first anchor cavity is similar to the cavity of **FIG. 10** in that the lower wide portion is centered under the narrow portion. The second anchor cavity 1104 has the lower wide portion offset to one side of the narrow portion. Other embodiments include wide portions that only run a portion of the length of the anchor, and wide portions with sections that are alternately offset to each side of the narrow portion. Many alternate anchor cavity configurations are possible, the only criteria being that the anchor should be able to receive and hold the getter material.

[0050] **FIG. 12** is a cross section side view of the portion of a micromechanical package substrate 1100 of **FIG. 11** showing a getter 1106 held by the anchors of **FIG. 11**. Each of the getters 1106 in **FIG. 12** extend above the package substrate 1100. This extension allows a larger quantity of the getter material to be exposed to the package cavity, but is not a necessary feature of the present invention.

[0051] **FIG. 13** is a cross section side view of a portion of a micromechanical package substrate showing an alternate anchor cavity formed in the substrate to anchor the getter to the substrate. In **FIG. 13**, the package substrate 1302 has recesses formed in both the floor 1304 and wall 1306 portions. These recesses cooperate to form an anchor cavity capable of trapping a getter as described above. The recesses of **FIG. 13** may be formed in a manner similar to the recesses described above. In **FIG. 13**, a first anchor cavity is formed by a recess in only the floor 1304 of the package substrate 1302, while a second anchor cavity 1310 is formed by a recess in both the floor 1304 and the wall 1306 of the package substrate.

[0052] **FIG. 14** is a cross section side view of the portion of a micromechanical package substrate 1302 of **FIG. 13** showing getters 1412, 1414 held by the anchor of **FIG. 13**. As in **FIG. 11**, each of the getters 1412, 1414 in **FIG. 14** extend above the package substrate 1302. Not only does this extension allow a larger quantity of the getter material to be exposed to the package cavity, but the extension is likely necessary to prevent the getter material 1414 in the second anchor cavity 1310 from coming out of the anchor cavity.

[0053] **FIG. 15** is a cross section side view of a portion of a micromechanical package substrate showing an alternate cavity formed in the substrate to anchor the getter to the substrate. The cavity anchor of **FIG. 15** relies on the

package lid or window 1502, in combination with the package substrate 1504, to capture and retain the getter materials. The package substrate 1504 of **FIG. 15** provides a cavity to limit the motion of the getter in the plane of the package substrate and lid. The lid 1502 prevents the getter material from leaving the anchor cavity in a direction perpendicular to the plane of the package substrate. **FIG. 16** is a cross section side view of the portion of a micromechanical package substrate of **FIG. 15** showing getter material 1506, 1508 held by the anchor cavities of **FIG. 15**.

[0054] **FIG. 17** is a schematic view of an image projection system 1700 using a micromirror 1702 having an improved package according to the present invention. In **FIG. 17**, light from light source 1704 is focused on the improved micro-mirror 1702 by lens 1706. Although shown as a single lens, lens 1706 is typically a group of lenses and mirrors which together focus and direct light from the light source 1704 onto the surface of the micromirror device 1702. Image data and control signals from controller 1714 cause some mirrors to rotate to an on position and others to rotate to an off position. Mirrors on the micromirror device that are rotated to an off position reflect light to a light trap 1708 while mirrors rotated to an on position reflect light to projection lens 1710, which is shown as a single lens for simplicity. Projection lens 1710 focuses the light modulated by the micromirror device 1702 onto an image plane or screen 1712.

[0055] Thus, although there has been disclosed to this point a particular embodiment of a system and method for a micromechanical getter anchor, it is not intended that such specific references be considered as limitations upon the scope of this invention except insofar as set forth in the following claims. Furthermore, having described the invention in connection with certain specific embodiments thereof, it is to be understood that further modifications may now suggest themselves to those skilled in the art, it is intended to cover all such modifications as fall within the scope of the appended claims.

#### 1-18. (canceled)

19. An anchor to hold material in place within a micromechanical device package, said anchor comprising:

a package substrate; and

a member attached to said package substrate, said member shaped to provide mechanical retention of said material formed over said member.

20. The anchor of claim 19, said member comprising:

at least one elongated member attached to said package substrate.

21. The anchor of claim 19, said member comprising:

at least one elongated member attached to said package substrate by one point.

22. The anchor of claim 19, said member comprising:

at least one elongated member attached to said package substrate by one end.

23. The anchor of claim 19, said member comprising:

at least one elongated member attached to said package substrate by at least two points.

**24.** The anchor of claim 19, said member comprising:  
at least one elongated member attached to said package substrate by at least two ends.

**25.** The anchor of claim 19, said member comprising:  
at least one elongated member attached to said package substrate though an intermediate bond pad.

**26.** The anchor of claim 19, said member comprising:  
at least one wire member attached to said package substrate.

**27.** The anchor of claim 19, said member comprising:  
at least one bond wire member attached to said package substrate.

**28.** A micromechanical device package comprising:  
a package substrate;  
a package lid enclosing a package cavity;  
a micromechanical device in said package cavity; and  
a getter anchor in said package cavity.

**29.** The micromechanical device package of claim 28, wherein said getter anchor comprises at least one member attached to said package substrate.

**30.** The micromechanical device package of claim 28, wherein said member is attached to said package substrate by one point.

**31.** The micromechanical device package of claim 28, wherein said member is attached to said package substrate by one end.

**32.** The micromechanical device package of claim 28, wherein said member is attached to said package substrate by at least two points.

**33.** The micromechanical device package of claim 28, wherein said member is attached to said package substrate by at least two ends.

**34.** The micromechanical device package of claim 28, wherein said member is attached to said package substrate though an intermediate bond pad.

**35.** The micromechanical device package of claim 28, wherein said member is a wire.

**36.** The micromechanical device package of claim 28, wherein said member is a bond wire.

**37.** The micromechanical device package of claim 28, wherein said anchor is a cavity anchor.

**38.** The micromechanical device package of claim 28, wherein said cavity anchor is formed in said package substrate.

**39.** The micromechanical device package of claim 28, wherein said cavity anchor is a slot formed in said package substrate.

**40.** The micromechanical device package of claim 28, wherein said slot has a narrow top and a wider bottom portion.

**41.** The micromechanical device package of claim 28, said cavity anchor formed to provide mechanical retention of a getter material.

**42.** A method of packaging a micromechanical device, said method comprising:  
providing a package substrate having a getter anchor;  
attaching a micromechanical device to said package substrate;

attaching a getter material to said getter anchor; and  
attaching a package lid to said package substrate.

**43.** The method of claim 42, wherein providing a package substrate having a getter anchor comprises:  
providing a ceramic package substrate having an anchor cavity formed therein.

**44.** The method of claim 42, wherein providing a package substrate having a getter anchor comprises:  
providing a package substrate having at least one member attached thereto, said member forming said getter anchor.

**45.** The method of claim 42, wherein providing a package substrate having a member attached thereto comprises:  
attaching at least one elongated member to said package substrate.

**46.** The method of claim 42, wherein providing a package substrate having a member attached thereto comprises:  
attaching at least one mushroom shaped member to said package substrate.

**47.** The method of claim 42, wherein providing a package substrate having a member attached thereto comprises:  
attaching at least one wire to said substrate.

**48.** The method of claim 42, wherein providing a package substrate having a member attached thereto comprises:  
attaching at least one wire loop to said substrate.

**49.** The method of claim 42, wherein providing a package substrate having a member attached thereto comprises:  
providing a package substrate having a member attached to a bond pad of said substrate.

**50.** The method of claim 42, wherein attaching a getter material to said getter anchor comprises:  
putting a getter material into an anchor cavity.

**51.** The method of claim 42, wherein attaching a getter material to said getter anchor comprises:  
putting a desiccant material into an anchor cavity.

**52.** The method of claim 42, wherein attaching a getter material to said getter anchor comprises:  
putting a molecular sieve material into an anchor cavity.

**53.** The method of claim 42, wherein attaching a getter material to said getter anchor comprises:  
putting a getter mixed with a carrier material into an anchor cavity.

**54.** The method of claim 42, wherein attaching a getter material to said getter anchor comprises:  
putting a getter mixed with a solvent material into an anchor cavity.

**55.** The method of claim 42, wherein attaching a getter material to said getter anchor comprises:  
putting a getter mixed with a lubricant into an anchor cavity.

**56.** The method of claim 42, wherein attaching a getter material to said getter anchor comprises:  
attaching a desiccant material to said anchor.

**57.** The method of claim 42, wherein attaching a getter material to said getter anchor comprises:  
attaching a molecular sieve material to said anchor.

**58.** The method of claim 42, wherein attaching a getter material to said getter anchor comprises:

attaching a getter mixed with a carrier material to said anchor.

**59.** The method of claim 42, wherein attaching a getter material to said getter anchor comprises:

attaching a getter mixed with a solvent material to said anchor.

**60.** The method of claim 42, wherein attaching a getter material to said getter anchor comprises:

attaching a getter mixed with a lubricant to said anchor.

**61.** The method of claim 42, wherein attaching a getter material to said getter anchor comprises:

attaching an adhesive to said anchor; and

attaching a getter to said adhesive.

**62.** The method of claim 42, wherein attaching a getter material to said getter anchor comprises:

attaching an adhesive to said anchor; and

attaching a preformed getter to said adhesive.

**63.** A method of forming a package having an anchor, said method comprising:

forming a first package substrate layer;

forming a second package substrate layer, said second layer having a void;

forming a third package substrate layer;

laminating said first, second, and third layers such that said void forms an anchor cavity suitable for anchoring a getter.

**64.** The method of claim 63, further comprising:

forming a fourth package substrate layer, said fourth package substrate layer having a void, wherein said second and fourth layers are adjacent when said layers are laminated such that a cavity anchor with a narrow top and a relatively wide bottom is formed by said voids in said second and fourth layers.

**65.** A method of packaging a micromechanical device, said method comprising:

providing a package substrate;

attaching a micromechanical device to said package substrate;

attaching bond wires between said micromechanical device and said package substrate;

attaching a getter material to said bond wires; and

attaching a package lid to said package substrate.

**66.** The method of claim 65, wherein attaching a getter material to said getter anchor comprises:

attaching an adhesive to said bond wires; and

attaching a getter to said adhesive.

**67.** The method of claim 65, wherein attaching a getter material to said getter anchor comprises:

attaching an adhesive to said bond wires; and

attaching a preformed getter to said adhesive.

\* \* \* \* \*