

**PROVIDING AN ENVIRONMENTAL ACCESS/SAMPLING PORT TO A
SEMICONDUCTOR DIE**

CROSS-CITATION TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. provisional patent application 63/612,299 filed on 19 December 2023, the entirety of which is incorporated by reference.

TECHNICAL FIELD

[0002] The subject matter described herein relates to providing environmental sampling port to a semiconductor die.

BACKGROUND

[0003] Traditional methods of bioanalysis include preparation of a sample including a target analyte and analyzing the analytes using analyte-specific chemistries (e.g., detect the analyte by attaching to the analyte). The preparation of the sample can include stripping the biological matrix of the sample from the analyte to be detected to present a “clean” sample for detection. The detection can be performed by the sensor including a physical transducer that converts information about the presence of the analyte to a measurable signal (either via the intermediate binding step or directly as done in mass spectrometry). The interaction of the transducer with the to-be-detected analyte can require intermediate cleaning steps to ensure there is no interference in the transducer signal from other biological species in the stripped-down and sample-prepared matrix.

[0004] The traditional approach can require target-specific chemicals, biological reagents and cleaning steps to be incorporated as part of a multi-step protocol in the detection of analytes. The use of these target-specific chemicals, biological reagents and cleaning steps also necessitates a-priori hypothesis/knowledge of the target that will be detected as part of the workflow. Furthermore, each time a new analyte in the sample needs to be analyzed, the sample may need to be prepared again. As a result, traditional methods of bioanalysis can be cumbersome, inefficient and expensive.

SUMMARY

[0005] This disclosure relates to providing an environmental access/sampling port to a semiconductor die.

[0006] An example implementation of the subject matter described within this disclosure is an analyte sensor with the following features. A laminated substrate defines a hole there through. The laminated substrate includes a core including a first biologically inert material, and a first conductive layer adjacent to the core. A gasket includes a second biologically inert material. The gasket extends from a lower side of the laminated substrate. The gasket defines a portion of the hole. The gasket is configured to abut a sensor chip that covers an end of the hole.

[0007] Aspects of the example analyte sensor, which can be combined with the example analyte sensor alone or in combination with other aspects, can include the following. The laminated substrate further includes an upper layer of a third biologically inert material. The first conductive layer is between the core and the upper layer. A lower layer of a fourth biologically inert material is also included. A second conductive layer is between the core and the lower layer.

[0008] Aspects of the example analyte sensor, which can be combined with the example analyte sensor alone or in combination with other aspects, can include the following. The first biologically inert material, the second biologically inert material, and the third biologically inert material, and the fourth biologically inert material are a same material.

[0009] Aspects of the example analyte sensor, which can be combined with the example analyte sensor alone or in combination with other aspects, can include the following. The first conductive layer includes a ground or shield.

[0010] Aspects of the example analyte sensor, which can be combined with the example analyte sensor alone or in combination with other aspects, can include the following. The second conductive layer includes a first trace coupling a first lead of the sensor chip to the ground or shield, and the second conductive layer includes a second trace configured to couple a second lead of the sensor chip to a controller.

[0011] Aspects of the example analyte sensor, which can be combined with the example analyte sensor alone or in combination with other aspects, can include the following. The lower layer of the fourth biologically inert material defines openings exposing a portion of the first trace and a portion of the second trace to the first lead and the second lead respectively.

[0012] Aspects of the example analyte sensor, which can be combined with the example analyte sensor alone or in combination with other aspects, can include the following. An anisotropically conductive paste or film is between the sensor chip and the portion of the first trace or the portion of the second trace.

[0013] Aspects of the example analyte sensor, which can be combined with the example analyte sensor alone or in combination with other aspects, can include the following. The second biologically inert material includes a thermoplastic.

[0014] Aspects of the example analyte sensor, which can be combined with the example analyte sensor alone or in combination with other aspects, can include the following. An interface between the gasket and the sensor chip is configured to seal liquid within the hole.

[0015] Aspects of the example analyte sensor, which can be combined with the example analyte sensor alone or in combination with other aspects, can include the following. The gasket abuts the core at a first end of the gasket and is configured to abut the sensor chip at a second end of the gasket.

[0016] An example embodiment of the subject matter described within this disclosure is a method with the following features. A sample fluid receiving by a vial. The vial is defined in part by laminated substrate. The laminated substrate includes a core with a first biologically inert material and a conductive layer adjacent to the core. An analyte is sensed by a sensor defining a bottom of the vial.

[0017] Aspects of the example method, which can be combined with the example method alone or in combination with other aspects, can include the following. A current is directed from a controller to a sample fluid.

[0018] Aspects of the example method, which can be combined with the example method alone or in combination with other aspects, can include the following. The conductive layer includes a first trace and a second trace. The method further includes the following features. A current is directed by the first trace from the sample fluid a controller. A current is directed from the sample fluid to the sensor. A current is directed by the second trace from the controller to the sensor.

[0019] An example embodiment of the subject matter described within this disclosure is an analyte sensing system with the following features. An analyte sensor is coupled to a sample vial. The analyte sensor includes a laminated substrate defining a hole there through. The laminated substrate includes the following features. A core includes a first biologically inert material. An upper layer includes a second biologically inert material. A first conductive layer is between the core and the upper layer. A lower layer includes a third biologically inert material. A second conductive layer is between the core and the lower layer. A gasket extends from a lower side of the laminated substrate. The gasket defines a portion of the hole. A sensor chip abuts the gasket. The sensor chip covers an end of the hole. A controller is configured to direct a current to a content of the sample vial and receive a current from the sensor chip responsive to the directed current.

[0020] Aspects of the example analyte sensing system, which can be combined with the example analyte sensing system alone or in combination with other aspects, can include the following. The gasket includes thermoplastic.

[0021] Aspects of the example analyte sensing system, which can be combined with the example analyte sensing system alone or in combination with other aspects, can include the following. An interface between the gasket and the sensor chip is configured to seal liquid within the hole.

[0022] Aspects of the example analyte sensing system, which can be combined with the example analyte sensing system alone or in combination with other aspects, can include the following. The first biologically inert material, the second biologically inert material, or the third biologically inert material include different materials.

[0023] Aspects of the example analyte sensing system, which can be combined with the example analyte sensing system alone or in combination with other aspects, can include the following. The gasket abuts the core at a first end of the gasket and the sensor chip at a second end of the gasket.

[0024] Aspects of the example analyte sensing system, which can be combined with the example analyte sensing system alone or in combination with other aspects, can include the following. The first conductive layer comprises a ground or shield.

[0025] Aspects of the example analyte sensing system, which can be combined with the example analyte sensing system alone or in combination with other aspects, can include the following. The second conductive layer includes a first trace coupling a first lead of the sensor chip to the ground or shield and a second trace configured to couple a second lead of the sensor chip to a controller.

[0026] Aspects of the example analyte sensing system, which can be combined with the example analyte sensing system alone or in combination with other aspects, can include the following. The lower layer of the third biologically inert material defines openings exposing a portion of the first trace and a portion of the second trace to the first lead and the second lead respectively.

[0027] Aspects of the example analyte sensing system, which can be combined with the example analyte sensing system alone or in combination with other aspects, can include the following. An anisotropically conductive paste or film is between the sensor chip and the portion of the first trace or the portion of the second trace.

BRIEF DESCRIPTION OF THE FIGURES

[0028] These and other features will be more readily understood from the following detailed description taken in conjunction with the accompanying drawings.

[0029] FIG. 1 is a side cross-sectional view of an example analyte sensor;

[0030] FIG. 2 is a planar view of a first conductive layer;

[0031] FIG. 3 is a planar view of a second conductive layer;

[0032] FIG. 4 is a bottom perspective view of the example analyte sensor;

[0033] FIG. 5 is a bottom perspective view of the example analyte sensor without a sensor chip;

[0034] FIG. 6 is a block diagram of an example controller that can be used with aspects of this disclosure; and

[0035] FIG. 7 is a flowchart of an example method that can be uses with aspects of this disclosure.

DETAILED DESCRIPTION

[0036] The present disclosure generally relates to, a sensor that can be used in characterizing samples (e.g., electrochemical solution including analytes and redox species). Methods and systems with which the subject matter described within can be used are described, for example in U.S. Patent Application No. 18/488,569, which is hereby incorporated by reference.

[0037] The present disclosure describes a sensor that can be incorporated with a sample vial of an analyte sensing system configured to receive a sample fluid for analysis. The sensor itself can include a laminated substrate defines a hole there through. The laminated substrate includes a core including a first biologically inert material, and a first conductive layer adjacent to the core. A gasket includes a second biologically inert material. The gasket extends from a lower side of the laminated substrate. The gasket defines a portion of the hole. The gasket is configured to abut a sensor chip that covers an end of the hole. In some implementations, the sensor and the vial are consumable components.

[0038] In some implementations, a consumable component and/or instrument can be modified to tailor to specific applications. The consumable can include the sensor with an

interface geometry configured to interface with a sample including an analyte. The interface geometry can include nanoscale electrochemical interface described in U.S. Patent Application Number 16/016,468, U.S. Patent Application Number 17/317,422, and U.S. Patent No. 9,285,336 which have been incorporated herein by reference in their entirety. The consumable can be integrated with a sample collection mechanism (e.g., syringe, pipette, breath analyzer). Alternately, the consumables can be integrated with a sample storage device (e.g., storage cap, vial/test tube, vacutainer, beaker, dried spot card, microtiter plate, culture/other flask, μ fluidic cartridge, etc.). In some implementations, the consumable and/or the instrument can be integrated with sample handling robots. The instrument can be integrated with the consumable (e.g., can be configured to receive an electric signal indicative of detection by the consumable). The instrument can have a low throughput (e.g., single consumable read), a medium throughput (e.g., 6 consumable read) or a high throughput (e.g., 24-1536 consumable read). The medium and high throughput instruments can perform multiple readouts / scan of samples in multiple consumables.

[0039] In the following detailed description, reference is made to the accompanying drawings, which form a part hereof. In the drawings, similar symbols generally identify similar components, unless context dictates otherwise. The illustrative alternatives described in the detailed description, drawings, and claims are not meant to be limiting. Other alternatives may be used and other changes may be made without departing from the spirit or scope of the subject matter presented here. It will be readily understood that the aspects, as generally described herein, and illustrated in the Figures, can be arranged, substituted, combined, and designed in a wide variety of different configurations, all of which are explicitly contemplated and make part of this application.

[0040] Unless otherwise defined, all terms of art, notations, and other scientific terms or terminology used herein are intended to have the meanings commonly understood by those of skill in the art to which this application pertains. In some cases, terms with commonly understood meanings are defined herein for clarity and/or for ready reference, and the inclusion of such definitions herein should not necessarily be construed to represent a substantial difference over what is generally understood in the art. Many of the techniques and procedures

described or referenced herein are well understood and commonly employed using conventional methodology by those skilled in the art.

[0041] FIG. 1 is a side cross-sectional view of an example analyte sensor 100 coupled to a sample vial 102. The sensor 100 includes a laminated substrate 104 defining a hole 106 there through. The laminated substrate 104 includes a core 108. Between the core 108 and an upper layer 110 is an upper conductive layer 112. The upper conductive layer 112 can include, for example, copper tracing. In some implementations, the upper conductive layer 112 is adjacent to the core 108. In some implementations, the upper layer 110 can be omitted. A lower layer 114 can also be included. A second, lower conductive layer 116 is between the core 108 and the lower layer 114. The lower conductive layer 116 can be substantially similar to the first conductive layer with the exception of any differences described herein.

[0042] A gasket 118 extends from a lower side of the laminated substrate 104. The gasket 118 defines a portion of the hole 106 and is configured to abut a semiconductor die, such as a sensor chip 120 that covers an end of the hole 106. More specifically the gasket 118 abuts the core 108 at a first end of the gasket 118 and is configured to abut the sensor chip 120 at a second end of the gasket 118. An interface between the gasket 118 and the sensor chip 120 is configured to seal liquid within the hole 106, for example, liquid within the vial 102.

[0043] The core 108, the gasket 118, as well as the upper layer 110 and the lower layer 114 (if they are included) can include biologically inert materials. Biologically inert materials can include a thermoplastic, such as polyethylene terephthalate (PET), Polyether ether ketone (PEEK), Polytetrafluoroethylene (PTFE), Acrylonitrile butadiene styrene (ABS), liquid crystal polymer (LCP), or polyimide. In some implementations, non-thermoplastic biologically inert materials can be used, for example, ceramic. In some implementations, each component (the core 108, the gasket 118, the upper layer 110, and the lower layer 114) can include a same biologically inert material. In some implementations, some or all of the components can include different biologically inert materials from one another.

[0044] In implementations that include the lower layer, the lower layer can define openings 122 exposing a portion of the lower conductive layer, for example to allow leads of the

sensor chip 120 to be conductively coupled to the lower conductive layer 116. Such coupling can be achieved with conductive paste or film that extends between leads of the sensor chip 120 and the lower conductive layer 116 through the defined openings 122. In some implementations, the conductive paste or film 124 can be anisotropically conductive.

[0045] FIG. 2 is a planar view of the upper conductive layer 112. In the illustrated implementation, the upper conductive layer 112 extends substantially across the entire (greater than 60% of the planar surface area) laminated substrate 104, for example, across the core 108, and acts as a shield to block electromagnetic interference. In some embodiments, this upper conductive layer can act as or be coupled to a ground.

[0046] FIG. 3 is a planar view of the lower conductive layer 116. In some implementations, the lower conductive layer 116 can include at least a first trace 302 and a second trace 304. In some implementations, the first trace can be arranged to couple a first lead (not shown) of the sensor chip 120 to the ground or shield. For example, referring back to FIG. 1, in some implementations, the first trace 302 can be coupled to the upper conductive layer 112, for example through a conduit 126 (FIG. 1) defined by the core 108 and at least partially filled with a conductive material allowing conduction between the upper conductive layer 112 and the lower conductive layer 116. The lower conductive layer can include an additional, second trace 304 coupling a second lead (not shown) to the controller 306. More details on the interactions between the sensor 100 and the controller 306 are discussed throughout this disclosure. In some embodiments, the ground is connected to a ground of the controller 306. While primarily described as having a shielding upper conductive layer and a traced lower conductive layer, the conductive layers (112, 116) can be arranged in alternative configurations without departing from this disclosure, for example, in some implementations, the ground/shield can be located in the lower conductive layer 116 while the first trace 302 and the second trace 304 can be located in the upper layer.

[0047] FIG. 4 is a bottom perspective view of the example analyte sensor showing the sensor chip 120 connected to the first trace 302 and the second trace 304 with the conductive film or paste 124, more specifically with the lower layer omitted. FIG. 5 shows the same view

without the sensor chip 120. In the illustrated implementation, the ground trace 302 include pads to receive three leads of the sensor chip 120, while the trace to be coupled to the controller 306 includes a single pad to receive a single lead of the sensor chip 120. The openings 122 defined by the lower layer 114 provide access to the pads coupled to the first trace 302 and the second trace 304. Alternative arrangements can be used without departing from this disclosure. For example, some implementations, may have a greater number of traces and/or a greater number of leads upon the sensor chip 120.

[0048] FIG. 6 illustrates an example controller 306 that can be used with aspects of this disclosure. The controller 306 can, among other things, monitor parameters of the system ### send signals to actuate and/or adjust various operating parameters of such systems. As shown in FIG. 6, the controller 306 can include one or more processors 650 and non-transitory computer readable memory storage (e.g., memory 652) containing instructions that cause the processors 650 to perform operations described herein. The processors 650 are coupled to an input/output (I/O) interface 654 for sending and receiving communications with components in the system, including, the traces (302, 304). In certain instances, the controller 306 can additionally communicate status with and send actuation and/or control signals to one or more various system components (including, for example, a computer, the cloud service, or the sensor chip 100), as well as other sensors (e.g., temperature sensors, vibration sensors and other types of sensors) that provide signals to the controller 306.

[0049] In operation, the controller 306 directs a current to a content, such as a liquid, within the sample vial 102. The controller can then receive a current from the sensor chip responsive to the directed current. The controller can use the received current to identify produce a spectrum. The presence of a target analyte can then determine based on the produced spectrum, in some implementations, by the controller. Alternatively or in addition, the controller 306 can perform basic calibration tasks to correct drift and other errors in the measured current and voltage at the sensor interface.

[0050] FIG. 7 is a flowchart of an example method 700 that can be uses with aspects of this disclosure. In some implementations, some or all of the method can be performed by the

controller 306. At 702, a sample fluid is received by the vial 102. The vial is defined in part by the laminated substrate 104. At 704, the sensor 100 defining a bottom of the vial 102, senses an analyte.

[0051] In some implementations, a current is exchanged between (sent to and from) a controller and a sample fluid, for example, by a trace on the upper conductive layer 112 or the lower conductive layer 116. A current can also be directed from the sample fluid ### within the vial 102 to the sensor. A current can also be exchanged, by another trace, between (sent to and from) the controller 306 and the sensor 100.

[0052] Unless otherwise defined, all terms of art, notations and other scientific terms or terminology used herein are intended to have the meanings commonly understood by those of skill in the art to which this disclosure pertains. In some cases, terms with commonly understood meanings are defined herein for clarity and/or for ready reference, and the inclusion of such definitions herein should not necessarily be construed to represent a substantial difference over what is generally understood in the art. Many of the techniques and procedures described or referenced herein are well understood and commonly employed using conventional methodology by those skilled in the art.

[0053] The singular form “a”, “an”, and “the” include plural references unless the context clearly dictates otherwise. For example, the term “a cell” includes one or more cells, including mixtures thereof. “A and/or B” is used herein to include all of the following alternatives: “A”, “B”, “A or B”, and “A and B”.

[0054] It is understood that aspects and implementations of the disclosure described herein include “comprising”, “consisting”, and “consisting essentially of” aspects and implementations.

[0055] As used herein, “comprising” is synonymous with “including”, “containing”, or “characterized by”, and is inclusive or open-ended and does not exclude additional, unrecited elements or method steps. Any recitation herein of the term “comprising”, particularly in a description of components of a composition or in a description of steps of a method, is

understood to encompass those compositions and methods consisting essentially of and consisting of the recited components or steps. As used herein, “consisting of” excludes any elements, steps, or ingredients not specified in the claimed composition or method. As used herein, “consisting essentially of” does not exclude materials or steps that do not materially affect the basic and novel characteristics of the claimed composition or method.

[0056] Where a range of values is provided, it is understood by one having ordinary skill in the art that all ranges disclosed herein encompass any and all possible sub-ranges and combinations of sub-ranges thereof. Any listed range can be easily recognized as sufficiently describing and enabling the same range being broken down into at least equal halves, thirds, quarters, fifths, tenths, etc. As a non-limiting example, each range discussed herein can be readily broken down into a lower third, middle third and upper third, etc. As will also be understood by one skilled in the art all language such as “up to”, “at least”, “greater than”, “less than”, and the like include the number recited and refer to ranges which can be subsequently broken down into sub-ranges as discussed above. As will be understood by one skilled in the art, a range includes each individual member. Thus, for example, a group having 1-3 articles refers to groups having 1, 2, or 3 articles. Similarly, a group having 1-5 articles refers to groups having 1, 2, 3, 4, or 5 articles, and so forth.

[0057] Certain ranges are presented herein with numerical values being preceded by the term “about.” The term “about” is used herein to provide literal support for the exact number that it precedes, as well as a number that is near to or approximately the number that the term precedes. In determining whether a number is near to or approximately a specifically recited number, the near or approximating unrecited number may be a number which, in the context in which it is presented, provides the substantial equivalent of the specifically recited number. If the degree of approximation is not otherwise clear from the context, “about” means either within plus or minus 10% of the provided value, or rounded to the nearest significant figure, in all cases inclusive of the provided value.

[0058] It is appreciated that certain features of the disclosure, which are, for clarity, described in the context of separate implementations, may also be provided in combination in a

single implementation. Conversely, various features of the disclosure, which are, for brevity, described in the context of a single implementation, may also be provided separately or in any suitable sub-combination. All combinations of the implementations pertaining to the disclosure are specifically embraced by the present disclosure and are disclosed herein just as if each and every combination was individually and explicitly disclosed. In addition, all sub-combinations of the various implementations and elements thereof are also specifically embraced by the present disclosure and are disclosed herein just as if each and every such sub-combination was individually and explicitly disclosed herein.

[0059] Non-transitory computer program products (i.e., physically embodied computer program products) are also described that store instructions, which when executed by one or more data processors of one or more computing systems, causes at least one data processor to perform operations herein. Similarly, computer systems are also described that may include one or more data processors and memory coupled to the one or more data processors. The memory may temporarily or permanently store instructions that cause at least one processor to perform one or more of the operations described herein. In addition, methods can be implemented by one or more data processors either within a single computing system or distributed among two or more computing systems. Such computing systems can be connected and can exchange data and/or commands or other instructions or the like via one or more connections, including a connection over a network (e.g. the Internet, a wireless wide area network, a local area network, a wide area network, a wired network, or the like), via a direct connection between one or more of the multiple computing systems, etc.

[0060] While this disclosure contains many specific embodiment details, these should not be construed as limitations on the scope of what may be claimed, but rather as descriptions of features specific to particular embodiments. Certain features that are described in this disclosure in the context of separate embodiments can also be implemented in combination in a single embodiment. Conversely, various features that are described in the context of a single embodiment can also be implemented in multiple embodiments separately or in any suitable subcombination. Moreover, although features may be described above as acting in certain combinations and even initially claimed as such, one or more features from a claimed

combination can in some cases be excised from the combination, and the claimed combination may be directed to a subcombination or variation of a subcombination.

[0061] Similarly, while operations are depicted in the drawings in a particular order, this should not be understood as requiring that such operations be performed in the particular order shown or in sequential order, or that all illustrated operations be performed, to achieve desirable results. Moreover, the separation of various system components in the embodiments described above should not be understood as requiring such separation in all embodiments, and it should be understood that the described components and systems can generally be integrated together in a single product or packaged into multiple products.

[0062] Thus, particular embodiments of the subject matter have been described. Other embodiments are within the scope of the following claims. In some cases, the actions recited in the claims can be performed in a different order and still achieve desirable results. In addition, the processes depicted in the accompanying figures do not necessarily require the particular order shown, or sequential order, to achieve desirable results.

[0063] Other embodiments can be within the scope of the following claims.

What is claimed is:

1. An analyte sensor comprising:
 - a laminated substrate defining a hole there through, the laminated substrate comprising:
 - a core comprising a first biologically inert material; and
 - a first conductive layer adjacent to the core; and
 - a gasket comprising a second biologically inert material, the gasket extending from a lower side of the laminated substrate, the gasket defining a portion of the hole, the gasket configured to abut a sensor chip that covers an end of the hole.
2. The analyte sensor of claim 1, wherein the laminated substrate further comprises:
 - an upper layer of a third biologically inert material, the first conductive layer being between the core and the upper layer;
 - a lower layer of a fourth biologically inert material; and
 - a second conductive layer between the core and the lower layer.
3. The analyte sensor of claim 2, wherein the first biologically inert material, the second biologically inert material, and the third biologically inert material, and the fourth biologically inert material are a same material.
4. The analyte sensor of any one of claims 2-3, wherein the first conductive layer comprises a ground or shield.
5. The analyte sensor of claim 4, wherein the second conductive layer comprises:
 - a first trace coupling a first lead of the sensor chip to the ground or shield; and
 - a second trace configured to couple a second lead of the sensor chip to a controller.

6. The analyte sensor of claim 5, wherein the lower layer of the fourth biologically inert material defines openings exposing a portion of the first trace and a portion of the second trace to the first lead and the second lead respectively.
7. The analyte sensor of any one of claims 5-6, further comprising an anisotropically conductive paste or film between the sensor chip and the portion of the first trace or the portion of the second trace.
8. The analyte sensor of any one of the previous claims, wherein the second biologically inert material comprises a thermoplastic.
9. The analyte sensor of any one of the previous claims, wherein an interface between the gasket and the sensor chip is configured to seal liquid within the hole.
10. The analyte sensor of any one of the previous claims, wherein the gasket abuts the core at a first end of the gasket and is configured to abut the sensor chip at a second end of the gasket.
11. A method comprising:
 - receiving a sample fluid by a vial, the vial defined in part by a laminated substrate, the laminated substrate comprising:
 - a core comprising a first biologically inert material; and
 - a conductive layer adjacent to the core; and
 - sensing, by a sensor defining a bottom of the vial, an analyte.
12. The method of claim 11, further comprising:
 - directing a current from a controller to a sample fluid.
13. The method of any one of claims 11-12, wherein the conductive layer comprises a first trace and a second trace, the method further comprises:
 - directing a current, by the first trace, from the sample fluid a controller;

directing a current from the sample fluid to the sensor; and
directing a current, by the second trace, from the controller to the sensor.

14. An analyte sensing system comprising:
- a sample vial;
 - an analyte sensor coupled to the sample vial, the analyte sensor comprising a laminated substrate defining a hole there through, the laminated substrate comprising:
 - a core comprising a first biologically inert material;
 - an upper layer comprising a second biologically inert material;
 - a first conductive layer between the core and the upper layer;
 - a lower layer comprising a third biologically inert material; and
 - a second conductive layer between the core and the lower layer;
 - a gasket extending from a lower side of the laminated substrate, the gasket defining a portion of the hole;
 - a sensor chip abutting the gasket, the sensor chip covering an end of the hole; and
 - a controller configured to:
 - direct a current to a content of the sample vial; and
 - receive a current from the sensor chip responsive to the directed current.
15. The analyte sensing system of claim 14, wherein the gasket is comprised of thermoplastic.
16. The analyte sensing system of anyone of claims 14-15, wherein an interface between the gasket and the sensor chip is configured to seal liquid within the hole.
17. The analyte sensing system of anyone of claims 14-16, wherein the first biologically inert material, the second biologically inert material, or the third biologically inert material comprise different materials.
18. The analyte sensing system of anyone of claims 14-17, wherein the gasket abuts the core at a first end of the gasket and the sensor chip at a second end of the gasket.

19. The analyte sensing system of anyone of claims 14-18, wherein the first conductive layer comprises a ground or shield.
20. The analyte sensing system of claim 19, wherein the second conductive layer comprises:
 - a first trace coupling a first lead of the sensor chip to the ground or shield; and
 - a second trace configured to couple a second lead of the sensor chip to a controller.
21. The analyte sensing system of claim 20, wherein the lower layer of the third biologically inert material defines openings exposing a portion of the first trace and a portion of the second trace to the first lead and the second lead respectively.
22. The analyte sensing system of claim 21, further comprising an anisotropically conductive paste or film between the sensor chip and the portion of the first trace or the portion of the second trace.