

CLAIMS

What is claimed is:

1. ~~A flow cell, comprising:
a support frame comprising a top side, a back side and at least one cavity extending from the top side toward the bottom side;
at least one light detection device disposed within the at least one cavity comprising an active area and a top surface;
a support material disposed within the at least one cavity between the support frame and the periphery of the at least one light detection device coupling the support frame and the at least one light detection device together; and
a lid extending over the at least one light detection device and coupled to the top side of the support frame about the periphery of the at least one light detection device;
wherein the lid and at least the top surface of the at least one light detection device form a flow channel therebetween.~~
2. ~~The flow cell of claim 1, wherein the support frame further comprises at least one electrically conductive via extending from the top side to the bottom side.~~
3. ~~The flow cell of claim 2, wherein the at least one light detection device comprises at least one solid-state light detection device including a base wafer portion, a plurality of light sensors, device circuitry electrically coupled to the light sensors to transmit data signals based on photons detected by the light sensors, and a plurality of light guides associated with the plurality of light sensors.~~
4. ~~The flow cell of claim 3, wherein the device circuitry of the at least one solid-state light detection device is electrically coupled to the at least one electrically conductive via at the top side of the support frame.~~
5. ~~The flow cell of claim 1, wherein the lid is indirectly coupled to the top side of the support frame.~~

6. — The flow cell of claim 1, wherein the at least one cavity comprises a cavity with a plurality of light detection devices disposed therein.

7. — The flow cell of claim 6, wherein the plurality of light detection devices comprises distinct light detection devices that are spaced from each other, and wherein the support material further extends between adjacent light detection devices.

8. — The flow cell of claim 6, wherein the plurality of light detection devices comprises at least two integral light detection devices, and wherein the support material extends between the support frame and the periphery of the at least two integral light detection devices.

9. — The flow cell of claim 1, wherein the at least one light detection device comprises a plurality of light detection devices.

10. — The flow cell of claim 9, wherein the at least one cavity comprises a plurality of cavities, and wherein each light detection device of the plurality of light detection devices is disposed in a differing cavity of the support frame.

11. — The flow cell of claim 1, wherein the at least one light detection device comprises at least one solid state light detection device including a base wafer portion, a plurality of light sensors, device circuitry electrically coupled to the light sensors to transmit data signals based on photons detected by the light sensors, and a plurality of light guides associated with the plurality of light sensors.

12. — The flow cell of claim 11, wherein the at least one cavity extends through the support frame from the top side to the bottom side, wherein the device circuitry comprises vias extending through the base wafer portion, and wherein the flow cell further comprises electrical contacts that are at least partially disposed along the back side of the support frame and electrically coupled to the vias.

13. — The flow cell of claim 11, wherein the at least one light detection device further comprises a reaction structure disposed over the plurality of light guides that forms the top surface thereof, and wherein the reaction structure comprises a plurality of nanowells positioned within the active area.

14. — The flow cell of claim 1, wherein the at least one cavity extends only partially through the support frame from the top side toward the bottom side.

15. — The flow cell of claim 1, wherein the at least one light detection device comprises at least one complementary metal oxide semiconductor (CMOS) light sensor.

16. — The flow cell of claim 1, wherein the flow channel extends over the entirety of the active area of the at least one light detection device.

17. — A method, comprising:

— attaching a top surface of a support frame and a planar support surface of a substrate, the support frame comprising at least one cavity extending from the top side to a bottom side thereof;

— positioning at least one light detection device within the at least one cavity such that a top side thereof is positioned on the planar support surface of the substrate and an edge portion of the cavity extends between the support frame and the periphery of the at least one light detection device, the at least one light detection device comprising an active area and a top surface;

— filling the edge portion of the cavity with a support material to couple the support frame and the at least one light detection device together;

— detaching the support frame and the substrate; and

— attaching a lid to the top side of the support frame about the periphery of the at least one light detection device to form a flow cell, the lid extending over the at least one light detection device and forming a flow channel between the lid and at least the top surface of the at least one light detection device.

18.— The method of claim 17, wherein the at least one light detection device comprises at least one solid-state light detection device including a base wafer portion forming a back side, a plurality of light sensors, device circuitry electrically coupled to the light sensors coupled to transmit data signals based on photons detected by the light sensors, and a plurality of light guides associated with the plurality of light sensors, wherein the support frame further comprises at least one electrically conductive via extending from the top side to the bottom side, and further comprising electrically coupling the device circuitry of the at least one solid-state light detection device to the at least one electrically conductive via at the top side of the support frame.

19.— The method of claim 17, wherein the at least one light detection device comprises at least one solid-state light detection device including a base wafer portion forming a back side, a plurality of light sensors, device circuitry electrically coupled to the light sensors coupled to transmit data signals based on photons detected by the light sensors, and a plurality of light guides associated with the plurality of light sensors, wherein device circuitry comprises vias extending through the base wafer portion to the back side thereof, and further comprising electrically coupling contacts that are at least partially disposed along the back side of the support frame to the vias at the back side of the base wafer portion.

20.— The method of claim 17, further comprising forming a reaction structure on the at least one light detection device prior to attaching the lid, the reaction structure forming the top surface of the at least one light detection device and comprising a plurality of nanowells positioned within the active area.

21.— The method of claim 20, wherein detaching the support frame and the substrate exposes a recessed top side of the support material that extends below and between the top side of the support frame and a top portion of the at least one light detection device, wherein the reaction structure extends over the recessed top side of the support material and the top side of the top side of the support frame, and wherein the reaction structure forms a planar top surface from which the plurality of nanowells extend.

~~22. The method of claim 17, further comprising obtaining the at least one light detection device, and wherein obtaining the at least one light detection device comprises dicing at least one complementary metal-oxide semiconductor (CMOS) light sensor from a plurality of integral CMOS light sensors.~~

~~23. The method of claim 17, wherein the flow channel extends over the entirety of the active area of the at least one light detection device.~~

~~24. A method, comprising:~~

~~—— depositing a first support material on a bottom portion of at least one cavity of a support frame, the at least one cavity extending only partially through the support frame from a top side thereof toward a bottom side thereof;~~

~~—— positioning at least one light detection device within the at least one cavity and over the deposited first support material such that an edge portion of the at least one cavity extends between the support frame and the periphery of the at least one light detection device, the at least one light detection device comprising an active area and a top surface;~~

~~—— filling the edge portion of the cavity with a second support material; and~~

~~—— attaching a lid to the top side of the support frame about the periphery of the at least one light detection device to form a flow cell, the lid extending over the at least one light detection device and forming a flow channel between the lid and at least the top surface of the at least one light detection device.~~

~~25. The method of claim 24, wherein the flow channel extends over the entirety of the active area of the at least one light detection device.~~

CLAIMS

1. A device, comprising:

a support frame comprising a top side, a back side and at least one cavity extending from the top side toward the bottom side, wherein the support frame further comprises at least one electrically conductive via extending from the top side toward the bottom side;

at least one light detection device disposed within the at least one cavity, wherein the at least one light detection device comprises a top surface and a plurality of light sensors;

a support material disposed within the at least one cavity between the support frame and the periphery of the at least one light detection device coupling the support frame and the at least one light detection device together; and

a lid extending over the at least one light detection device, wherein the lid and at least the top surface of the at least one light detection device form a flow channel therebetween.

2. The device of claim 1, wherein the lid is coupled to the top side of the support frame.

3. The device of claim 1, wherein the lid is coupled to the top side of the support frame around the periphery of the at least one light detection device.

4. The device of claim 1, wherein the at least one light detection device further comprises a plurality of light guides.

5. The device of claim 4, wherein each of the plurality of light guides is associated with a corresponding light sensor of the plurality of light sensors.

6. The device of claim 4, wherein the at least one light detection device further comprises a reaction structure disposed over the plurality of light guides that forms the top surface of the at least one light detection device.

7. The device of claim 6, wherein the reaction structure comprises a plurality of nanowells positioned within an active area on the top surface of the at least one light detection device.

8. The device of claim 1, wherein the at least one light detection device further comprises device circuitry electrically coupled to the plurality of light sensors to transmit data signals based on photons detected by the plurality of light sensors.

9. The device of claim 8, wherein the device circuitry of the at least one light detection device is electrically coupled to the at least one electrically conductive via.

10. The device of claim 9, wherein the device circuitry of the at least one light detection device is electrically coupled to the at least one electrically conductive via at the top side of the support frame.

11. The device of claim 2, wherein the lid is indirectly coupled to the top side of the support frame.

12. The device of claim 1, wherein the at least one light detection device comprises a plurality of light detection devices, and wherein the plurality of light detection devices is disposed within the at least one cavity.

13. The device of claim 12, wherein the plurality of light detection devices comprises distinct light detection devices that are spaced from each other, and wherein the support material further extends between adjacent light detection devices.

14. The device of claim 13, wherein the plurality of light detection devices comprises at least two integral light detection devices.

15. The device of claim 1, wherein the at least one light detection device comprises a plurality of light detection devices, wherein the at least one cavity comprises a

plurality of cavities, and wherein each light detection device of the plurality of light detection devices is disposed in a differing cavity of the plurality of cavities.

16. The device of claim 1, wherein the at least one cavity extends through the support frame from the top side to the bottom side.

17. The device of claim 16, wherein the at least one detection device further comprises a base wafer portion, and device circuitry electrically coupled to the plurality of light sensors to transmit data signals based on photons detected by the plurality of light sensors, wherein the device circuitry comprises vias extending through the base wafer portion, and wherein the flow cell further comprises electrical contacts that are at least partially disposed along the back side of the support frame and electrically coupled to the vias.

18. The device of claim 1, wherein the at least one cavity extends only partially through the support frame from the top side toward the bottom side.

19. The device of claim 1, wherein the at least one light detection device comprises at least one complementary metal-oxide semiconductor (CMOS) light sensor.

20. The device of claim 1, wherein the flow channel extends over the entirety of an active area of the at least one light detection device.